2018

Sustained Impact of Unhealthy Food Advertising on Children's Dietary Intake

Jennifer Anne Norman
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Sustained Impact of Unhealthy Food Advertising on Children’s Dietary Intake

A thesis submitted in fulfilment of the requirements for the award of the degree Doctor of Philosophy from the University of Wollongong

by

Jennifer Anne Norman
Bachelor of Nutrition and Dietetics (Class I Hons)

Early Start

School of Health and Society

Faculty of Social Sciences

2018
I, Jennifer Anne Norman, declare that this thesis, submitted in fulfilment of the requirements for the award of Doctor of Philosophy, in the Faculty of Social Sciences, University of Wollongong, is wholly my own work unless otherwise referenced or acknowledged. The document has not been submitted for qualifications at any other academic institution.

Jennifer Anne Norman

10 September 2018
ABSTRACT

Background

A growing body of evidence indicates that unhealthy food marketing exposure affects children’s food attitudes, preferences and consumption, most likely through a logical, cumulative sequence of cognitive and behavioural responses. An important reason impeding policy change to restrict food marketing to children is the lack of evidence showing a direct link between food marketing and children’s energy intake and the sustained effect of exposures on children’s body weight. In experimental studies, children’s food intake is the most relevant outcome measure to investigate this direct link.

Brief exposure to food advertising on television (TV) or online advergames (branded games) has an immediate direct effect on children’s food consumption, significantly increasing their intake of snack foods, but whether or not this increased energy intake is compensated for at later eating occasions is not known. Many of these single exposure experimental studies have been conducted in laboratory settings and have not accounted for the cumulative effects of media exposures or the impact of repeated exposures across multiple media.

Aim

The research outlined in this thesis aimed to investigate the direct effects of sustained exposure to unhealthy food advertising on TV and online advergames on children’s dietary intake and its potential influence on children’s weight. Furthermore the research aimed to determine whether there was an increased effect of advertising among children with overweight and obesity and/or children whose parents reported controlling feeding practices; and to investigate how the creative content within the advertisements affected children’s recognition and attitudinal responses to advertised food brands.
Methods

A within-subject, randomised, crossover, counter-balanced trial was conducted across four, six-day school holiday camps in New South Wales, Australia (n=160, aged 7–12 years). Two gender- and age-balanced groups were formed for each camp (n=20), randomised to either a multiple media or single media condition and exposed to food and non-food advertising in an online game and/or a TV cartoon. Children’s food consumption (kilojoules (kJ)) was measured at a snack immediately after exposure and then at lunch later in the day. To isolate the effects of advertising, international food brands, not available for sale in Australia or advertised on Australian commercial TV stations, were used. Children completed a brand recognition and attitude survey pre- and post-intervention. Parents completed the Child Feeding Questionnaire at baseline. Marketing techniques and themes in individual TV food advertisements and advergames were analysed and described.

Findings

One hundred and fifty four children completed the study. All children in the multiple media condition ate more at a snack after exposure to food advertising compared with non-food advertising; this was not compensated for at lunch, leading to additional daily food intake of 194 kJ (95% CI 80–308, p=0.001). Exposure to multiple media food advertising compared with a single media source increased the effect on snack intake by a difference of 182 kJ (95% CI 46–317, p=0.009). Food advertising had an increased effect among children with heavier weight status, and among children whose parents reported controlling feeding practices, in both media groups.

There was a significant increase in the recognition of all food brands post-exposure (p<0.0001). All brands were rated positively. The majority of brands appealed to children of all ages, with children wanting to eat the advertised products. Playing the online advergame appeared to enhance children’s opinions of a person who would eat the promoted brand, with the highest ratings for positive consumer perceptions by children in the TV and advergame
group. Furthermore, brand consumers were rated as more cool by children who played the advergame compared with those saw the TV advertisement only ($\chi^2 = 4.172, p=0.041$).

Common persuasive techniques used across the TV advertisements included brand equity characters, fantasy, happiness and highly palatable food products; techniques unique to the most recognised and highly rated TV advertisements included anti-adult themes, humour, parent-pleasing and parental-themes.

**Significance and contribution to knowledge**

Online advertising combined with TV advertising exerted a stronger influence on children’s food consumption than TV advertising alone. The lack of compensation at lunch for children’s increased snack intake after food advertising exposure indicates that unhealthy food advertising exposure contributes to a positive energy-gap, of a magnitude that would cumulatively lead to the development of childhood overweight. To our knowledge this is the first experimental study to demonstrate a direct link between children’s exposure to food advertising and their dietary intakes, beyond measuring a snack consumed at the time or immediately after the advertising exposure. The increased effects observed in children with a heavier weight status and whose parents reported controlling feeding practices highlights two groups of children with particular vulnerability. Of significance, however, is that all children in the multiple media condition were affected by the food advertising, regardless of their self-regulatory capacity. Given that the multiple media group in this study most closely emulates young people’s current media experiences, these findings are of particular concern.

The persuasive techniques within the study advertisements delivered a marketer’s objective of building brand-equity by stimulating children’s brand recognition and positive affect. Yet these techniques are not excluded under current regulatory schemes in Australia.

The findings reported in this thesis clearly highlight the need for stricter regulation on the extent and power of food marketing to children and call for a review of current regulatory arrangements. This research adds a significant contribution to the evidence supporting the
need for legislation to limit unhealthy food marketing across multiple media platforms to help protect children.
DEDICATION

This thesis is dedicated to my Mum and Dad, Margery and Nigel Heritage

Thank you for a lifetime of love
ACKNOWLEDGEMENTS

I would like to thank my supervisors Associate Professor Bridget Kelly and Dr Anne McMahon for their superb guidance and expertise throughout my PhD journey. I have learnt so much and have had so many fantastic opportunities throughout my candidature. Thank you for your unwavering encouragement, enthusiasm and belief in me. It has been an absolute joy to work with you.

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Thank you to all my colleagues and friends at Early Start; I have loved being part of such a collaborative and vibrant research team. Thank you to Tony Okely for your excellent leadership and inclusivity. Thank you to Penny, Tamara, Bec, Sarah and Julie for your...
kindness, friendship and support. To all my dear PhD friends and colleagues, Rachel, Karen, Jade, Yvonne, Megan, Michele, Sameeha, Limin, Amy, Erin, Soo Jin, Lyndal, Ruth and Katharina, your friendship and encouragement means the world to me. Thank you to all the Mt Keira hill-walking enthusiasts; walking with you all has been a highlight every week.

Most importantly, thank you to my family for your love and support; to my sisters, Jane and Sara, and their families, and my dear Mum. Thank you to Jo and Tim and to Jess and Em for your support and enthusiasm every step of the way. A special thank you to my precious son, Alistair, for your love; I love you most dearly. And finally thank you to my dear husband Ross for encouraging me to undertake this journey, for believing in me and for your unconditional love and support.
### IMPACT SUMMARY OF THESIS RELATED RESEARCH

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**Figure A: Impact summary of thesis related research (as at 30 August 2018)**
PUBLICATIONS CONSTITUTING THIS THESIS

Peer-reviewed publications

Chapter Two (Appendix A)


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Chapter Four (Appendix B)


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Chapter Five (Appendix C)


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Manuscripts submitted for publication

Chapter Six

**Norman, J.**, Kelly B., McMahon A-T., Boyland E., Chapman K., King L. 2018, Remember me? An analysis of the role of marketing techniques in driving children’s brand recognition, attitudes and desire to eat foods after advertising exposure: a randomized crossover trial

**Conference papers**


Behavioral Nutrition and Physical Activity Conference in Cape Town, South Africa, 8-11 June (Appendix G)

Presentations

Three minute thesis (Appendix H)

Norman, J. 2018 ‘Sustained impact of energy-dense food marketing on children’s dietary intake’. Three minute thesis presented at the University of Wollongong Faculty of Social Sciences Three Minute Thesis Competition Heat, 7 June. People’s Choice Winner

Norman, J. 2018 ‘Sustained impact of energy-dense food marketing on children’s dietary intake’. Three minute thesis presented at the NSW Health, Health Promotion Service Quarterly Meeting, 12 June

Norman, J. 2018 ‘Sustained impact of energy-dense food marketing on children’s dietary intake’. Three minute thesis presented at the University of Wollongong Nutrition Forum, 4 July

Norman, J. 2018 ‘Sustained impact of energy-dense food marketing on children’s dietary intake’. Three minute thesis presented at the University of Wollongong Three Minute Thesis Competition Final, 12 July. People’s Choice Winner. Presentation available at

https://youtu.be/_GSAkzvupw0

UK Parliament

Dr Emma Boyland presented the findings from Norman et al. 2018 to the UK Parliament Health and Social Care Committee’s inquiry into Childhood Obesity on Tuesday 8th May 2018. Dr Boyland’s remarks can be viewed at:

https://parliamentlive.tv/event/index/94719b98-f1fc-4583-a266-7c8252e2f4d4
Citations of published articles


**Norman et al. 2016** was cited in the UK Government’s 2018 Obesity Plan:


**Norman et al. 2016** has been cited by the following peer-reviewed journal articles:

Logan, A. & Prescott, S. 2017. Astrofood, priorities and pandemics: reflections of an ultra-processed breakfast program and contemporary dysbiotic drift. *Challenges*, 8, 24. (This article has been cited 4 times)

Prescott, S. & Logan, A. 2016. Transforming life: a broad view of the developmental origins of health and disease concept from an ecological justice perspective. *International Journal of Environmental Research and Public Health*, 13, 1075. (This article has been cited 11 times)

Neyens, E. & Smits, T. 2017. Seeing is doing. The implicit effect of TV cooking shows on children's use of ingredients. *Appetite*, 116, 559-567. (This article has been cited once)


world. *Journal of Allergy and Clinical Immunology*, 140, 24-40. (This article has been cited 9 times)


Prescott, S. & Logan, A. 2018. Larger Than Life: Injecting Hope into the Planetary Health Paradigm. *Challenges*, 9, 13. (This article has been cited once)


**Norman et al. 2018** has been cited in:


Hickey K, Mandelbaum J, Bloom K, Martin J. *Overbranded, underprotected. How industry self-regulation is failing children from unhealthy food marketing.*
Melbourne: Obesity Policy Coalition; 2018 Available at:

MEDIA COVERAGE FROM THESIS RELATED RESEARCH

Appendix I

Media release: ‘Children’s self-regulation of eating overpowered by junk food marketing.’
University of Wollongong website, 15 March 2018.

Appendix J

Online news article: ‘Junk Food’. Checkup Medical Column, Australian Associated Press
16 March 2018.
This article was republished on a number of News Corp news websites including SBS News Australia, Daily Mail Australia, The Australian, The Daily Telegraph, Brisbane Courier-Mail, Adelaide Advertiser and Yahoo!7.

Appendix K

Online news article: ‘UOW professor wants greater regulation of junk food marketing to children’. The Illawarra Mercury 16 March 2018.
This was published on 45 Fairfax Australian regional news outlets’ web pages, including the large regional centres: Newcastle, Maitland, Port Macquarie, Ballarat, Wagga, Albury-Wodonga, Launceston, Burnie-Devonport, Orange, and Dubbo. Appendix K details all the news outlets that featured this article.

Appendix L

Printed newspaper article: ‘UOW study finds children ‘overpowered’ by junk food marketing’ The Illawarra Mercury 19 March 2018.

Social media coverage:

Appendix M

Media release: ‘Junk food ads lead to overeating capable of driving unhealthy weight gain in children, new study finds.’ University of Wollongong website, 23 April 2018

Radio interviews:

23 April 2018   Radio interview with Lindsay McDougall ABC Illawarra Drive

24 April 2018   Radio interview 3AW Drive with Nick McCallum (standing in for Tom Elliott) Available at: https://omny.fm/shows/drive-with-tom-elliott/3aw-drive-with-nick-mccallum-april-24?t=13m49s

Appendix N

TV program appearances:

WIN News Illawarra, 2018, TV program, Channel Nine Entertainment Company, Australia, 23 April

‘Junk Food’. The Today Show 2018, TV program, Channel Nine Entertainment Company, Australia, 24 April. The Today Show Panel discussion on interview available at:
https://www.facebook.com/iwakeupwithtoday/videos/1987182297983092/

(Approximately 200,000 TV viewers, 21,000 Facebook views)

https://www.facebook.com/tennews/videos/1927923067277991/?t=0

(409,000 TV viewers, 3,000 Facebook views)

‘Junk time’. The Project, 2018, TV program, Network Ten Pty Limited, Australia, 24 April. News segment available at:
https://www.facebook.com/TheProjectTV/videos/10155487655408441/
(413,000 TV viewers; 23,000 Facebook views)


Appendix O

Online article: ‘Junk food ads driving weight-gain in children - study’. The Educator Australia 24 April 2018


Online article: ‘Junk food ads driving weight-gain in children - study’. The Educator Asia 23 April 2018


Appendix P

Online Article: ‘Kids stack on extra kilojoules after watching junk food ads: research’. Herald Sun 24 April 2018


Appendix Q

Online Article: ‘UOW study reveals parents steamrolled by junk food industry’. Illawarra Mercury 24 April 2018


This article was published on 80 Fairfax Australian regional news outlets’ web pages: see Appendix Q for the full list of news outlets.
Appendix R

Online magazine article: Essential kids 2018, ‘Proof that junk food advertising makes children overeat’ viewed 23 July 2018:

Appendix S

Webpage articles and references:

Australian Government, Australian Research Council 2018 ‘Junk food ads lead to overeating and weight gain in children’. Research Highlights, viewed 23 July 2018:

New South Wales Cancer Council 2018, ‘Aussie kids eat more after seeing junk food ads’, viewed 23 July 2018:

World Health Organization 2018, ‘Reducing the impact of marketing of foods and non-alcoholic beverages on children. Evidence and clinical trials, viewed 23 July 2018:
http://apps.who.int/trialsearch/nutrition.aspx?Title=marketing%20and%20obesity%20

Social media coverage:

Twitter: 54 tweets from 45 users with an upper bound of 82,053 followers, viewed 29 August 2018 https://www.altmetric.com/details/37115260/twitter
GOVERNMENT SUBMISSIONS FROM THESIS RELATED RESEARCH

UK Parliament Submission:

Dr Emma Boyland presented the findings from Norman et al. 2018 to the UK Parliament Health and Social Care Committee’s inquiry into Childhood Obesity on Tuesday 8 May 2018. Dr Boyland’s remarks can be viewed at:

https://parliamentlive.tv/event/index/94719b98-f1fc-4583-a266-7c8252e2f4d4

Appendix T

New South Wales Parliament Food Marketing Submission


Appendix U

New South Wales Parliament Adjournment Speech

Walker D., 2018 ‘Childhood Obesity’ adjournment speech presented to the New South Wales Parliament, Legislative Council 23 May, viewed 23 July 2018:


Appendix V

Senate Select Committee into the Obesity Epidemic in Australia Submission:

Kelly B. and Norman J., on behalf of the Food and Movement Research Theme, Early Start, University of Wollongong, 2018, ‘Submission to the Select Committee into the Obesity Epidemic in Australia’ (submission number 69), viewed 23 July 2018:
Appendix W

Invitation to give evidence at the Senate Select Committee public hearing into the Obesity Epidemic in Australia

Following the above submission to the Senate Select Committee into the Obesity Epidemic in Australia, the Early Start Food and Movement Research Theme were invited to give evidence at the Senate Committee public hearing into the Obesity Epidemic. Professor Heather Yeatman, Associate Professor Bridget Kelly and Jennifer Norman gave evidence on behalf of the Theme on Tuesday 4 September 2018. The Hansard transcript of the public hearing will be available at:

https://www.aph.gov.au/Parliamentary_Business/Committees/Senate/Obesity_epidemic_in_Australia/Obesity/Public_Hearings
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2. The research study was funded by an Australian Research Council Linkage Grant: Attitudinal and Behavioural Impacts of Energy-Dense Food Marketing to Children (LP 140100120) and Cancer Council NSW.
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<table>
<thead>
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<th>Full name</th>
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<tbody>
<tr>
<td>ACMA</td>
<td>Australian Communications Media Authority</td>
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<tr>
<td>ABS</td>
<td>Australian Bureau of Statistics</td>
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<tr>
<td>CFQ</td>
<td>Child Feeding Questionnaire</td>
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<tr>
<td>CI</td>
<td>Confidence interval</td>
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<tr>
<td>DMFT</td>
<td>Decayed, missing and filled teeth index</td>
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<tr>
<td>fMRI</td>
<td>Functional Magnetic Resonance Imaging</td>
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<tr>
<td>fx</td>
<td>Frequency</td>
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<td>NSW</td>
<td>New South Wales</td>
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<tr>
<td>OR</td>
<td>Odds ratio</td>
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<tr>
<td>p-value</td>
<td>Probability value</td>
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<tr>
<td>RCT</td>
<td>Randomised controlled trial</td>
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<tr>
<td>RR</td>
<td>Relative risk</td>
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<tr>
<td>SD</td>
<td>Standard deviation</td>
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<td>TAFE</td>
<td>Technical and Further Education</td>
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<td>TV</td>
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<td>WHO</td>
<td>World Health Organization</td>
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CHAPTER ONE

INTRODUCTION, RATIONALE AND THESIS OVERVIEW

1.1 Food marketing and its relationship with childhood obesity

1.1.1 Childhood overweight and obesity

Obesity is considered one of the most serious public health challenges of the 21st Century (World Health Organization 2014). Childhood obesity is a national health priority, and the prevention of unhealthy weight gain is a key area of focus (NSW Ministry of Health 2013, Bauman et al. 2016). In Australia, one in four children have overweight or obesity (27.4%), affecting approximately 1.1 million children (Australian Bureau of Statistics 2015). This is a significant concern because overweight and obesity have been shown to track from childhood through into adulthood, with about 80% of overweight youth remaining overweight as adults (Herman et al. 2009). Overweight and obesity result in immediate health outcomes for children and, particularly, adolescents and longer-term detrimental health outcomes; conditions range from sleep apnoea, psychosocial problems and Type II diabetes to increased risk of coronary heart disease, hypertension, gallbladder disease and certain types of cancer (World Health Organization 2000, Biro and Wien 2010, Reilly and Kelly 2011).

1.1.2 Food marketing and childhood obesity

The etiology of obesity is multi-faceted, most simply explained by an energy imbalance between dietary intake and energy expenditure, which is influenced by a complex matrix of genetic, behavioural and environmental determinants (Gortmaker et al. 2011). However, the steep rise in the prevalence of children with overweight and obesity in the past three decades clearly points to environmental influences playing a central role (Swinburn et al. 2011).

A significant contributor to this ‘obesogenic’ environment is food and beverage marketing (World Health Organization 2003), with the majority of products advertised being high in
added saturated fat, sugar and salt (Kelly et al. 2007, Cairns et al. 2013, Powell et al. 2013b). These energy-dense, nutrient-poor foods are described as discretionary foods in the Australian Dietary Guidelines (National Health and Medical Research Council 2013). The Australian Dietary Guidelines recommend that their intake be limited, however data from the 2011-2012 Australian Health Survey indicate that discretionary foods contribute up to 40% of children’s energy intake (Australian Bureau of Statistics 2014). These foods are referred to as ‘unhealthy’ throughout this thesis.

Fundamentally, effective marketing is a function of two core components: exposure to the marketing message, and the persuasive content and power of that message (World Health Organization 2012). Exposure relates to the frequency, reach and engagement with the marketing messages; determined by media platforms used, industry marketing expenditures, and children’s media-use behaviours (World Health Organization 2012, Kelly 2018). The persuasive power of marketing relates to the creative content and execution of marketing messages (World Health Organization 2012). Essentially, frequent exposure to powerful messages is the overall objective of marketing campaigns (Jackson et al. 2014, Kelly 2018).

Worldwide, TV is still the main media platform for food advertising (Cairns et al. 2013, Powell et al. 2013a), however, the proliferation of digital technologies, including the Internet and mobile devices, has seen an increasing prevalence of food advertising on ‘new media’ (Kelly et al. 2015c). In recent years, advergames (branded games) have been introduced as an online marketing tool, where the brand and/or product are a prominent feature (Schwartz et al. 2013).

There is a recognised link between unhealthy food marketing and childhood obesity (Harris et al. 2009c, Goris et al. 2010, World Health Organization 2013) and its restriction has been highlighted as a critical component in childhood obesity prevention (National Preventative Health Taskforce 2009, Australian Government 2010, World Health Organization 2010). In light of this a key recommendation from the World Health Organization’s (WHO) report on
Ending Childhood Obesity was to restrict the amount of unhealthy food advertising that children are exposed to and to reduce the power of the marketing communications used, via restrictions on the persuasive techniques used to appeal to children (World Health Organization 2016a). Globally, however, there is limited statutory regulation restricting the extent of food marketing to children or moderating the specific marketing techniques used (World Cancer Research Fund International 2018). Economic modelling suggests that limiting unhealthy food advertising to children would be a cost-effective intervention to reduce childhood obesity (Magnus et al. 2009, Brown et al. 2018).

1.1.3 Influence of food marketing on children

There are a number of ways that exposure to unhealthy food marketing affects children’s diet-related health including influencing their nutrition knowledge, food preferences and choices, brand and product attitudes, purchase requests and behaviours and short-term food intake (Hastings et al. 2006, Institute of Medicine 2006, Cairns et al. 2009, Cairns et al. 2013, Kelly et al. 2015b, Boyland et al. 2016). Despite these reported effects and influences, the shortage of evidence showing a direct link between food marketing and children’s weight remains an obstacle to public health advocates seeking legislation to further regulate children’s exposure to unhealthy food marketing (Hoek and Gendall 2006). In its review of the Children’s Television Standards in 2009, the Australian Communications and Media Authority (ACMA) cited the difficulty in quantifying the relative contribution of food and beverage marketing on childhood obesity and the establishment of a causal relationship between the two, as one of its prime reasons for its limited action in restricting advertising of food and beverages during children’s viewing times (Australian Communications and Media Authority 2009).

In experimental studies, children’s food intake is arguably the most relevant outcome measure to investigate direct links between unhealthy food marketing and children’s weight (Boyland and Whalen 2015). A systematic review and meta-analysis of 13 experimental
studies on the effects of brief exposure to unhealthy food advertising on TV and online advergames on children’s immediate food consumption, showed that children ate more food after seeing food advertising compared with controls (SMD: 0.56; p=0.003) (Boyland et al. 2016). Many of these single exposure experimental studies were conducted in laboratory settings and did not account for the cumulative effects of media exposures or the impact of repeated exposures across multiple media. This review concluded that there was a clear need for research to investigate the effects of sustained or longer-term exposures to food advertising to test whether demonstrated immediate increases in food consumption after brief exposures are not compensated for and, therefore, could lead to weight gain in children over time. The research presented in this thesis attempts to address this gap in the evidence.

Research also shows that some children are more likely to be influenced by food advertising than others (Halford et al. 2008, Anschütz et al. 2010, Folkvord et al. 2014, Folkvord et al. 2015). Increased effects on children’s immediate food intake after food advertising exposure on TV or online advergames have been demonstrated among children with overweight and obesity (Halford et al. 2008); children with high impulsivity (Folkvord et al. 2014) and increased attentional bias (Folkvord et al. 2015); and among children whose mothers exhibit encouragement to be thin (Anschütz et al. 2010). Additionally, research suggests that children who experience controlling parental feeding practices are less successful in self-regulating their food intake than others (Birch and Fisher 1998, Birch et al. 2003) and are possibly more influenced by external food cues (Stoeckel et al. 2017). This gives rise to the question whether this group of children are more susceptible to advertising’s effects.

1.2 Aim

The primary aim of this research was to investigate the direct effects of sustained exposure to unhealthy food advertising on TV and online advergames on children’s dietary intake and its potential influence on children’s weight.
Secondary aims of this thesis were to determine whether sub-groups of children were more susceptible to advertising effects and to investigate how the creative content within the advertisements affected children’s recognition and attitudinal responses towards advertised brands.

1.3 Objectives of the research

The specific objectives of the study reported in this thesis were:

1. To quantify the impact of sustained exposures to unhealthy food advertising on TV and online advergames on children’s immediate and subsequent food intake;

2. To investigate whether exposure to unhealthy food advertising on TV and online advergames had an increased effect on children with a heavier weight status;

3. To investigate whether exposure to unhealthy food advertising on TV and online advergames had an increased effect on children whose parents report controlling feeding practices (i.e. restriction or pressure to eat);

4. To investigate the effects of exposure to unfamiliar food brands in TV advertising and online advergames on children’s brand recognition and recall; perceptions and attitudes towards brands and consumers of those brands; and desire to eat the advertised products;

5. To review the creative content used in the different food advertisements and to identify the persuasive techniques within the advertisements that most appealed to children and captured their attention.

1.4 Research questions

The thesis attempts to answer these specific research questions, grouped as follows:

1. The impact of sustained exposures of unhealthy food advertising on children’s immediate and subsequent food intake: Does exposure to unhealthy food advertising result in an increase in children’s intake of foods compared with their food intake after non-food advertising exposure? Does exposure to unhealthy food advertising across
multiple media have an increased effect on children’s intake of foods compared to those only exposed to unhealthy food advertising in a single media source? Is any increased intake of food following exposure to unhealthy food advertising compensated for at a subsequent meal? Do food consumption responses to advertising differ between children with different weight statuses?

2. Do food consumption responses to advertising differ between children whose parents report different feeding practices? (i.e. restriction or pressure to eat)

3. Children’s brand recognition, attitudes and desire to eat foods after advertising exposure: Does exposure to unfamiliar food brands in TV advertising and online advergames increase children’s brand recognition and recall after exposure? How does exposure to unfamiliar food brands in TV advertising and online advergames affect children’s perceptions and attitudes towards brands and consumers of those brands and desire to eat the advertised products? What persuasive techniques are used within the food advertisements that most appealed to children and captured their attention?

1.5 The significance of the research

Globally and in Australia there is a resounding need for government regulatory reform to restrict food advertising to children (Lumley et al. 2012, Watson et al. 2014, Lobstein et al. 2015, Obesity Policy Coalition and The Global Obesity Centre 2017, Hickey et al. 2018). This study aimed to add new evidence to the debate about the need to restrict children’s exposure to unhealthy food marketing. It planned to do this by being the first experimental study to investigate the effects of unhealthy food advertising across multiple media, and the potential impact on children’s longer term dietary intake. Significantly, this study monitored if any increased energy consumed by children as a result of exposure to unhealthy food advertising, from both single media and multiple media platforms, was compensated for at a later eating occasion. Utilising a holiday camp as a setting and a within-subject design, this study gathered dietary intake data from children over a period of six days, exploring whether
a lack of compensation contributed to sustained energy imbalance which, over time, could lead to a risk of unhealthy weight gain and diet-related disease.

1.6 Thesis outline

This thesis is presented by compilation, including three published journal articles and one manuscript currently under review for publication in a peer-reviewed journal. Each publication or manuscript is presented in a separate chapter. Figure 1.1 illustrates the thesis outline.

Chapter Two presents the literature review for this thesis. It consists of two parts. The first part was published in the journal *Current Nutrition Reports* in 2016. This published review synthesised the evidence from observational and experimental studies that have examined the relationship between food marketing, across a range of media platforms, and children’s food behaviours (food preferences and choices, short term food consumption and usual dietary intake). These studies were appraised against Bradford Hill’s causality framework (Bradford Hill 1965). The review identified gaps in the literature that constituted the main study within this thesis. The second part of the literature review contains an update of the literature published since the original review. The original search was replicated and, in accordance with the framework of the published review, all articles were assessed against the Bradford Hill criteria (Bradford Hill 1965). A discussion of the relevance of the updated literature to the initial review findings is presented.

Chapter Three gives an explanation of the theoretical framework which informs the study design and provides an outline of the research methods used in this thesis. Psychosocial theories, cue-reactivity theory and Bronfenbrenner’s ecological theory of child development that underpin the design of the randomised trial, that is central to this thesis, are briefly discussed.

Chapter Four reports on the main findings of the randomised crossover trial, specifically addressing the first group of research questions, which sought to quantify the impact of
sustained exposures of unhealthy food advertising on children’s immediate and subsequent food intake. Findings from this chapter have been published in the *International Journal of Physical Activity and Behavioral Nutrition* in 2018.

Chapter Five draws on data collected from the randomised crossover study presented in Chapter Four and investigates whether children whose parents report controlling feeding practices have an increased vulnerability to advertising effects, thus addressing the second research question. This chapter has been published in the journal *Appetite* in 2018.

Chapter Six addresses the final group of research questions and reports on the findings that investigated how persuasive techniques within the unfamiliar TV and online food advertisements affected children’s recall and attitudes towards brands. Persuasive techniques used within the advertisements that most appealed to children were identified and described. The chapter has been submitted as a manuscript for publication with a peer-reviewed journal and is currently under review (31 August 2018).

Chapter Seven provides a summary of the key findings from the research that constituted this thesis. Based on these findings and their implications, recommendations for government regulation to restrict the extent and power of food advertising to children are proposed. Opportunities for future research in this field are also discussed.
Figure 1.1: The thesis outline: areas shaded in green are published journal articles and the area shaded in blue is the manuscript under review.
CHAPTER TWO

LITERATURE REVIEW

2.1 Preface

Preventing the development of overweight in childhood has been emphasised as the only feasible and realistic solution for the management of obesity (Lobstein et al. 2004). Further restriction of food marketing to children is a key part of this solution (World Health Organization 2016a). Globally, however, there is a reliance on industry self-regulation (World Cancer Research Fund International 2018) which is grossly ineffective and government regulation is needed for effective change to occur (Moodie et al. 2013). A key part of the evidence required to support the need for government regulation of food marketing is to demonstrate the causal link between food marketing and children’s dietary behaviours and obesity (Harris et al. 2009c). This direct link is difficult to measure and quantify given that a multiplicity of determinants contribute to dietary intake and the development of overweight (Vandenbroeck 2007). The Bradford Hill Criteria provide a framework by which epidemiological studies may be examined to consider whether a causal interpretation of an observed association is valid (Bradford Hill 1965). As such, the narrative review presented in this chapter synthesises the evidence that examines the relationship between food marketing, across a range of different media, and children’s food behaviours, and appraises these studies against Bradford Hill’s causality framework.

Peer-reviewed articles were identified from Business Source Complete, Cinahl, Cochrane Library, Emerald, Medline, Proquest Central, PsychINFO, Science Direct, Scopus, Soc. Index and Web of Science databases. Search terms included child* AND (nutrition OR food OR diet*) AND (marketing OR promotion OR advertising). The search was restricted to English-language articles published from 2009 to 2016, with earlier articles captured from the bibliography of a relevant systematic review of studies from 1970 to 2008 (Cairns et al. 2009). Data from meta-analyses, reviews and empirical studies that investigated the
relationship between food marketing, across a range of different media, and children’s food behaviours, including food preferences and choices, short term food consumption and usual dietary intake were included. This paper was published in the journal *Current Nutrition Reports* in 2016 in a special issue of a topical collection of papers on cardiovascular disease (Norman et al. 2016).

The latter part of the chapter replicates the initial search to include literature that has been published since the publication of the original review and includes a discussion of the relevance of the updated literature to the initial review findings. In keeping with the framework of the published review, all studies were appraised against the Bradford Hill criteria (Bradford Hill 1965).

The first part of this chapter was written and published as a peer-reviewed journal article during the course of this degree (see Appendix A). It is presented as it was published with minor changes in terms of formatting (such as figure and table numbering, and the referencing style) to ensure cohesion within the thesis and to conform to the University of Wollongong’s referencing style which is Harvard. The Harvard style is used throughout the thesis.

Citation: Norman, J., Kelly, B., Boyland, E., McMahon, A-T., (2016), The impact of marketing and advertising on food behaviours: evaluating the evidence for a causal relationship. *Current Nutrition Reports*, 5(3): p. 139-149

Author’s contribution: J. Norman and B. Kelly conceived the research aims. J. Norman conducted the literature search, wrote the manuscript, and had primary responsibility for the final content of the manuscript. B. Kelly and E. Boyland reviewed the literature search results and contributed additional seminal papers. J. Norman, B. Kelly, E. Boyland and A-T. McMahon abstracted summaries of the aims, methods and key findings from the identified articles; and appraised each article against the Bradford Hill criteria. J. Norman
synthesised the key findings. All authors critically reviewed the manuscript for its content and approved the final version of the manuscript. B. Kelly supervised the process.

As at August 2018, the findings from this paper have been cited 11 times, including in the UK Government’s 2018 Obesity Plan (Department of Health and Social Care UK Government 2018).
2.2 The published literature: The impact of marketing and advertising on food behaviours: evaluating the evidence for a causal relationship

2.2.1 Abstract

The prevention of overweight in childhood is paramount to long term heart-health. Food marketing predominately promotes unhealthy products which if over-consumed will lead to overweight. International health expert calls for further restriction of children’s exposure to food marketing remain relatively unheeded, with a lack of evidence showing a causal link between food marketing and children’s dietary behaviours and obesity an oft cited reason for this policy inertia. This direct link is difficult to measure and quantify with a multiplicity of determinants contributing to dietary intake and the development of overweight. The Bradford Hill Criteria provide a credible framework by which epidemiological studies may be examined to consider whether a causal interpretation of an observed association is valid. This paper draws upon current evidence that examines the relationship between food marketing, across a range of different media, and children’s food behaviours, and appraises these studies against Bradford Hill’s causality framework.

Keywords: Food; Beverage; Child; Marketing; Advertising; Obesity; Causation; Bradford Hill
2.2.2 Introduction

Cardiovascular disease (CVD) is largely preventable, yet, globally, it contributes to the greatest burden of premature mortality (Mendis et al. 2011). Modifiable, diet-related CVD risk factors include overweight and obesity and high consumption of saturated and trans fatty acids, refined carbohydrates and sodium (World Health Organization 2003, World Health Organization 2011a). Establishing healthy dietary behaviours and maintaining a healthy weight in childhood is paramount for maximising heart-health (Lobstein et al. 2004), however within our current food environment, this has never been more challenging.

Overweight is a natural response to today’s obesogenic environment (Swinburn et al. 2011). Our food supply is dominated by inexpensive, highly processed, yet highly palatable, energy-dense nutrient-poor food products (Monteiro et al. 2013). This food environment is all our current generation of young people have ever known; they are high soft drink, snack and fast food consumers (Kit et al. 2013, Australian Bureau of Statistics 2014) and are more susceptible to overweight than ever before (Allman-Farinelli et al. 2007). A risk that is highlighted by the fact that a positive energy gap of approximately 200-300 kJ a day is all that is needed for the development of overweight in children (Plachta-Danielzik et al. 2008, van den Berg et al. 2011).

The public face of this toxic food environment is food marketing. The ubiquitous promotion of unhealthy food establishes societal norms around acceptable and desirable foods (Hoek and Gendall 2006, Schwartz et al. 2013) and adverts serve as conditioned stimuli that trigger food cravings and cue an increase in food consumption (Boswell and Kober 2016), particularly in children (Boyland et al. 2016). The disparity between food advertising expenditure for different food groups is extreme (Schwartz et al. 2013): government campaigns promoting fruit and vegetables are dwarfed by the billions of dollars spent on fast food and ‘junk’ food marketing each year (Chapman et al. 2007, Powell et al. 2013a). The majority of these advertised foods and drinks are high in added fat, sugar and salt, are
contrary to dietary recommendations and, if eaten in excess, can contribute to overweight and the risk of developing CVD (Zuppa et al. 2003, Kelly et al. 2007, Powell et al. 2007, Watson et al. 2014).

Restricting food marketing to children has been identified at the highest levels of international policy setting as a priority public health nutrition intervention (Australian Government 2010, World Health Organization 2010). It is one of 25 targets set by the World Health Organization to reduce non-communicable disease premature mortality by 2025 (World Health Organization 2011b). Some countries have shown leadership in policy action reform, however the global response as a whole remains limited (World Cancer Research Fund International 2018), stymied by the food and advertising industries actively contesting and undermining public health policies and programmes (Hoek and Gendall 2006, Australian Association of National Advertisers 2007, Moodie et al. 2013).

A large number of reviews over the past decade have assessed the relationship between different aspects of food marketing and its effect on children (Hastings et al. 2006, Institute of Medicine 2006, Cairns et al. 2009, Boyland and Whalen 2015, Kelly et al. 2015b, Kraak and Story 2015, Smits et al. 2015, Boyland et al. 2016). The most recent comprehensive systematic review concluded that there is strong evidence that food marketing effects children’s food purchases both at a food category and brand level and found modest evidence that it influences their food knowledge, preferences and choices, consumption behaviours and diet-related health (Cairns et al. 2009).

Despite this evidence, the difficulty in quantifying the relative contribution of food marketing on childhood obesity, and the establishment of a causal relationship between the two, are oft cited reasons, by both governments (Hoek 2005, Australian Communications and Media Authority 2009) and the food industry (Coalition on Food Advertising to Children 2006), for the limited action to restrict children’s exposure to unhealthy food marketing. The development of obesity is multi-factorial (Swinburn et al. 2011) and the pathway linking
food marketing exposures to children’s weight is complex; most likely operating through sequenced and cumulative impacts over time, ultimately influencing the consumption of unhealthy foods (Kelly et al. 2015b). As such, the direct link to obesity is difficult to measure and quantify (Kelly et al. 2015b). Examining the evidence in relation to children’s food behaviours, in particularly food consumption and dietary intake, is, therefore, an appropriate way to investigate a causal link between unhealthy food marketing and children’s weight (Boyland and Whalen 2015).

Ascribing cause and effect in many areas of epidemiology is difficult, where observational studies that identify associations between exposure and outcomes may be a result of reverse causation, chance, bias or confounding (Wakeford 2015). Conducting experimental studies with high ecological validity in this field of research is also difficult. Given the prolific and integrated exposure to food marketing in everyday life, isolating its effect in an experimental setting is challenging and, in the longer-term, expensive and methodologically difficult (Livingstone 2005). The ‘Bradford Hill Criteria’, first published over fifty years ago, are a recognised and widely-used framework against which epidemiological studies may be examined to consider whether a causal interpretation of an observed association is valid (Bradford Hill 1965, Lucas and McMichael 2005). In this vein, these guidelines have been widely used in the public health arena to explore whether causal links exist between an exposure of interest and a behaviour or health outcome (Bosch et al. 2002, Gazdar et al. 2002, Hu 2013, Weyland et al. 2014).

This paper draws upon current evidence from meta-analyses, reviews and empirical studies that examine the relationship between food marketing, across a range of different media, and children’s food behaviours, including food preferences and choices, short term food consumption and usual dietary intake. Included data are those published since the last systematic review in 2009, plus seminal papers prior to this date. Each study was reviewed and appraised according to the relevant Bradford Hill Criteria (Table 2.1). In this way, we categorise the evidence and examine whether there is a case to be made that a causal
relationship exists between children’s exposure to food promotion and their subsequent food behaviours.

2.2.3 Evidence review of a causal relationship between food promotion exposure and food behaviours

We considered the following Bradford Hill Criteria in our appraisal of the evidence: strength of association, experimental evidence, dose-response relationship, consistency, temporality, biological plausibility and coherence. As noted by Bradford Hill himself, these are not pre-requisites that must be satisfied before an association can be judged as causal but rather serve as prompts for considering the weight of the evidence to assess if cause and effect is a realistic and credible deduction (Bradford Hill 1965).

2.2.3.1 Bradford Hill Criteria: Strength of Association

2.2.3.1.1 Observational evidence

Observational studies have found statistically significant positive associations between children’s (3-18 years) exposure to food marketing and their food choice, consumption and usual intake (Andreyeva et al. 2011, Scully et al. 2012, Olafsdottir et al. 2014, Giese et al. 2015, Kelly et al. 2015a, Longacre et al. 2016), with effect sizes ranging from small (odds ratio (OR) <2) to moderate-strong (OR ≥3 or <4) (Ferguson 2009). Marketing exposure was assessed through either parental or self-report or using data on advertising patterns, including Gross Ratings Points (GRPs). GRPs give the proportion of the target audience reached by advertising for the category of interest in a specific geographic area during a certain time period (using this measure an advertisement that reached 80% of the specified audience and was shown 100 times during the year would have a GRP of 8,000 (80% x 100)) (Andreyeva et al. 2011).

Longitudinal studies are considered to be the strongest non-randomised study design as these eliminate the possibility of reverse causality. However, we found limited evidence in this regard, identifying only one prospective cohort study from Sweden (baseline (n=1733, mean...
age 5.7 years) and two-year follow-up (n=1333)) (Olafsdottir et al. 2014). Consuming sweetened beverages at least weekly at follow-up was predicted by exposure to commercial TV at baseline (OR 1.4, 95% CI 1.1–1.9 (p<0.001)), independent of parental sweetened beverage consumption norms. In this study, cross-sectional analyses of baseline data found stronger effects, with exposure to commercial TV associated with drinking sweetened beverages at least weekly (OR 1.6, 95% CI 1.3–2.1 (p<0.001)), compared with no commercial TV exposure. Where parents did not fully limit their children’s exposure to commercials, the likelihood of drinking sweetened beverages at least weekly was more than double compared with children whose parents restricted their exposure completely (OR 1.9, 95% CI 1.4–2.6 (p<0.001)). Parent proxy reports may have been subject to social desirability bias with reported screen time and sweetened drink intakes lower than national comparative data. As such, the strength of the association would have been attenuated.

Similar trends were seen in the following studies when children self-reported exposure to food marketing (either on TV, print, on public transport, at school or digitally) and their usual food intake and/or purchase requests for promoted products (Scully et al. 2012, Giese et al. 2015, Kelly et al. 2015a).

An Australian study (n=12,188, 12-17 years) found that compared with children who did not watch commercial TV, average viewers (≤ 2 hours/day) were more likely to report asking for a food product they had seen advertised in the last month (OR 1.25, 95% CI 1.10-1.42 (p<0.01)), while more frequent viewers (> 2 hours/day) were more likely to have both asked for (OR 1.61, 95% CI 1.38-1.88 (p<0.001)) and tried a new food product they had seen advertised (OR 1.48, 95% CI 1.27-1.71 (p<0.001)) (Scully et al. 2012). Stronger associations were seen between exposure to all forms of non-broadcast (non-TV) marketing and children’s food choices, particularly in children with greater than two exposures in the last month (ORs 2.48 - 3.74 (p<0.001)). The stronger association with digital marketing could be as a result of the personalised nature of these messages and the interactive content (Kelly et al. 2015c).
Another Australian study (n=417, 10-16 years) showed a significant positive association between watching commercial TV when children did not skip through advertisements, and unhealthy dietary intake (F [3, 307] = 5.44, p=0.001). In contrast, watching commercial TV without advertisements was not linked to poor diet and non-commercial TV was only weakly associated with unhealthy food and drink intake (Kelly et al. 2015a). This pattern was also observed in a study of young people from three European countries (n=2851, age 8-21 years) with those exposed to all types of unhealthy TV food advertising having a higher consumption of fast food, snacks and soft drinks of up to 1 unit per week compared to unexposed participants (P< 0.001) across all countries (Giese et al. 2015).

The reliance of these studies on self-report and recall gives potential for measurement error with underreporting of dietary intake (Livingstone et al. 2004) and for true exposure to marketing to be underestimated (Heath and Nairn 2005), likely diminishing the strength of associations and attenuating results towards the null hypothesis. Conversely, there is also the possibility of some recall bias, with children who consume more unhealthy foods potentially being more likely to remember advertisements for these products.

A US study (n=9,760, mean age 11.2 years) took a different approach (Andreyeva et al. 2011). Dietary intake data from a national cohort study was compared with annual GRPs for spot advertising for sugary drinks and fast food restaurants purchased for the survey year and the preceding two years. For soft drink intake, an increase in exposure to advertisements for soft drink by 10,000 GRPs over the 3 years (equivalent to 100 advertisements over three years) was associated with a 9.4% increase in children’s consumption of soft drinks (P<0.01). Advertisements for fast food were also associated with increased soft drink intake.

There is a risk that observed associations may have been due to confounding by other correlated dietary and lifestyle factors; however, factors such as such as age, gender, weight, socio-demographic characteristics and total TV viewing were typically adjusted for in multivariate analyses across the studies described.
2.2.3.1.2. Experimental evidence

Associations seen in observational studies are supported by a strong, rigorous experimental evidence base. A recent meta-analysis reviewed the effects of acute exposure to unhealthy food advertising on food and drink consumption in children and adults (Boyland et al. 2016). Sixteen experimental studies reported outcomes in children: twelve on TV and four on Internet advergames (an advergame is an industry designed online game with the brand embedded as a central component, such as a game piece). Twelve of these studies found unhealthy food advertising had a significant effect on food consumption, with children consuming a greater amount of food after seeing food advertising compared with controls (standardised mean difference: 0.56; p=0.003; 95% CI: 0.18, 0.94; I² = 98%). Publication bias was ruled out with no signs of missing studies. Food advertising on TV and advergames was seen to have a significant effect on children’s food consumption with a moderate magnitude.


2.2.3.1.2.1 Experimental studies using TV advertising

A series of studies by a UK research group consistently showed significant increases in children’s immediate food consumption (p<0.001) following exposure to unhealthy food
advertising embedded in cartoons, across two different age ranges (5-7 years and 8-11 years) (Halford et al. 2004, Halford et al. 2007, Halford et al. 2008). In these studies, children, on average, consumed 16% more kilojoules after exposure to food adverts compared with control toy adverts, in within-person crossover design trials. An increased effect was commonly observed among children with overweight and obesity, although this difference in intake by weight status was only seen in unhealthy food advertising conditions.

A more recent UK study examined TV advertising effects among children who had higher than usual exposures to marketing, as determined by volume of TV watched (Boyland et al. 2011). This study (n=281, 6-13 years) demonstrated that food advertisements increased the preference for branded, energy-dense foods particularly in children who watched more TV (>21 hours per week) (p<0.001) (Boyland et al. 2011).

Similarly in the USA, children (n=108, 7-11 years) were shown cartoons embedded with either food or non-food advertisements and were given a bowl of crackers, which they could eat whilst watching (Harris et al. 2009a). Children ate 45% more during the food advertising condition (p=0.01), regardless of weight status.

2.2.3.1.2.2 Experimental studies using Internet advergames

The significant effect of unhealthy food Internet advergames on children’s subsequent food intake has been demonstrated (Harris et al. 2012, Folkvord et al. 2013, Folkvord et al. 2014, Folkvord et al. 2015). A US study (n=121, 7-12 years) found that children who played a branded unhealthy food game ate over 50% more energy-dense snack foods (322 kJ) than those who played a similar healthy food game (p<0.05) (Harris et al. 2012). Likewise children (n=270, 8-10 years) in a Dutch study ate more (p<0.001) after playing a game promoting energy-dense foods compared with a non-food game (284 kJ (53%)) and with the no-game control group (316 kJ (57%)) (Folkvord et al. 2013).
2.2.3.1.2.3 Experimental studies using product placement

Two European studies have shown the effect of product placement in movies on subsequent soft drink selection (Auty and Lewis 2004) and food choice and consumption (Matthes and Naderer 2015). After watching a two minute movie, children (n=57, 11-12 years; n=48, 6-7 years) who were exposed to a Pepsi product placement were more likely to choose Pepsi as a drink (p=0.04) (Auty and Lewis 2004). The second study showed children (n=121, 6-14 years) a seven minute excerpt from a popular children’s movie that contained a product placement for the savoury snack, Utz Cheese Balls. Exposure to the product placement exerted a significant effect on snack consumption (p<0.05).

2.2.3.1.2.4 Experimental studies using brand endorsers

The strength of the effect of branding, in the form of brand mascots and characters, cartoon media characters, and celebrity or sports endorsers, on children’s food behaviours has been reported in two recent systematic reviews (Kraak and Story 2015, Smits et al. 2015). The reviews examined 18 experimental studies (for children aged between 3-12 years) with a wide heterogeneity of design. They concluded that the evidence clearly demonstrates that brand endorsers have the persuasive capability of increasing children’s liking of, and preference for, foods they endorse. Particularly strong effects were seen when familiar media characters were paired with energy-dense, nutrient-poor foods.

The power of branding was demonstrated in a study of American pre-schoolers (n=63, 3-5 years), where they were asked to rate the taste of identical foods, with or without the McDonalds logo (Robinson et al. 2007). After tasting the foods, children were significantly more likely to state that the McDonalds branded foods tasted better than the matched plain-packaged pair (p<0.001) for both healthy and non-healthy foods. This study was replicated in Canadian children (n=65, 3-5 years) with similar findings, but noting highly colourful packaging, as typically found in non-healthy foods targeting children, was also influential (Elliott et al. 2013).
A UK Study (n=181, 8-11 years) demonstrated the strength of the effect of exposure on TV to a sports celebrity endorser and found that significant consumption effects (p<0.05) were not only seen after exposure to the endorsed commercial but also after TV footage of the endorser in his role as a presenter (Boyland et al. 2013).

2.2.3.1.2.5 Experimental studies using premium offers

The strength of toy premiums on children’s food choices has been demonstrated in two different age ranges. When presented with ‘meal-deal’ images, young children (n=56, 3-5 years) were more likely to favour both healthy (p<0.01) and unhealthy (p<0.001) meals when they were paired with a collectible toy, compared with foods paired with a non-collectible toy or no toy (McAlister and Cornwell 2012). At a holiday camp older children (n=337, 6-12 years) were offered a choice from two unhealthy and two ‘healthier’ McDonalds Happy Meals (Hobin et al. 2012). When all meals were paired with a toy, 19% of children chose the ‘healthier meals’ compared with 40% when the toy was only offered with the ‘healthier’ meals (OR=3.19, 95% CI: 1.89-5.40) (p<0.0001).

2.2.3.2 Bradford Hill Criteria: Experimental evidence

A vast body of robust experimental research has been conducted, largely by research groups in the UK (Auty and Lewis 2004, Halford et al. 2004, Halford et al. 2007, Halford et al. 2008, Boyland et al. 2011, Dovey et al. 2011, Boyland et al. 2013, Boyland et al. 2015) and also the USA (Harris et al. 2009a) (Harris et al. 2012, McAlister and Cornwell 2012), the Netherlands (Anschutz et al. 2009, Anschutz et al. 2010) (Folkvord et al. 2013, Folkvord et al. 2014, Folkvord et al. 2015), Australia (Dixon et al. 2014a), Austria (Matthes and Naderer 2015), Canada (Gorn and Goldberg 1982, Dhar and Baylis 2011, Elliott et al. 2013) (Hobin et al. 2012) and Chile (Uribe and Fuentes-Garcia 2015) among a range of different ethnic populations (Harris et al. 2009a, Harris et al. 2012, Kraak and Story 2015, Smits et al. 2015). All these studies demonstrated significant effects on children’s food behaviours from exposure to a wide range of advertising media and promotions. As reported above, the

As previously mentioned, conducting experimental studies in this domain over longer periods is methodologically challenging and expensive (Livingstone 2005) and, as such, research of this nature is limited. Two studies, however, give insight to the longer effects of food advertising exposure. The first study conducted at a Canadian children’s camp over a 14 day period in 1982 (n=288, 5-8 years) saw children who were exposed to 5 minutes of candy advertisements daily select significantly less fruit as a snack, compared with children in other advertising conditions (healthy food and non-food ads) (33-36%, p<0.001) (Gorn and Goldberg 1982). A second Canadian ecological study compared household food purchases in the predominantly French-speaking province of Quebec (n=5,024) (which has a ban on food advertising to children) with the neighbouring, predominantly English-speaking province of Ontario (n=9,177) (without a ban) (Dhar and Baylis 2011). French-speaking households with children in Quebec had a 13% (p<0.05) lower propensity for purchasing fast
food compared with equivalent French-speaking households in Ontario: this equated to 40,691 fewer households in Quebec purchasing fast food per week in 1992, translating to an estimated reduction of fast food purchases of $88 million per year.

2.2.3.3 Bradford Hill Criteria: Dose-response

Dose-response relationships were identified in a number of cross-sectional studies. An Australian study (n=417, 10-16 years) (Kelly et al. 2015a) demonstrated that every hour of commercial TV viewing per week was associated with a 0.067 unit increase in unhealthy diet score; with food and drink scores calculated from reported frequencies for commonly advertised unhealthy products.

This trend was also observed among young Swedish children (n=1733, mean age 5.7 years) with the odds ratio for at least weekly consumption of sweetened beverages being 1.5 (1.2–1.9) for each hour of TV watched per day. Further, exposure to commercial channels was independently associated with sweetened beverage consumption, regardless of the amount watched (Olafsdottir et al. 2014).

Another US study (n=9,760, mean age 11.2 years), which used purchased advertising data (Andreyeva et al. 2011), found an increase in exposure to fast food ads by 100 advertisements over 3 years was associated with a 1.1% increase in children’s consumption of fast food (p<0.1). The same increase in exposure to adverts for soft drinks increased fast food consumption by 7.4% (p<0.05).

This pattern was further shown in another Australian study (n=12,188, 12–17 years) (Scully et al. 2012). As children’s exposure to both commercial TV and non-broadcast advertising increased so too did their intakes of commonly advertised foods or likelihood of requesting or trying advertised foods (all p<0.001). For example, with an increase from one to two digital marketing exposures the odds ratios increased from 1.34 to 3.19 for children being likely to ask for an advertised food and from 1.47 to 2.54 for children being likely to try them. Likewise this trend was also observed in a recently published Malaysian study (n=402,
7-12 years), for every additional hour of TV viewing there was a 6% increase (OR 1.06 (1.04-1.08) (p<0.05) in the likelihood of children liking and asking their parents for advertised non-core food products (Ng et al. 2015).

Experimental studies have also demonstrated dose-response relationships across different media. The effects from playing branded advergames were increased for children who had played them previously: these children consumed 577 kJ more from unhealthy snack foods than those who played healthy or non-food advergames (Harris et al. 2012). The authors suggest that familiarity makes game play more automatic and, potentially, the advertising message becomes more noticeable, thus strengthening the effect.

High frequency product placement in a movie had an increased effect on consumption. Given the choice of three similar snacks, 45% of children consumed the advertised product after high frequency exposure compared with 31% after lower frequency product placement and 18% in the control condition (p<0.05) (Matthes and Naderer 2015). Similarly, combined exposure to McDonald’s food product placement plus McDonalds TV advertising saw children’s (n=483, 9-15 years) intention to consume fast food increase from 18% (control condition) to 47% (single exposure) to 54% (p<0.05) (Uribe and Fuentes-Garcia 2015). Likewise for their intention to consume McDonalds: 38% (control) to 45% (single exposure) to 57% (combined exposure) (p<0.05).

2.2.3.4 Bradford Hill Criteria: Consistency of evidence

Evidence from observational and experimental studies on the association between food marketing exposure and food consumption behaviours is highly consistent. Significant positive associations were seen in observational studies across a range of populations and countries, using a variety of instruments and methods to measure exposures to marketing and food behaviours in children aged 3-18 years (Andreyeva et al. 2011, Scully et al. 2012, Giese et al. 2015, Kelly et al. 2015a, Lioutas and Tzimitra-Kalogianni 2015, Ng et al. 2015, Longacre et al. 2016). Similarly, experimental studies have shown significant effects from

A small percentage of studies were inconsistent with other findings. A Korean cross-sectional study, (n=2419, 11-13 years) found that all associations between food advertising and reported intake disappeared after adjusting for the amount of TV watched (Lee et al. 2014). Two identical experimental studies in Latin America (n=600, 3-10 years) (Gregori et al. 2013) and India (n=1680, 3-11 years) (Gregori et al. 2014), found no significant association between TV food advertising exposure and children’s subsequent snack food consumption. In these studies, children were exposed to varying amounts of food adverts embedded within a cartoon program, presumably to assess if snack intake increased with increasing exposures. However, the absolute exposure to food advertisements was minimal (between 0-3 ads). Half of the children were also given a toy with their snack and this did not increase intake of the food. However, toy premiums are known to encourage purchase and choice, rather than stimulate consumption once the product is obtained (Institute of Medicine 2006, McAlister and Cornwell 2012). Further, an Australian study (n=354, 7-13 years) which explored the effect of a pop-up Internet advertisement on children’s subsequent snack choice found that although exposed children chose the advertised food more frequently than
the control group, differences did not reach significance (Tarabashkina et al. 2015). Further analysis revealed a significant result (p<0.001) in a subset of children who had low nutrition knowledge and were hedonism-oriented; children with obesity were more likely to belong to this group (p=0.037).

2.2.3.5 Bradford Hill Criteria: Temporality

The temporal relationship between food advertising and subsequent food behaviours is clearly established. A number of randomised controlled studies, discussed in this paper, have shown significant effects on children’s food behaviours after showing them unhealthy food advertising on TV (Gorn and Goldberg 1982, Halford et al. 2004, Halford et al. 2007, Halford et al. 2008, Boyland et al. 2011, Dovey et al. 2011, Boyland et al. 2015); in advergames (Harris et al. 2012, Folkvord et al. 2013, Folkvord et al. 2015); as product placements; (Auty and Lewis 2004, Matthes and Naderer 2015) and as branding in the form of celebrity endorsements (Boyland et al. 2013, Dixon et al. 2014a). The one longitudinal study included in this paper also confirms this relationship (Olafsdottir et al. 2014).

2.2.3.6 Bradford Hill Criteria: Biological Plausibility and Coherence

Evidence suggests that young children are predisposed to prefer foods that are sweet and salty, particularly those that are high in energy-density (e.g. high-fat) (Ventura and Worobey 2013). These food preferences, however, are malleable and can be shaped through experiential learning from exposure to different foods (Mennella 2014). Food and beverage advertising is predominately for foods that are high in added fat, sugar and salt (Zuppa et al. 2003, Kelly et al. 2007, Powell et al. 2007, Watson et al. 2014) and exposure promotes these foods as being a normal part of daily intake and potentially undermines healthy nutrition messages (Schwartz et al. 2013). Eating patterns are established early in life, generally extending in to adulthood and there is evidence that food marketing negatively influences the food environment and has a bearing on how children’s dietary patterns evolve (Institute of Medicine 2006). It is hedonistic, not homeostatic need, that is the main driver to consume
these types of foods, with highly processed foods of this nature more likely to prompt overeating than healthier, less processed foods (Schulte et al. 2015).

Food promotion is typically characterised by mouth-watering images of food, catchy music, humour, positive imagery and celebrity endorsements: content likely to promote positive, emotional associations, with both brands and products (Harris and Graff 2012). Contemporary social cognitive theories suggest that repeated exposure to this type of promotion can lead to changes in attitudes, beliefs and behaviours without a conscious, deliberate processing of the information presented (Bargh and Ferguson 2000, Strack and Deutsch 2004, Chartrand 2005). Children are more likely to process food advertisements through this implicit route and so less likely to be able to defend themselves against its effects (Nairn and Fine 2008, Buijzen et al. 2010).

Cue-Reactivity Theory proposes that food-related cues prompt cravings for food and induce subsequent food intake via previously conditioned responses (Jansen 1998, Carter and Tiffany 1999). The strength of the influence of cue-reactivity and how it can explain behavioural responses to food advertising has been demonstrated in a recently published quantitative meta-analysis that assessed the predictive effects of food cue reactivity and craving on eating and weight-related outcomes (Boswell and Kober 2016). Results found that cue-condition and cue reactivity paradigms had medium-to-large effects on eating ($r=0.32$, CI: 0.26–0.39, $z=9.08$, $p<0.001$) and weight outcomes ($r=0.51$, CI: 0.26–0.69, $z=3.69$, $p<0.001$). Visual food cues (e.g. images and videos) were as strongly related to food behavioural outcomes as reactivity to real food exposure.

These theories are reinforced by recent functional magnetic resonance imaging (FMRI) studies. Areas of the brain related to both reward and cognitive control have been shown to be activated in children in response to food commercials (Gearhardt et al. 2014) and food logos (Bruce et al. 2012, Bruce et al. 2013), with children with obesity showing more pronounced responses to food logos ($p<0.01$) (Bruce et al. 2013).
2.2.3.7 Bradford Hill Criteria: Specificity

This criterion was not evaluated in this review. Food marketing is one of many intra-, inter- and environmental determinants which have the potential to affect dietary behaviours (Vandenbroeck 2007, Swinburn et al. 2011). Bradford Hill notes that the absence of specificity is not sufficient to reject causality with one-to-one relationships not frequently observed (Bradford Hill 1965).

2.2.4 Conclusion

The current evidence on exposure to food marketing and children’s food behaviours, when examined together, satisfies all key criteria commonly used to evaluate causal relationships in epidemiology. As such, there is compelling evidence that the two are causally related. The experimental evidence base is particularly strong for children aged 3-12 years, with exposure to marketing across all media platforms consistently demonstrating significant, negative effects on food preferences, choices and short term food consumption. Observational evidence for children aged 3-18 years, in addition to confirming these findings, also shows the presence of significant positive associations between marketing exposure and poorer usual dietary intakes.

This review also highlights where gaps in the evidence base exist. Specifically, there is a lack of longitudinal evidence and experimental studies that investigate outcomes in adolescents and in the longer-term, particularly whether the demonstrated acute increases in food consumption are not compensated for at later eating occasions leading to net energy imbalance. However, as previously noted, studies of this nature would be methodologically challenging and, in the case of longer studies, expensive. There is also scope for further studies to assess the impact of other forms of online marketing. Despite these evidence limitations, the sum of the evidence appraised against the Bradford Hill criteria, and the particularly strong evidence base for children aged 3-12 years, substantiates the call at the highest levels for tighter restrictions on all forms of food marketing to children. We concur
with other public health advocates that it is time to shift the locus of responsibility for childhood obesity away from the individual and towards those that control the food system and resultant obesogenic environment (Moodie et al. 2013).

2.2.5 Compliance with Ethical Standards

Conflict of Interest: Jennifer Norman declares that she has no conflict of interest. Bridget Kelly declares that she has no conflict of interest. Emma Boyland declares that she has no conflict of interest. Anne-T McMahon has received financial support through grants from the Australian Meals on Wheels Association and the University of Wollongong and has received compensation from Pork CRC, Proportion Foods, Flagstaff Fine Foods, and IRT for conducting qualitative research studies; and from Yum! Corporation for service as a consultant in the development of a Nutrition Advisory Board.

Human and Animal Rights and Informed Consent: this review contains some studies with human subjects performed by Dr Kelly and Dr Boyland. There are no animal studies included in this article.
### Table 2.1 Summary of evidence relating to specific Bradford Hill Criteria

<table>
<thead>
<tr>
<th>Bradford Hill Criteria</th>
<th>Relation to causality</th>
<th>Study type/evidence base</th>
<th>Examples of specific reviews and studies</th>
</tr>
</thead>
</table>
| **Strength of association** | Hill suggests that strong associations are more likely to be causal than weak ones. However, he noted that relatively weak associations are common in epidemiology and should not be dismissed in representing a causal relationship. | Meta-analyses; Reviews; Longitudinal studies; Cross-sectional studies; Experimental studies | *Meta-analyses*: Boyland et al. 2016  
*Longitudinal studies*: Olafsdottir et al. 2014  
*Cross-sectional studies*:  
TV advertising: Kelly et al. 2016; Giese et al. 2015; Scully et al. 2012; Andreyeva et al. 2011  
Premium offers: Longacre et al. 2016  
*Experimental studies*:  
Advergames: Folkvord et al. 2015, 2014 and 2013; Harris et al. 2012  
Product placement: Matthes et al 2015; Auty and Lewis, 2004  
Brand endorsements:  
Reviews: Smits et al. 2015; Kraak and Story, 2015;  
Experimental studies (not included in the above reviews): Dixon et al. 2014; Elliott et al. 2013; Boyland et al. 2013; Robinson et al. 2007  
| **Experimental evidence** | In Hill’s opinion, experimental evidence offers the strongest support of a causal interpretation.                  | Experimental studies                                                                   | *Experimental studies*:  
Advergames: Folkvord et al. 2015, 2014 and 2013; Harris et al. 2012  
Product placement: Matthes et al 2015; Auty and Lewis, 2004  
Brand endorsements:  
Reviews: Smits et al. 2015; Kraak and Story, 2015;  
Experimental studies (not included in the above reviews): Dixon et al. 2014; Elliott et al. 2013; Boyland et al. 2013  
| **Dose-response**       | Dose-response relationships strengthen the likelihood of there being a causal relationship between an exposure and subsequent behaviour or health outcome. | Longitudinal studies; Cross-sectional studies; Experimental studies,                     | *Longitudinal studies*: Olafsdottir et al. 2014;  
*Cross-sectional studies*:  
TV advertising: Kelly et al. 2016; Ng et al. 2015; Giese et al. 2015; Scully et al 2012; Andreyeva et al. 2011  
*Experimental studies*:  
TV advertising: Uribe and Fuentes-Garcia, 2015;  
Advergames: Harris et al. 2012  
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<td><strong>Temporality</strong></td>
<td>Temporality is the one necessary criterion that must be met, that is, the exposure must precede the outcome.</td>
<td>Longitudinal studies; Experimental studies</td>
<td><em>Longitudinal studies</em>: Olafsdottir et al. 2014; <em>Experimental studies</em>: TV advertising: Boyland et al. 2015; Boyland et al. 2011; Dovey et al. 2011 Halford et al. 2008, 2007 and 2004; Gorn and Goldberg 1982 Advergames: Folkvord et al. 2015 and 2013; Harris et al. 2012 <em>Product placement</em>: Matthes et al 2015; Auty and Lewis, 2004 <em>Brand endorsements</em>: Dixon et al. 2014; Boyland et al. 2013</td>
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<tr>
<td><strong>Plausibility and Coherence</strong></td>
<td>The presumptive causal relationship is strengthened if the suspected connection is biologically plausible and does not seriously conflict with currently recognized theory or knowledge.</td>
<td>Meta-analyses; Experimental studies</td>
<td><em>Meta-analyses</em>: Boswell and Kober, 2016 <em>Experimental studies</em>: Gearhardt et al. 2014; Bruce et al 2013 and 2014</td>
</tr>
<tr>
<td><strong>Specificity</strong></td>
<td>Absence of specificity is not sufficient to reject causality; Hill notes that one-to-one relationships are not frequent.</td>
<td></td>
<td>This criterion was not evaluated in this review.</td>
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2.3 Extended literature review

2.3.1 Preface

The initial literature review concluded that all key Bradford Hill criteria were satisfied and therefore a causal relationship between exposure to food marketing exposure and children’s food behaviours could be inferred. Gaps in the evidence base that were highlighted were the paucity of: longitudinal studies; experimental trials among adolescents; and studies investigating the effect of other forms of online marketing on children’s food behaviours in addition to advergames. The review found no experimental studies that investigated whether the observed immediate increases in children’s food consumption following advertising exposure were compensated for at later meals, leaving unanswered the question of whether there was an enduring positive energy-balance after advertising exposure.

An update of the literature is presented covering the two years since the publication of the initial review (July 2016 - July 2018). The search strategy that was used in the prior review was replicated. Consistent with the previous review methodology, studies were appraised against the Bradford Hill criteria (Table 2.2). Additional evidence to support a causal relationship between children’s food marketing exposure and their subsequent food behaviours are discussed.

2.3.2 Updated evidence review of a causal relationship between food promotion exposure and food behaviours

2.3.2.1 Bradford Hill Criteria: Strength of Association

2.3.2.1.1 Observational evidence

The initial literature review identified six observational studies which found statistically significant positive associations between children’s exposure to food marketing (3-18 years) and their food preferences, consumption and usual dietary intake. In the updated literature six further observational studies of children aged 3-14 years were identified (Emond et al. 2016, Dalton et al. 2017, Liu et al. 2017, Longacre et al. 2017, Powell et al. 2017,
Tarabashkina et al. 2017). Food marketing exposure was assessed through parental and child report, TV programming analyses or advertising ratings data.

Longitudinal analyses of a large data set of children in the USA (n= 8,340 (baseline (n=4,320, 10-11 years) and three year follow-up (n=4020, 13-14 years) found that exposure to soft drink TV advertisements was significantly associated with higher frequency of soft drink consumption among youth (p=0.01) (Powell et al. 2017). Exposure to one additional soft drink advertisement per week was associated with increased soft drink frequency consumption of 0.3 times per week. Furthermore exposure to cereal TV advertising was significantly associated with young adolescents’ BMI (p<0.05); exposure to one additional cereal advertisement per week was associated with 0.30 to 0.50 units higher BMI percentile. Cross-sectional analyses revealed that children’s exposure to cereal advertising was associated with both percent body fatness (p=0.01) and percent trunk adiposity (p=0.01) and fast food advertising was significantly associated with percent trunk fatness (p<0.05). Data analysis models controlled for individual-level hours of TV viewing and household- and individual-level characteristics.

The association between TV advertising for sugary breakfast cereals and young children’s (n= 548, 3-5 years) consumption of these brands has been observed in a US study (Longacre et al. 2017). Children consumed 14% (relative risk (RR) = 1.14, 95% CI: 1.02, 1.27) more sugary breakfast cereal brands for every 10 sugary breakfast cereal advertisements seen in the past 7 days. The hours per week children watched TV, as well as their other screen time, were not associated with children’s sugary breakfast cereal brand consumption, which suggests that cereal advertising exposure may have had a specific link with children’s sugary cereal consumption.

Younger children and their families’ food behaviours and associations with fast food TV advertising exposure were examined in two further North American studies (Emond et al. 2016, Dalton et al. 2017). A significant association was found between children (n=100, 3-7
years) who were high commercial TV viewers and frequency of family visits to fast food restaurants (p<0.001), however no association between non-commercial TV viewing frequency and fast food restaurant visitations was found (Emond et al. 2016). Additionally, greater commercial TV exposure was associated with requests for, and collection of, toy premiums from fast food restaurants advertising to children on TV during the study period (p<0.01). Similarly, pre-school children’s (n=548, 3-5 years) fast-food consumption was found to be significantly associated with their exposure to fast-food TV advertising exposure, but not their overall TV viewing time (Dalton et al. 2017). Children with moderate and high levels of McDonald’s advertisement exposure were 38% (95% CI 1·17, 1·62 and 95% CI 1·09, 1·76, respectively) more likely to have eaten at McDonald’s in the past week compared with children with no exposure. Demographics, socio-economic status and other screen time were adjusted for.

Associations between children’s self-reported unhealthy food intakes and food advertising exposure were examined in two studies from China (Liu et al. 2017) and Australia (Tarabashkina et al. 2017). Chinese children’s (n=452, 10-13 years) food intakes and reasons for these food preferences (e.g. food taste, promotional gift, food advertising influence) were investigated (Liu et al. 2017). There was a significant difference in the consumption of unhealthy snacks between the groups of students who reported they were influenced by food advertising and those who said they were not influenced by advertisements ($\chi^2=4.68$, p=0.03), with OR 1.13 (95% CI, 1.01, 1.27). This trend also applied to unhealthy beverage advertising. Children’s selection of unhealthy beverages was significantly increased among children reporting they were influenced by TV advertisements compared with those not ($\chi^2=5.77$, p=0.02), with an OR value of 1.23 (95% CI, 1.04, 1.46). Likewise, a survey conducted among Australian children (n=354, 7-13 years), found that children’s self-reported exposure to unhealthy food advertising was positively associated with their consumption of energy-dense foods ($\beta = 0.35$, p<0.00) (Tarabashkina et al. 2017).
2.3.2.1.2 Experimental evidence

The initial literature review reported on a wide, experimental evidence base which showed that that exposure to food marketing across multiple platforms strongly influenced children’s food preferences, choices or food consumption (Norman et al. 2016). The updated literature review uncovered another ten studies that manipulated exposures to TV advertising (Bruce et al. 2016, Gatou et al. 2016, Gilbert-Diamond et al. 2017, Lorenzoni et al. 2017, Rapuano et al. 2017, Esmaeilpour et al. 2018); Internet advergames (Folkvord et al. 2017, Esmaeilpour et al. 2018); product placement in movies (Brown et al. 2017); brand endorsers (McGale et al. 2016); and premium offers (Dixon et al. 2017a).

2.3.2.1.2.1 Experimental studies using TV advertising

Extending earlier work by Bruce et al. (2012 and 2103) (Bruce et al. 2012, Bruce et al. 2013), two experimental studies used functional magnetic resonance imaging (fMRI) to investigate children’s (8-12 years) brain activity when they were exposed to unhealthy food advertising (Bruce et al. 2016, Rapuano et al. 2017). These two studies found significant differences in the activity of reward-related regions of the brain when children were exposed to food advertising compared with non-food advertising (p<0.05). Additionally, the study by Rapuano et al. (2017) and a study by Gilbert-Diamond et al. (2017) explored how children who are genetically at risk for obesity respond to TV advertising exposure as measured by their food intake or choices (Gilbert-Diamond et al. 2017, Rapuano et al. 2017). Gilbert et al. (2017) found that when children viewed food advertisements in a cartoon they consumed an additional 48kcal (95% CI, 10, 85) compared with children who viewed toy advertisements. Furthermore, there was a significant interaction between the fat mass and obesity- associated gene (FTO) rs 9939609 genotype and advertisement condition (p=0.02); where the difference in consumption increased linearly with each FTO risk allele, even after controlling for BMI percentile. Likewise, independent of obesity status, children with a genetic risk of obesity showed a heightened response to food advertisements (p<0.05) with higher
activation in reward-associated brain regions than children without the FTO gene (Rapuano et al. 2017).

A Greek study investigated exposure to TV advertising of cariogenic (causing tooth decay) foods and children’s (n=183, 11-12 years) food preferences and whether the responses were moderated by children’s dental health status (decayed, missing and filled teeth index (DMFT)) (Gatou et al. 2016). Food preference was assessed by children selecting from eight photographs of ‘healthy’ foods and eight photographs of ‘unhealthy’ foods after watching a cartoon with food or non-food advertisements embedded. Exposure to the food advertisements resulted in children choosing significantly fewer healthy foods (p=0.01). Furthermore, children with a higher DMFT index (indicating poorer dental health) chose a higher proportion of unhealthy foods than children with a lower DMFT index (p=0.04). This study identifies another group of children with an increased susceptibility to food advertising effects.

2.3.2.1.2.2 Experimental studies using Internet advergames

A recent meta-analysis examined the strength of the effect of playing advergames that promote unhealthy foods on eating behaviours, or predictors of eating behaviours, in children (Folkvord and van ‘t Riet 2018). Fifteen experimental studies were included reporting on a range of attitudinal and behavioural outcomes: brand attitudes (three studies); purchase request intention (two studies); food choice (three studies); and food choice with caloric intake (seven studies). Meta-analysis revealed that advergames promoting unhealthy foods have a significant effect on children’s attitudes, intentions, and/or consumption behaviours with a small-to-moderate magnitude of effect (g=0.30 (95% CI: 0.22–0.37)). This effect-size is highly comparable with a previous meta-analysis, included in our published literature review, which reported on the effect of exposure to food advertising on TV or advergames and children’s short term food consumption (Boyland et al. 2016).
The majority of the studies in this meta-analysis (Folkvord and van ‘t Riet 2018) that had children’s food preferences and/or consumption as an outcome, were included in the previous literature review (Norman et al. 2016). Two further studies not included in the original literature review explored the potential of counter-advertising approaches on children’s food behavioural responses to advergames (Folkvord et al. 2017, Esmaeilpour et al. 2018). A study conducted with children (9-12 years) from Spain (n=382) and the Netherlands (n=211) found that playing an advergame promoting energy-dense snacks increased caloric intake in all children, irrespective of whether the game contained a ‘protective’ message or not (p<0.05). Protective messages were prominently visible, central to the upper-part of the screen, stating ‘Remember: This game is an advertisement for ‘X’’. Notably, only 4% of the Spanish children and 5% of the Dutch children who played the energy-dense advergame with the ‘protective’ message remembered the content of that message. Separate analyses comparing children who remembered the message and the children who didn’t remember the message showed no differences in snack intake.

An Iranian study investigated whether the activation of children’s (n=330, 6–11 years) health knowledge prior to playing an advergame that promoted unhealthy food moderated their subsequent food choices (Esmaeilpour et al. 2018). This study found that children chose more unhealthy foods after exposure to unhealthy food advertising (p=0.000) but that activation of health knowledge moderated this effect (p=0.032). However, health knowledge was activated via a questionnaire prior to advertising exposure and, hence, does not represent real world experiences.

2.3.2.1.2.3 Experimental studies using product placement

The effect of food product placements in movies on children’s (n= 114, 9-11 years) food choices and consumption has, again, been demonstrated (Brown et al. 2017). Children were assigned to watch a high (n=54) or low (n=60) product-placement movie. After viewing, children selected a snack choice from five food choices, several of which were specifically
featured in the high product-placement movie. Participants who watched the high product-placement movie had 3.1 times the odds (95% CI 1.3-7.2) of choosing cheese balls (most featured snack) compared with children who watched the low product-placement movie. Children's weight status did not significantly affect their choice of snack.

2.3.2.1.2.4 Experimental studies using brand endorsers

Three experimental studies which demonstrated the effect of different types of branding on children’s food and drink preferences were identified: brand equity characters on congruent and non-congruent food packaging (McGale et al. 2016); healthy vs. non-healthy food brand sports sponsorship (Dixon et al. 2017b); and personalised bottled drink labelling (McDarby et al. 2018). Children (n=209, 4-8 years) were significantly more likely to show a preference for foods with a brand equity character displayed on the packaging compared with a matched food without a brand equity character, for both congruent (p=0.001) and incongruent food-character associations (p<0.001) (McGale et al. 2016). The effect of food brand sports sponsorship on children’s food preferences (n=1124, 5–10 years) showed mixed results (Dixon et al. 2017b). Compared with the control condition, there were no significant effects of unhealthy food branding on preferences for these brands, however, there was evidence of reduced preference for the unhealthy food sponsor brands among children exposed to the healthier food brands (31·4% vs.40·1%; adjusted OR=0·67, 95% CI 0·46, 0·96, p=0·027) compared with the non-food brand condition. The authors suggest that the null findings in the unhealthy food brand condition may be due to ceiling effects for unhealthy food brands that are already heavily marketed to children and are already closely aligned with sport, such that children had a strong prior ‘dose’ of advertising exposure that was not heightened by the brief intervention in the study. The effect of personalising bottled drinks on children’s (n=404, 8–13 years) beverage choices was demonstrated (McDarby et al. 2018). Personalising healthy drinks increased children’s choice of healthy drinks (OR, 2.21; 95% CI, 1.24–4.00), and personalising unhealthy drinks reduced children’s choice of healthy
drinks (OR, 0.35; 95% CI, 0.15–0.75). There were no significant associations of BMI, or parental consumption of soft drinks with children’s choice of unhealthy or healthy drinks.

2.3.2.1.2.5 Experimental studies using premium offers

The influence of a movie tie-in toy premium on children’s preferences for unhealthy and healthier fast food meals has been demonstrated in an online study where Australian children (n=904, 5-9 years) watched a movie trailer followed by either an associated fast food TV advertisement or non-food advertisement (Dixon et al. 2017a). Subsequently children were shown a range of ‘meal-deal’ images, with different permutations of healthier versus unhealthy meals and with or without the movie tie-in toy premium. Overall, children showed a preference for unhealthy meals (76%) over healthier ones. When unhealthy meals were paired with a toy premium, 80% of children selected an unhealthy meal, compared with 71% when unhealthy meals were not paired with a toy premium (p=0.001). Children were significantly more likely to select a healthier meal over an unhealthy meal when only the healthier meals were accompanied by a toy premium (p<0.001).

2.3.2.2 Bradford Hill Criteria: Experimental evidence

The solid experimental evidence base reported in the published literature review (Norman et al. 2016) has been expanded upon. Since 2016, new research studies have been conducted in the USA (Bruce et al. 2016, Brown et al. 2017, Gilbert-Diamond et al. 2017, Rapuano et al. 2017), Australia (Dixon et al. 2017a, Dixon et al. 2017b), the UK (McGale et al. 2016), Greece (Gatou et al. 2016), Iran (Esmailpour et al. 2018) and Ireland (McDarby et al. 2018). All these studies reported significant effects on children’s food behaviours from exposures across a wide variety of promotions and media platforms with a wide heterogeneity of study design: advergames (Folkvord et al. 2017, Esmailpour et al. 2018), brand equity characters (McGale et al. 2016), product placement in children’s movies (Brown et al. 2017), personalised bottled drinks (McDarby et al. 2018) and toy premiums (Dixon et al. 2017a). Other new experimental studies used fMRI and genetic screening to
investigate physiological and neurological mechanisms that may underpin children’s 
behavioural responses to unhealthy food advertising (Bruce et al. 2016, Gilbert-Diamond et 

The majority of studies were conducted with children under 12 years in a laboratory setting 
school setting (Gatou et al. 2016, McGale et al. 2016, Dixon et al. 2017a, Dixon et al. 2017b, 

2.3.2.3 Bradford Hill Criteria: Dose-response

In addition to the dose-response relationships discussed in the previous literature review 
(Norman et al. 2016), two further such relationships were identified in a cross-sectional 
study (Emond et al. 2016) and one experimental study (Brown et al. 2017).

In a study of young American children (n=100, 3-7 years), families were 2.84 times more 
likely to frequently visit advertised fast food restaurants with each one point increase in the 
child’s commercial TV viewing score (Emond et al. 2016). As previously mentioned this 
study found no associations between a child’s non-commercial TV viewing and frequency of 
visitations to fast food restaurants.

Consistent with previous experimental findings (Matthes and Naderer 2015, Uribe and 
Fuentes-García 2015), food product placement in movies has been shown to result in a dose-

Children who watched a high frequency product-placement movie had 3.1 times the odds 
(95% CI 1.3-7.2) of choosing the most featured snack compared with children who watched 
a low product-placement movie.

2.3.2.4 Bradford Hill Criteria: Consistency of evidence

The previous literature review determined that the evidence from observational and 
experimental studies were highly consistent (Norman et al. 2016). Similarly, findings
observed in studies included in the updated literature review demonstrate a consistency of evidence. Significant positive associations were reported in observational studies among children across different age-groups and countries, using a range of methodologies to measure exposures to marketing and food behaviours in children aged 3-14 years (Emond et al. 2016, Dalton et al. 2017, Liu et al. 2017, Longacre et al. 2017, Powell et al. 2017, Tarabashkina et al. 2017). Likewise, recent experimental studies have demonstrated significant outcomes from exposure to TV advertising (Bruce et al. 2016, Gatou et al. 2016, Gilbert-Diamond et al. 2017, Lorenzoni et al. 2017, Rapuano et al. 2017, Esmaeilpour et al. 2018); Internet advergames (Folkvord et al. 2017, Esmaeilpour et al. 2018); product placement in movies (Brown et al. 2017); brand endorsers (McGale et al. 2016); and premium offers (Dixon et al. 2017a) on children’s food choices, preferences and short-term food consumption.

One experimental trial was inconsistent with the other studies. A Chilean between-subject study (n=40, 6-12 years) found no impact on children’s snack consumption during TV advertising exposure (Lorenzoni et al. 2017). There was, however, minimal advertisement exposure (between 0-3 advertisements). Additionally, there were five different experimental conditions in the study with only eight children within each of these groups, as such, the study appeared under-powered to observe a significant difference between groups.

2.3.2.5 Bradford Hill Criteria: Temporality

The previous literature review reported that the temporal relationship between food advertising exposure and children’s subsequent food behaviours was firmly established (Norman et al. 2016). This latest review adds further evidence to this criterion. The significant effect on children’s food behaviours after exposing them to unhealthy food advertising has been demonstrated on TV (Bruce et al. 2016, Gatou et al. 2016, Gilbert-Diamond et al. 2017, Rapuano et al. 2017, Esmaeilpour et al. 2018); Internet advergames
(Esmaeilpour et al. 2018); product-placement in movies (Brown et al. 2017); brand endorsers (McGale et al. 2016, McDarby et al. 2018); and premium offers (Dixon et al. 2014b)

2.3.2.6 Bradford Hill Criteria: Biological Plausibility and Coherence

The published literature review discussed a range of physiological and theoretical explanations that support how and why unhealthy food advertising affects children’s food behaviours (Norman et al. 2016). Recent fMRI studies investigating children’s brain activity after exposure to food advertising have expanded this knowledge base and offer insight into how reward pathways of the brain are activated in response to food advertising stimuli (Bruce et al. 2016, Rapuano et al. 2017). The ventromedial prefrontal cortex (vmPFC), which is the brain region most active during reward valuation, has been shown to exhibit increased activity when children (n= 78, 9-12 years) have been exposed to TV food advertising compared with non-food advertising (p<0.05) (Bruce et al. 2016). Additionally, children with a genetic predisposition to obesity have shown an increased susceptibility to food advertising exposure: children’s food consumption following food advertisement exposure increased linearly with each obesity risk-related allele (Gilbert-Diamond et al. 2017). Indeed studies also suggest that the neural reward response to food advertising stimuli is greater for children with genetic predisposition to obesity, independent of weight status (Rapuano et al. 2017).

2.3.3 Conclusion

The updated literature review adds further evidence, from both observational and experimental studies, to support the findings of the published review that, when appraised against the Bradford Hill criteria, there is robust evidence that food marketing and children’s food behaviours are causally related.

Taken together the evidence from the published and updated literature reviews can be summarised against the Bradford Hill criteria as follows:
Strength of association: evidence from observational and experimental studies shows that food marketing exposure is strongly associated with children’s unhealthy food behaviours and poor dietary intake;

Experimental evidence: across numerous study designs using a range of media, experimental evidence demonstrates that food marketing strongly, and negatively, influences children’s food preferences, choices and food intake;

Dose-response: evidence shows that as the level of food marketing exposure increases so does the impact of that marketing; across a range of media;

Consistency of evidence: many study designs using a diversity of media, conducted in a wide range of countries and ethnic populations; evidence consistently shows negative impact of food marketing on children’s food behaviours;

Temporality: evidence from experimental studies clearly demonstrates the significant effects on children’s food behaviours subsequent to food marketing exposures;

Plausibility and coherence: biological underpinnings of children’s food preference development, neurological mechanisms and psychosocial theories support the impact of food marketing on children’s food behaviours

Whilst the update of the literature found increased evidence about the impact of marketing on children under 14 years of age, there remains a shortage of experimental studies that examine outcomes among adolescents. Furthermore, neither the published review (Norman et al. 2016) nor the updated literature review revealed any longer-term experimental studies that investigated whether short-term increases in food consumption after advertising exposure were compensated for at later eating occasions; nor any studies that examined the cumulative effects from media exposures over many days from more than one media source. The next chapter will discuss the theoretical framework that underpins this thesis and informs the methodology of the research employed to investigate those gaps.
<table>
<thead>
<tr>
<th>Bradford Hill Criteria</th>
<th>Study type/evidence base</th>
<th>Examples of specific reviews and studies</th>
</tr>
</thead>
</table>
| **Strength of association** | Meta-analyses; Longitudinal studies; Cross-sectional studies; Experimental studies | **Meta-analyses:** Sadeghirad et al. 2016; Folkvord et al. 2018  
**Longitudinal studies:** Powell et al. 2017  
**Cross-sectional studies:**  
Experimental studies:  
TV advertising: Bruce et al. 2016; Gatou et al. 2016; Gilbert-Diamond et al. 2017; Rapuano et al. 2017; Esmaeilpour et al. 2018  
Advergames: Folkvord et al. 2017; Esmaeilpour et al. 2018;  
Product placement: Brown et al. 2017  
Brand endorsements: McGale et al. 2016; McDarby et al. 2018  
Premium offers: Dixon et al. 2017 |
| **Experimental evidence** | Experimental studies | **Experimental studies:**  
TV advertising: Bruce et al. 2016; Gatou et al. 2016; Gilbert-Diamond et al. 2017; Rapuano et al. 2017; Esmaeilpour et al. 2018  
Advergames: Folkvord et al. 2017; Esmaeilpour et al. 2018;  
Product placement: Brown et al. 2017  
Brand endorsements: McGale et al. 2016; McDarby et al. 2018  
Premium offers: Dixon et al. 2017 |
| **Dose-response** | Cross-sectional studies; Experimental studies | **Cross-sectional studies:**  
TV advertising: Emond et al. 2016; Dalton et al. 2017;  
Experimental studies:  
Product placement: Brown et al. 2017 |
| **Consistency of evidence** | Longitudinal studies; Cross-sectional studies; Experimental studies | **Longitudinal studies:** Powell et al. 2017  
**Cross-sectional studies:**  
Experimental studies:  
TV advertising: Bruce et al. 2016; Gatou et al. 2016; Rapuano et al. 2017; Esmaeilpour et al. 2018  
Advergames: Folkvord et al. 2017; Esmaeilpour et al. 2018;  
Product placement: Brown et al. 2017  
Brand endorsements: McGale et al. 2016; McDarby et al. 2018  
Premium offers: Dixon et al. 2017 |
| **Temporality** | Longitudinal studies; Experimental studies | **Longitudinal studies:** Powell et al. 2017  
**Experimental studies:**  
TV advertising: Bruce et al. 2016; Gatou et al. 2016; Gilbert-Diamond et al. 2017; Rapuano et al. 2017; Esmaeilpour et al. 2018  
Advergames: Folkvord et al. 2017; Esmaeilpour et al. 2018;  
Brand endorsements: McGale et al. 2016; McDarby et al. 2018  
Premium offers: Dixon et al. 2017 |
| **Plausibility and Coherence** | Experimental studies | **Experimental studies:**  
TV advertising: Bruce et al. 2016; Gilbert-Diamond et al. 2017; Rapuano et al. 2017 |
| **Specificity** | This criterion was not evaluated in this review. |
CHAPTER THREE

THEORETICAL FRAMEWORK AND RESEARCH METHODS

3.1 Preface

This chapter outlines the theoretical framework that informs the study design and research methods used in this thesis. In the previous chapter, the literature review highlighted that a key part of the evidence required to support the need for government regulation of food marketing to children is to demonstrate the direct link between food marketing exposure and childhood overweight and obesity. Children’s food intake is the most relevant outcome measure to investigate this direct link in an experimental setting (Boyland and Whalen 2015). Longer-term experimental studies that test whether children’s increases in food consumption after brief exposures to food advertising are compensated for at later eating occasions, would provide evidence that food marketing exposure contributes to an energy imbalance that could drive overweight in children over time. The literature review confirmed that research that would demonstrate this direct link is lacking. The primary aim of this thesis was to address this research gap. Secondary aims of this thesis were to determine whether sub-groups of children were more susceptible to advertising effects and to investigate how the creative content of advertisements affected children’ recognition and attitudinal responses towards advertised brands.

The five objectives of this thesis are outlined in Chapter One, Page 5. In order to achieve the objectives a randomised, within-subject, crossover study was undertaken utilising a quantitative research design approach. Specifically the study addressed the primary aim of this thesis by quantifying the impact of food advertising exposures from TV advertising and online advergames on children’s immediate food intake and at a later meal, daily over the course of a six-day holiday camp. Furthermore children’s recognition and attitudinal responses to the advertisements were measured and persuasive techniques that most appealed to children were identified.
This chapter begins with an explanation of the theoretical framework that informed the design of this randomised trial and an outline of the research methods used in the trial, including participant recruitment, randomisation, data collection and ethical considerations. As this dissertation is presented as a thesis by compilation, each subsequent chapter or manuscript includes a description of the research methods relevant to that specific study. Likewise, data analyses pertinent to each study are discussed in the associated chapters. The overview of the research methods presented here includes some aspects that have not been elaborated upon in the published articles or manuscript (which appear in this thesis as chapters) due to limitations of journal publication formats.

3.2 Children’s processing of persuasive messages in contemporary advertising

An understanding of the psychosocial theories that underpin children’s responses to contemporary food advertising was needed to develop a sound research design. Traditional models used to describe the effects of food advertising on behaviour were based on an information processing model (McGuire 1976). That is, after exposure to an advertisement, and following sequential shifts in preferences, attitudes and beliefs, purchase or consumption of a particular food product resulted (McGuire 1976). It was posited that for an advertisement to have an effect, the message needed to be attended to, processed and interpreted. In line with this model, and John’s consumer socialisation theory (John 1999), a commonly held belief has been that as children increase with age and attain greater cognitive maturity they become more aware of advertising’s persuasive effect, their advertising literacy increases and they become better equipped to defend themselves against advertising’s negative effects (Calvert 2008). Recent research challenges this thought, however, showing that older children, purportedly with higher levels of persuasion knowledge due to their age and cognitive development, are influenced by food advertising at least equal to, if not more so, than younger children (Livingstone and Helsper 2006). Indeed, there is no substantive empirical evidence that children’s advertising literacy does decrease
children’s vulnerability to the effects of advertising (Rozendaal et al. 2011a). Dual-processing theories offer insight into how contemporary advertisements are processed by children.

3.2.1 Dual-processing theories

Dual-process theories draw on the psychological distinction that mental processes that elicit behavioural outcomes can operate in both an implicit and explicit way (Nairn and Fine 2008, Gawronski and Creighton 2013). Implicit processing is characterised by requiring little cognitive resource; predominantly independent of working memory and general intelligence; occurring outside conscious awareness or intention; based on associative learning and external cues; reflexive by nature; and is evolutionarily primitive (Barrouillet 2011, Evans 2011, Gawronski and Creighton 2013, Büttner et al. 2014). Explicit processing is typified by operating within conscious awareness; using a large amount of cognitive resources and working memory resources; being initiated intentionally; and being based on rules and rational thought (Barrouillet 2011, Evans 2011, Gawronski and Creighton 2013, Büttner et al. 2014). Two contemporary dual-processing models of persuasion most commonly accepted in the adult literature to explain how audiences respond to advertising messages are the Elaboration Likelihood Model (ELM) (Petty et al. 2005) and the Heuristic Systematic Model (HSM) (Chen et al. 1999). These models distinguish between two modes of processing: a persuasive message is either processed explicitly with thought and elaboration (systematic or central process) or implicitly and rapidly, without much thought, relying on cues and shortcuts (heuristic or peripheral process).

It is the role of the implicit pathway in processing and persuasion that offers insight into why advertising literacy does not fully protect against the effects of advertising in children, whatever their age. Contemporary social cognitive theories suggest that repeated exposure to advertising can lead to changes in attitudes, beliefs and behaviours without a conscious, deliberate processing of the information presented (Bargh and Ferguson 2000, Strack and
Deutsch 2004, Chartrand 2005, Bargh and Morsella 2008). Food advertisements are designed with implicit psychological processing in mind, utilising content likely to promote positive associations such as humour, fun, social desirability, positive imagery and celebrity endorsements in their content (Harris and Graff 2012). It has been proposed that children are more likely to process food advertisements through this implicit route (Nairn and Fine 2008, Buijzen et al. 2010).

The ‘food marketing defense model’ presents a theoretical approach which aids in understanding how and why food advertising affects children and youth (Harris et al. 2009b). This model proposes that in order for someone to resist food advertising stimuli they must: 1) attend to the marketing message and understand the persuasive intent; 2) understand how that marketing message may affect their attitudes or behaviours and have the knowledge to guard against those effects; 3) have the cognitive capacity and available resources to resist the advertising; and 4) be motivated to resist the marketing. This model posits that in order to resist the influence of food marketing all four of the aforementioned conditions must be met. When the persuasive techniques and immersive nature of many forms of contemporary food advertising are considered (Hebden et al. 2011, Jenkin et al. 2014), these theories and research give explanation to why children’s persuasion knowledge and cognitive abilities may be helpful, but are not sufficient, in defending them against the unhealthy influences of food advertising.

3.2.2 Priming and Cue-Reactivity Theory

Priming can be described as a psychological phenomenon in which exposure to an external stimulus or cue, subconsciously attended to, can automatically activate implicit associations that then influence behaviour (Schacter 1992, Bargh and Ferguson 2000, Dijksterhuis and Smith 2005). Food advertisements are an example of an environmental prime (Harris et al. 2009a), with the activation of affective associations and food-related cues serving to influence behaviour. The difference in taste between different brands within a food category
can be very subtle and, as such, food marketers typically rely on emotional appeals to connect their brand with positive, affective associations (Buijzen and Valkenburg 2002, Roberts and Pettigrew 2007). Food advertisements are predominantly characterised by humour, action, adventure and fun (Cairns et al. 2009, Jenkin et al. 2014) and these associations and emotions will transfer to the product itself and overtime increase preference for the food or brand (Dijksterhuis et al. 2005, Gawronski and Bodenhausen 2006). Cue-reactivity theory proposes that food-related cues prompt cravings for food and induce subsequent food intake via previously conditioned responses (Jansen 1998, Carter and Tiffany 1999). Food when consumed (an unconditioned stimulus) triggers metabolic responses (an unconditioned response) and, with repeat pairings, becomes associated with food-related cues, such as the sight and smell of food (conditioned stimulus) (Jansen 1998, Carter and Tiffany 1999). Food-related cues, henceforth, can stimulate a set of physiological responses, including salivation, increased heart rate, gastric activity and insulin release (Mattes 1997, Nederkoorn et al. 2000, Power and Schulkin 2008); activate the reward system pathways within the brain (Volkow et al. 2008, Volkow et al. 2011); and trigger thoughts and desires to eat (Jansen 1998, Carter and Tiffany 1999, Berridge et al. 2009). Short term experimental studies suggest that food advertisements can operate as food-related cues, stimulating increased food consumption (Halford et al. 2004, Anschutz et al. 2009, Harris et al. 2009a, Anschutz et al. 2010, Folkvord et al. 2013, Folkvord et al. 2014, Folkvord et al. 2015). Indeed, a recent meta-analysis has demonstrated the strength of the influence of cue-reactivity on eating responses; cue reactivity paradigms had medium-to-large effects on eating ($r=0.32$, $p<0.001$) and visual food cues (such as those found in food advertising) were as strongly related to food consumption outcomes as reactivity to real food exposure (Boswell and Kober 2016).

Priming methods provide a way to test for these implicit causal effects (Schacter 1992). In priming research studies, pertinent mental representations and associations are activated in a discrete way in the first stage of an experiment, and then the effects of this activation are
assessed in a subsequent stage (Harris et al. 2009a). This methodology informs the basis of
the main study design in this thesis. Showing children unhealthy food advertisements
embedded in a cartoon or represented in an advergame in the primary phase of an experiment
will give opportunity to measure the priming effect of the advertisements on eating
behaviour in a second stage. Effects on eating behaviour can be quantified by measuring
dietary intake at a meal offered post advertisement exposure (Harris et al. 2009a). Exposing
children to the same advertisements, embedded in a cartoon and/or advergame over three
days will give opportunity to assess children’s responses to cumulative effects of exposure
over time.

3.3 Ecological Theory

 Ecological models of children’s development consider environmental influences and their
effects on the developing child. Bronfenbrenner’s ecological framework highlights
environmental contexts that range from a child’s everyday settings, such as their home and
school, to broader societal-cultural systems in which their lives are embedded
(Bronfenbrenner 1979, Bronfenbrenner 1994). Bronfenbrenner identifies four different
environmental systems as important interacting influencers on a child’s development and
behaviour, all occurring over time (Figure 3.1).

A child’s microsystem is the direct interactions and relationships between a child and their
immediate environment; e.g. a child’s family, peers, school and neighbourhood.
Interrelationships between different parts of a child’s microsystem are called the
mesosystem. The exosystem refers to the larger social system in which a child lives; these
influence the child but the child does not necessarily interact with them, for example their
parent’s place of work or government and social policy. The most distal system, the
macrosystem, consists of cultural values and belief systems, economic and political systems
under which the child is raised. The chronosystem refers to the all the life experiences a child
has over their life course, including historical events and major life transitions.
Figure 3.1: Bronfenbrenner’s ecological theory of child development (Santrock 2007)

A child’s family and home environment, within the microsystem, is one of the primary influences on child socialisation (Maccoby and Martin 1983) including the development and establishment of eating behaviours (Patrick and Nicklas 2005, Sleddens et al. 2014). By the age of three, children’s eating is no longer simply driven by hunger but is strongly influenced by environmental and parental cues (Klesges et al. 1991, Koivisto et al. 1994).

By definition parenting practices are particular techniques or behaviours used by parents as they endeavour to raise and socialise their children. This is distinct from ‘parenting styles’ which describe the broader emotional and relational landscape in which these practices are embedded (Patrick et al. 2013). Patrick et al. (2013) characterise parenting practices as what parents do and parenting styles as how they do it. Numerous studies indicate that certain parenting styles and feeding practices are associated with children’s dietary intake and propensity to overweight (Sleddens et al. 2014). Experimental studies indicate that restrictive and pressurised parental feeding practices are associated with many negative dietary behaviours and weight outcomes (Larsen et al. 2015). It is suggested that over-control of children’s food consumption could interfere with children’s development of self-regulation (Costanzo and Woody 1985), making the child more receptive to external food cues rather
than internal cues such as hunger and satiety (Faith et al. 2004). As demonstrated with other different sub-groups of children (Halford et al. 2008, Anschutz et al. 2010, Folkvord et al. 2014, Folkvord et al. 2015), children who experience controlling parental feeding practices may be more susceptible to food advertising effects. One of the most frequently used psychometric instruments to assess parental feeding practices is Birch et al’s (2001) Child Feeding Questionnaire (CFQ) (Birch et al. 2001, Vaughn et al. 2013) and this self-report tool was used in the study to gather information in this regard.

3.4 Research Methods

3.4.1 Setting

The setting for this study was the Illawarra Region of New South Wales, Australia. We partnered with the University of Wollongong (UOW) School Holiday Sports Camp and UOW’s Early Start to conduct this study. Early Start is a child-focused research facility located on the same campus as the holiday camp and within a five minute walking distance. The study was conducted as part of usual care at the UOW sports holiday camp during the morning session (8am-1.30pm). The University runs the sports camps from Monday to Friday during each school holiday period; four times a year. The study interventions were conducted in rooms within Early Start; the facility has a large commercial kitchen with an adjacent dining room and a suite of large, carpeted interventions rooms.

3.4.2 Study dates

A pilot study was run over the course of six days during the school holiday period in January 2016. The main data collection took place across four, six-day school holiday camps in April, July and September 2016 and January 2017.

3.4.3 Study population, key inclusion and exclusion criteria

Study population: This research focused on the effects of food advertising on the dietary intake of children; therefore children of both sexes across a range of ages were needed to
achieve representative and accurate findings. Consistent with other studies that have investigated the effects of food advertising on children’s food consumption (Halford et al. 2004, Halford et al. 2008, Harris et al. 2009a, Harris et al. 2012, Folkvord et al. 2013, Folkvord et al. 2014, Folkvord et al. 2015), children aged 7 to 12 years (n=160 (n=40 x 4 camps) were the target group.

**Key inclusion criteria:** apparently healthy children aged 7 to 12 years were eligible to participate if they were able to attend all six days of the holiday camp. Written informed consent was required from children’s parents or guardians. Both males and females were eligible.

**Key exclusion criteria:** children were considered ineligible if they reported having any food allergies or intolerances; any medical conditions affecting what they could eat (e.g. diabetes); any dietary restrictions (e.g. vegetarian); a dislike of the study foods; or were not able to sit still and focus on a task for at least 15 minutes.

### 3.4.4 Sampling and recruitment

The sample size of 160 children was deemed to have sufficient statistical power (80%) to assess the first primary outcome (difference in mean snack intake between food and non-food advertising days), with a significance of < 0.05. The estimated difference in mean snack intake between intervention and control conditions was 451 kJ (standard deviation 620 kJ), based on published data from a similar, short-term advertising exposure feeding trial in the UK using the differences in kJ reported between conditions (Halford et al. 2007).

Participant recruitment took place in the month preceding each holiday camp period, in March, June, July and December 2016. A number of recruitment strategies were used. Local schools and recreation and sports clubs were contacted via email (Appendix X) regarding their interest in advertising the study via a flyer (Appendix Y). The recruitment flyer was also sent out through community and university email and social media networks and also to
families who have previously attended the UOW sports camp (Recruitment email: Appendix Z). Promotion was targeted across a range of demographic areas.

After interested parents responded to the flyer they were spoken to over the telephone by the PhD researcher who gave an overview of the research study and confirmed children met the eligibility criteria (Screening script: Appendix AA). An information pack was then emailed or posted to interested parents containing the Participant Information Sheet (Appendix BB), the Consent Form (Appendix CC) and a cover letter (Appendix DD).

Incentives for participants included payment for holiday camp attendance and the opportunity to enter in a draw to win an iPad Air 2 (one for each study camp).

3.4.5 Study design

The study utilised a within-subject, randomised, crossover, counter-balanced design with two media condition arms: multiple media (TV and advergame) or single media (TV-only) (Figure 3.2). Each media arm had two advertising conditions: control (an advergame featuring a non-food brand and/or exposure to ten non-food TV advertisements) and experimental (an advergame featuring a food brand and/or exposure to ten TV food advertisements) (see Section 3.4.7, Page 65). Each child took part in both advertising conditions and therefore acted as their own control. This allowed for a robust evaluation of the effects of advertising exposure on the various outcome measures.

After recruitment was complete for each study camp (i.e. 40 children were recruited) two groups of 20 children were formed for each camp, with an approximate even spread of gender and age between groups. The two groups were then randomised to one of the two media arms (single or multiple media) by an independent researcher. A simple, manual randomisation method was used, with the first group of children drawn out of a hat allocated to the single media intervention. Within each holiday camp children remained within the media arm to which they were allocated, and completed both the food advertising and non-food advertising conditions within their allocated media group. Each advertising condition
lasted for three days with the order of advertising exposure counter-balanced across holiday camps. Counterbalancing was employed to minimise any order effects. The food advertising condition was first in the April and September camps and second in the July and January camps. The April, September and January camps had a washout period of four days between Days 1-3 and Days 4-6. There was no washout period during the July camp: this was constrained due to the camp organisers only running the children’s holiday camp over a six day period.

**Figure 3.2: Experimental study design**

### 3.4.6 Daily procedure

An overview of the daily procedure can be seen in Table 3.1. Each morning at 8am, children arrived fasting (self-reported by parents/caregivers) at the Early Start research centre and were signed in by their parents/caregivers, who then left. Children washed their hands, entered the dining area and were then served breakfast. The dining space was set up with 40 individual trays (Figure 3.3) and, each day, children were offered a selection of portioned
breakfast cereals, fruit, toast or pikelets, spreads and water to drink (Figure 3.4) (see Appendix EE for daily breakfast set-up procedure).

Table 3.1: Children’s daily schedule

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.00am</td>
<td>• Children arrive at Early Start research centre</td>
</tr>
<tr>
<td></td>
<td>• Children are registered for the day; parent/caregiver leaves</td>
</tr>
<tr>
<td></td>
<td>• <em>Children eat breakfast</em></td>
</tr>
<tr>
<td></td>
<td>• Day One: children’s height and weight measured</td>
</tr>
<tr>
<td>8.30am-10.00am</td>
<td>• Children escorted to UOW Sports Hub for camp activities</td>
</tr>
<tr>
<td>10.00am-10.45am</td>
<td>• Children escorted back to Early Start research centre to intervention rooms</td>
</tr>
<tr>
<td></td>
<td>• Media interventions</td>
</tr>
<tr>
<td></td>
<td>• <em>Children eat morning tea</em></td>
</tr>
<tr>
<td>10.45am-1.00pm</td>
<td>• Children escorted back to UOW Sports Hub for camp activities</td>
</tr>
<tr>
<td>1.00pm-1.30pm</td>
<td>• Children escorted back to Early Start research centre</td>
</tr>
<tr>
<td></td>
<td>• <em>Children eat lunch</em></td>
</tr>
<tr>
<td>1.30pm</td>
<td>• Children leave study for the day</td>
</tr>
</tbody>
</table>

Figure 3.3: Photograph of dining area
Four trained research assistants and the PhD researcher supervised the children. The children were told that they could eat as much or as little as they liked, and were given more of each food item as requested. Children were also told to eat only from their own tray. Additional food items were also in pre-portioned amounts. Children were allocated a unique identifying number which was placed on their meal tray at each eating occasion and used to track how much each child ate daily. After 30 minutes, the children were escorted by sports camp leaders to participate in the nearby sports camp activities. Camp leaders ensured that the physical intensity of the sports camp activities was similar each session and each day of the study. Children's breakfast intake was estimated from the proportion of each standardised food item consumed (see Section 3.4.8.1, Page 66). Visual estimation methods have been demonstrated to be a valid and highly reliable method for estimating children’s food and beverage intake of pre-portioned food items in field research settings (Kenney et al. 2015). Children’s breakfast intakes were estimated each day to establish whether they ate similar amounts on both the food advertising and non-food advertising days. Breakfast food consumption was not an outcome measure in the randomised trial.
At mid-morning children were directed to their intervention rooms in the research centre with each room supervised by two research assistants. All children washed their hands and a roll call was taken. The rooms were bright and colourful with a carpeted floor and a large, wall mounted TV screen. Children in both intervention rooms were asked to take a seat on the floor and to report how hungry they felt by filling out a picture rating scale (Bennett and Blissett 2014) (see Section 3.4.8.6, Page 69). Children were then told that they would be watching a cartoon and some advertisements. Children were asked to sit quietly during the TV program (Figure 3.5). Once the cartoon had finished, iPads were distributed to the children in the multiple media condition and, after an explanation on how to play, they played an online advergame for five minutes (Figure 3.6).

Figure 3.5: Photograph of TV advertising exposure
In both rooms, after media exposure was complete, individual trays with six small bowls of snack foods were given out. Bowls contained 50 grams of each of the following foods: high-fat savoury (crinkle-cut crisps, plain potato crisps or chicken-flavoured crackers); low-fat savoury (pretzels, plain crackers or rice crackers); high-fat sweet (milk chocolate, chocolate-covered biscuits or sugar-coated chocolate confectionery); low-fat sweet (assorted jelly lollies); fruit (green and black grapes or peeled mandarin segments); and vegetable (carrot sticks) (see Appendix FF). These selections were in line with previous study designs (Halford et al. 2008). Snack items offered on Day One were matched with those offered on Day Four, Day Two with Day Five and Day Three with Day Six. None of the brands offered to children to eat were featured in any of the advertisements. Children were asked to wait until everyone had their trays before they could start eating (Figure 3.7).
They were, again, told that they could eat as little or as much as they liked, and if they would like some more they should put their hand up and they would be given more of the requested food (in pre-weighed portions). This was the only time either food or eating was referred to by the research assistants. Advertisements were not discussed with the children. Eating time was limited to 15 minutes after which children were instructed to stand up and leave the room. The time limit was not disclosed to children; research assistants told children when to start eating and when to stop. Children ate together in their assigned media conditions. Afterwards children left and were escorted by camp leaders to take part in further holiday camp activities and the remaining food on each child’s tray was weighed and recorded (see Section 3.4.8.2, Page 67).

Lunch was served at 1pm each day back in the Early Start research centre dining room. Once again 40 individual trays were set up with pre-weighed food items. There was a different menu for Days One to Three that was repeated on Days Four to Six. Lunch items included
fruit, vegetables, yoghurt and healthier versions of fast food, i.e. cheese and tomato pizza, low-fat beef burger, oven baked chicken pieces and chips (see Appendix GG for lunch menu items and full preparation procedures). The children’s menus were finalised after the pilot study, during which we determined the food items that were preferred by children of the study age-group. The dining room was supervised by a minimum of four research assistants. All children washed their hands before eating. Each day prior to lunch, children completed the picture rating scale to report how hungry they felt (Bennett and Blissett 2014) (see Section 3.4.8.6, Page 69). As with the previous meal occasions, children were told that they could eat as little or as much as they liked and if they would like some more to ask and they would be given more of the requested food (Figure 3.8).

Figure 3.8: Photograph of children eating lunch

Parents arrived to pick children up at 1.30pm, whereupon children were signed out of the research study for the day. Once children had left, all remaining individual food items were
weighed and recorded (see Section 3.4.8.3, Page 67). We did not collect dietary data from children once they left camp for the day.

### 3.4.7 Materials: media and advertising

The TV advertisements (approximately 30 seconds each) were embedded within a ten minute age-appropriate, gender-neutral cartoon and shown each day (Table 3.2). Three advertisements were shown at the beginning or the cartoon, three in the middle and four at the end. The order of the advertisements with the cartoons varied each day.

The cartoons were matched by series across condition but with a different episode of the cartoon shown each day. Each cartoon was vetted and carefully edited to ensure that there were no references to, or depictions of, foods or eating in any of the cartoons. The cartoon series were selected following the pilot study during which we determined the types of cartoon that children of the study age-range preferred.

**Table 3.2: Media and advertising summary table - cartoons and branded products featured in advergames and TV advertisements by condition**

<table>
<thead>
<tr>
<th>Experimental (food advertisement condition)</th>
<th>Control (non-food advertisement condition)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cartoons:</strong></td>
<td></td>
</tr>
<tr>
<td>Day One: ‘SpongeBob SquarePants’ - ‘Snowball Effect’</td>
<td>Day One: ‘SpongeBob SquarePants’ - ‘Idiot Box’</td>
</tr>
<tr>
<td>Day Two: ‘Danger Mouse’ - ‘Welcome to Danger World’</td>
<td>Day Two: ‘Danger Mouse’ - ‘Jeopardy Mouse’</td>
</tr>
<tr>
<td><strong>Advergame:</strong></td>
<td></td>
</tr>
<tr>
<td>Nestle Kokokrunch cereal</td>
<td>Lego</td>
</tr>
<tr>
<td><strong>TV advertisements:</strong></td>
<td></td>
</tr>
<tr>
<td>McVities Delichoc biscuit</td>
<td>The North Face sportswear</td>
</tr>
<tr>
<td>Burger King Meal Deal</td>
<td>Vodafone Ireland</td>
</tr>
<tr>
<td>Taco Bell Smart Phone App</td>
<td>Speedo swimwear</td>
</tr>
<tr>
<td>McCoys crisps</td>
<td>Visit England</td>
</tr>
<tr>
<td>Nestle Kokokrunch cereal</td>
<td>O2 telecommunications</td>
</tr>
<tr>
<td>Hersheys chocolate spread</td>
<td>British Airways</td>
</tr>
<tr>
<td>McVities BN biscuit</td>
<td>Bloomingdales</td>
</tr>
<tr>
<td>Walkers Mixups crisps</td>
<td>Mini</td>
</tr>
<tr>
<td>Hula Hoops savoury snacks</td>
<td>Disney Cruise Line</td>
</tr>
<tr>
<td>Maynards Discovery Patch confectionery</td>
<td>Petplan insurance</td>
</tr>
</tbody>
</table>
The advergames featured the advertised brand or product as active game components, present throughout the duration of the game, and rated as suitable to be played by all study ages.

Food products in the experimental condition were classed as high in fat, salt and/or sugar in accordance with the nutrient profiling criteria developed by Food Standards Australia New Zealand (Food Standards Australia New Zealand 2015) (see Chapter Six, Table 6.1, Page 127 for individual food product nutrient profiles). In order to isolate the effects of the study advertising exposure, the branded products selected for the experimental condition were for real food products available in other countries but not available for sale in Australian supermarkets or advertised on commercial TV within Australia (Table 3.2). The branded food advergames were only available for download from international app stores.

Non-food advertisements were selected on the basis that they used creative content such as catchy music, action and promotional characters; themes that are commonly used in food advertisements to appeal to children (Jenkin et al. 2014). The non-food advertisements were all vetted to ensure they contained no references to food products or depicted people eating. Full descriptions of the creative content and marketing techniques within the experimental advertisements can be found in Chapter Six, Supplementary Tables 6.1 and 6.2.

**3.4.8 Participant measures**

Children’s daily food intakes were recorded each day in the child’s daily record sheet (see Appendix HH for an example). These sheets were kept out of view of the children at all times.

**3.4.8.1 Children's daily breakfast intake (kJ)**

Each day children’s breakfast intake was estimated by assessing whether children had eaten all, more than half, half, less than half or none of each food item. A trained research assistant (an Accredited Practising Dietitian) assessed each child’s tray and recorded the amounts that the child had eaten of each food on the child’s daily record sheet. This was conducted in the
absence of and out of the view of the children. At a later time, and with reference to a breakfast estimation weight chart (Appendix II), kJ were estimated from the proportion of each standardised food item consumed, using FoodWorks 8 nutrient analysis software (https://xyris.com.au/). This data was then entered into Statistical Package for the Social Sciences (SPSS) statistical software package, version 23 (SPSS Inc., Chicago, IL, USA). Children’s mean breakfast intakes for the three days of food and three days of non-food advertising were estimated.

3.4.8.2 Children’s morning snack intake (kJ)

Each day all snack food items were weighed (g) prior to being presented to participants (see Appendix FF) and then reweighed after the eating period was finished to quantify how much of each food the children had eaten. This was conducted by a trained research assistant (an Accredited Practising Dietitian) in the absence of the children. Children’s snack intakes (g) were entered onto the child’s daily record sheet (Appendix HH). At a later time, children’s morning snack intakes were converted from gram amounts to kJ using FoodWorks 8 nutrient analysis software. This data was then entered into SPSS, version 23. Mean snack food intakes (kJ) were calculated for all children for the three days of food advertising and three days of non-food advertising.

3.4.8.3 Children’s lunch food intake (kJ)

Each day all lunch food items were weighed (g) prior to being presented to participants (see Appendix GG) and then reweighed after the eating period was finished (Figure 3.9). This was conducted by a trained research assistant (an Accredited Practising Dietitian) in the absence of the children. Children’s lunch intakes (g) were entered onto the child’s daily record sheet (Appendix HH). At a later time, children’s lunch intakes were converted from gram amounts to kJ using FoodWorks 8 nutrient analysis software. This data was then entered into SPSS, version 23. Mean lunch food intakes (kJ) were calculated for all children for the three days of food advertising and three days of non-food advertising.
3.4.8.4 Children’s anthropometric measures

Children’s height and weight were measured on Day One of the study by two trained research assistants. These measurements were taken in a quiet corner of a room adjacent to the dining space. Neither the child, nor any subsequent child being measured, saw the measurements recorded. If any child was reluctant to be weighed or measured they were not coerced to do so. No children refused to have their weight or height measured.

Children’s body mass index (BMI; weight/height²) and BMI z-scores (World Health Organization 2007) were calculated. These values were used to classify children into underweight, normal weight, overweight or obesity categories using international standardised cut-points (Cole and Lobstein 2012).

3.4.8.5 Children’s recall, recognition and attitude towards, advertised brands

An online brand recognition tool was designed to assess children’s recollection of the advertised food brands; both pre- and post-study (Appendix JJ). Children were asked: a) if
they recognised 20 different photographs of both food and non-food logos, and b) to describe the product to which the logo related. If children reported recognising a particular logo or brand, they were asked a series of questions designed to assess their attitudes and associations to/with that particular brand. This tool was based on a validated food brand recognition instrument for children of this age group (Turner et al. 2015) and based on questions used in previous research on children’s food brand attitudes (Kelly et al. 2016). Children completed the online brand recognition questionnaires at home prior to the study commencing and in the week following the study’s completion and a brand recognition score was calculated. Further details of this instrument can be found in Chapter Six, Page 127 and Appendix JJ.

3.4.8.6 Children’s self-reported hunger prior to morning tea and lunch

Children reported how hungry they felt prior to morning tea and lunch each day using a validated picture-rating scale; with the anchors ‘I am really hungry’ and ‘I am not hungry at all’ (Bennett and Blissett 2014). Picture rating scales are straightforward to use for children of this age group and are a reliable tool for assessing children’s subjective experiences related to hunger and satiety (Appendix KK).

3.4.9 Parent and family measures

Parents completed two online questionnaires pre- and post-study to capture the following data (Appendix LL and Appendix MM):

3.4.9.1 Parental Feeding Practices

Parents completed the validated Child Feeding Questionnaire (CFQ) (Birch et al. 2001) as part of their online baseline questionnaire. The CFQ is designed to be used in research studies and, as previously stated, is one of the most regularly used psychometric tools to assess parental feeding practices (Birch et al. 2001, Vaughn et al. 2013). More detail on this instrument can be found in Chapter Five, Page 107 and Appendix LL.
3.4.9.2 Family and child demographic data; child usual dietary intake and media habits

As part of their online baseline questionnaire (Appendix LL) parents reported children’s usual dietary intake using selected short dietary questions from the NSW Schools Physical Activity and Nutrition Survey (Hardy et al. 2016)). These short dietary questions have been validated to collect this dietary information for children of this age group (Flood et al. 2014, Golley et al. 2017). Children’s media habits included usual TV viewing (commercial and non-commercial) and Internet use were also reported in the parents’ baseline questionnaire. Family demographics included household make-up, income, language spoken at home, parents’ country of birth and level of education including and were reported by parents in the post-study questionnaire (Appendix MM).

The full study protocol was finalised following the pilot study that was conducted with 30 children over a six-day period in January 2016.

3.5 Ethical considerations

This research study raised some ethical considerations, including informed consent, exposure to advertisements, child-specific considerations, confidentiality, anonymity, and ethical approval.

3.5.1 Informed consent process

As the participants were children aged 7-12 years, written informed consent was obtained from a parent/guardian in order for their child to be allowed to participate in the study (Appendix CC). Information on the study was provided to parents to allow them to make an informed decision on whether they consented to their child’s participation (Appendix BB). Parents were given the opportunity to talk directly with the researchers involved in the study (contact details were provided on the Participant Information Sheet (Appendix BB) and Consent Form (Appendix CC). Furthermore, if parents or guardians were concerned with the research procedures they were encouraged to contact the University of Wollongong Human
Ethics Research Committee. Children gave their verbal assent to participate at the time of the study.

The Participant Information Sheet indicated that participants could withdraw from the study at any time, without any negative consequence to the parent or child and that it would not affect their relationship with UOW. Participants were also informed that if they were to withdraw from the study, any information provided would not be included in the study.

3.5.2 Exposure to advertisements

The interventions involved showing children a range of advertisements, embedded in either a cartoon or game. The food advertising was for less healthy products; however children are exposed to large volumes of food marketing in everyday life (Signal et al. 2017). Exposure to TV advertisements during the experimental interventions was similar to what children would reasonably see during an hour of popular family TV viewing times at home (Brindal 2011). All food advertisements were for overseas brands and were not available for purchase in supermarkets in Australia.

3.5.3 Child-specific considerations

All research assistants and university staff in contact with the children had a current NSW Working with Children Check. Children were supervised at all times by either camp supervisors or trained research assistants or study investigators. Children with any food allergies, food intolerances or medical conditions that affect the foods that they would be able to eat were excluded. Children who disliked any study foods were not included.

Menus for the children at breakfast and lunch were designed in accordance with the Australian Dietary Guidelines (National Health and Medical Research Council 2013). Foods offered to the children at morning tea included a range of choices, including healthy options. All foods offered at morning tea are commercially available in Australian supermarkets and are commonly consumed in the target population (Australian Bureau of Statistics 2015). All
meal times had a defined eating period. At the end of the study educational information was made available to parents with regards healthy eating, media use and advertisers’ strategies.

All foods were prepared onsite at the Early Start research centre food skills kitchen in line with current NSW food handling and kitchen hygiene requirements. The PhD researcher holds two Food Hygiene and Handling TAFE qualifications: SITXOHS001B ‘Follow health, safety and security procedures’ and SITXOHS002A ‘Follow workplace hygiene procedures’. Children did not have access to the Early Start kitchen at any time. Children were supervised to wash their hands prior to each eating occasion.

The children were weighed and measured on Day One of the study. These measurements were undertaken in private and neither the child nor any subsequent children saw the measurements taken.

The Early Start rooms that the interventions were held in were open plan and have a full glass wall so that children were in full view at all times.

3.5.4 Confidentiality and anonymity

Each participant was given an identification number to ensure all information and data that was obtained is kept anonymous. All questionnaire and data collected was de-identified and coded for the purposes of data analyses. All hard copy data files are kept in a locked filing cabinet in office 21.214 in Early Start, UOW. Electronic files are kept in password-protected folders on the PhD candidate’s computer hard drive. Access to data is restricted to researchers listed on the ethics application.

3.5.5 Photographic permission

Parental permission was sought on Day One of each study to take photographs of their child during the research study. Permission was given in writing on the UOW Photograph Release Form (Appendix NN). All photographs with children contained within this thesis are of
children for whom parental permission was granted. All signed photograph release forms are kept in a locked filing cabinet in office 21.214 in Early Start, UOW.

3.5.6 Ethical approval

Ethical approval was granted for the randomised crossover trial by the University of Wollongong Human Research Ethics Committee (UOW HREC) on 2 November 2015 (HE15/396) (Appendix OO). Minor amendments to the initial ethical protocols were obtained from the UOW HREC as required (Appendix PP-QQ). The study protocol was prospectively registered with the Australian New Zealand Clinical Trials Registry on 23 August 2017 and can be accessed at http://www.ANZCTR.org.au/ACTRN12617001230347.aspx.
CHAPTER FOUR

SUSTAINED IMPACT OF ENERGY-DENSE TV AND ONLINE FOOD ADVERTISING ON CHILDREN’S DIETARY INTAKE
A WITHIN-SUBJECT, RANDOMISED, CROSSOVER, COUNTER-BALANCED TRIAL

4.1 Preface

The literature review, presented in Chapter Two, identified the lack of longer-term experimental studies that investigated whether short-term increases in food consumption after advertising exposure were compensated for at later eating occasions, and studies which examined the cumulative effects from media exposures over many days from more than one media source. Research has indicated that these were important outcomes to investigate to determine whether there is a direct link between children’s food marketing exposure and an energy imbalance that could lead to the development of childhood overweight and obesity. This chapter reports on the findings from the randomised trial, specifically addressing the first group of questions outlined in Chapter One, Page 5 of this thesis.

This chapter was written and published as a peer-reviewed journal publication during the course of this degree (see Appendix B). It is presented as it was published with minor changes in terms of formatting (such as table and figure numbering, and the referencing style) to maintain cohesion within the thesis and to conform to the University of Wollongong’s referencing style which is Harvard.


Authors’ contributions: B. Kelly is the Chief Investigator of the study and led the writing of the initial study protocol and successful funding application. All authors contributed to the
conception and design of the study and review of the protocol following the pilot study. B. Kelly and A-T McMahon supervised J. Norman. J. Norman primarily implemented the study protocol, including recruitment. J. Norman led the statistical analysis, supervised by B. Kelly and with advice from A. Bauman and L. Baur. J. Norman had primary responsibility for the final content of the manuscript. All authors contributed to critical revision of this manuscript and approved the final version.

Key findings have also been presented at the Meeting of the World Health Organization European Action Network on Reducing Marketing Pressure on Children 2017; the International Society of Behavioral Nutrition and Physical Activity Conference 2017; and the University of Wollongong Social Sciences Higher Degree Research Conference, Transforming Communities through Innovative Research 2017 (see Appendices D-F).

The findings from this paper generated extensive media interest on National TV, radio, news outlets and social media. This media coverage is detailed on pages xvi - xix and Appendices M-S. In addition the findings have informed multiple government submissions; the UK Parliament, NSW Parliament and the Australian Government. The submission to the Australian Government resulted in an invitation to give evidence at the Senate Committee public hearing into the Obesity Epidemic in Australia on 4 September 2018 (Appendices T-W).
4.2 Abstract

Background: Policies restricting children’s exposure to unhealthy food marketing have been impeded by the lack of evidence showing a direct link between food advertising exposure and children’s energy intake and body weight. Food advertising exposure increases children’s immediate food consumption, but whether this increased intake is compensated for at later eating occasions is not known; consequently the sustained effect on diets remains unclear.

Methods: We conducted a within-subject, randomised, crossover, counter-balanced study across four, six-day holiday camps in New South Wales, Australia between April 2016 and January 2017. Children (7–12 years, n=160) were recruited via local schools, email networks and social media. Two gender- and age-balanced groups were formed for each camp (n=20), randomised to either a multiple media or a single media condition and exposed to food and non-food advertising in an online game and/or a TV cartoon. Children’s food consumption (kilojoules) was measured at a snack immediately after exposure and then at lunch later in the day. Linear mixed models were conducted to examine relationships between food advertising exposure and dietary intake, taking into account gender, age and weight status.

Results: All children in the multiple media condition ate more at a snack after exposure to food advertising compared with non-food advertising; this was not compensated for at lunch, leading to additional daily food intake of 194 kJ (95% CI 80–308, p=0.001, d=0.2). Exposure to multiple media food advertising compared with a single media source increased the effect on snack intake by a difference of 182 kJ (95% CI 46–317, p=0.009, d=0.4). Food advertising had an increased effect among children with heavier weight status in both media groups.

Conclusion: Online (‘advergame’) advertising combined with TV advertising exerted a stronger influence on children’s food consumption than TV advertising alone. The lack of compensation at lunch for children’s increased snack intake after food advertising exposure
suggests that unhealthy food advertising exposure contributes to a positive energy-gap, which could cumulatively lead to the development of overweight.

Trial registration: Australian New Zealand Clinical Trials Registry, number ACTRN12617001230347 (Retrospectively registered).

Keywords: Food advertising, advergame, children, food intake, dietary intake, childhood overweight, childhood obesity
4.3 Background

Overweight is, arguably, the natural response to our food environment (Swinburn et al. 2011) which is dominated by low-cost, ultra-processed, energy-dense, highly palatable food products (Monteiro et al. 2013). Food marketing most commonly promotes these high-fat, high salt and high sugar foods (Cairns et al. 2013). Worldwide, TV is still the main platform for food advertising (Cairns et al. 2013, Powell et al. 2013a), however, the proliferation of digital technologies, including the Internet and mobile devices, has seen an increasing prevalence of food advertising on ‘new media’ (Kelly et al. 2015c). In recent years, advergames have been introduced as an online marketing tool, where the brand and/or product is a prominent feature (Schwartz et al. 2013). This high prevalence of unhealthy food promotion propagates societal norms where advertised high energy and low nutrient dense foods are acceptable and desirable (Schwartz et al. 2013). Advertisements also serve as conditioned stimuli, which stimulate food cravings and cue consumption (Boswell and Kober 2016).

Restricting children’s food marketing exposure has been identified as an international policy priority for the prevention of childhood overweight and obesity (World Health Organization 2010, United Nations General Assembly 2011). However, few countries have enforced statutory regulations and, globally, major regulatory reform essentially remains unimplemented, with most countries relying on industry-led pledges for responsible advertising (Galbraith-Emami and Lobstein 2013). Research evidence indicates that these industry pledges have not been effective in reducing children’s exposures to unhealthy food marketing (Galbraith-Emami and Lobstein 2013, Harris et al. 2017). As such, children continue to be exposed to high levels of unhealthy food marketing across a wide variety of media and settings (Harris et al. 2017), to promotions they find highly appealing and engaging (Cairns et al. 2013). A growing body of evidence indicates that food marketing affects children’s food attitudes, preferences and consumption (Cairns et al. 2013, Norman et al. 2016), most likely through a logical, cumulative sequence of cognitive and behavioural
responses (Kelly et al. 2015b). A key issue impeding policy change, however, is the shortage of evidence showing a direct link between food marketing and children’s energy intake and the sustained effect of exposures on children’s body weight (White House Task Force on Childhood Obesity 2010). Brief exposure to food advertising on TV or Internet advergames has an immediate direct effect on children’s food consumption, significantly increasing their intake of snack foods (Boyland et al. 2016), but whether or not this increased energy intake is compensated for at later eating occasions is not known. Many of these single exposure experimental studies have been conducted in laboratory settings and have not accounted for the cumulative effects of media exposures or the impact of repeated exposures across multiple media.

Economic modelling suggests that limiting food marketing to children would be one of the most cost-effective population-based strategies to reduce the prevalence of childhood obesity, resulting in both children’s health gains and health-service savings (Magnus et al. 2009). Data that were used to calculate these cost-benefits are now over three decades old, being derived from the only longer-term experimental study in this field, conducted at a children’s holiday camp in Canada in 1982 (Gorn and Goldberg 1982). The advertising landscape of 2018 is vastly different (Kelly et al. 2015c) and up-to-date data is needed for contemporary economic modelling studies. Conducting longer-term experimental studies in this field, however, is methodologically challenging and resource intensive and, as such, research of this nature is limited (Kelly et al. 2015b).

This study aimed to document children’s dietary intake over a period of six days during their time at a holiday camp, following exposure to food and non-food advertising from online (advergames) and/or TV media platforms. There were three main objectives for this study. First, we tested the hypothesis that children would eat more at a snack after food advertising exposure compared with non-food advertising. Secondly, we hypothesised that exposure to food advertising across multiple media would have an increased effect on children’s immediate snack intake compared with those only exposed to food advertising from a single
media source. Thirdly, this study measured if any increased energy consumed as a result of exposure to food advertising was compensated for by children consuming less energy at the later lunchtime eating occasion, and hence identified whether food advertising exposure resulted in a positive energy balance during their time at camp.

4.4 Methods

4.4.1 Study design, participants and materials

The study took place across four, six-day school holiday camps, from 8am to 1.30pm each day, between April 2016 and January 2017, at a single location in New South Wales (NSW), Australia. We partnered with the University of Wollongong Children’s Sports Holiday Camp and the Early Start research centre. Early Start is a child-focused research facility incorporating a large commercial kitchen, dining area and community engagement rooms. Both the camp and research centre are located on the same campus, within five minutes walk of each other.

Participant recruitment took place in the month preceding each holiday camp period, in March, June, July and December 2016. A total of 160 children, (78 female, 82 male), aged 7–12 years (9.3 ± 1.6 (mean ± SD), were recruited into the camp (n=40/camp) via local schools, community and university networks and social media. Children were deemed eligible if they were able to attend the camp on all days; did not report having any food allergies or intolerances or medical conditions affecting what they could eat; had no dietary restrictions or dislike of the study foods; and were able to sit still and focus on a task for at least 15 minutes. Incentives for participants included payment for their holiday camp fees and the opportunity to enter a draw to win an iPad at the end of each camp. Children were only permitted to participate once in the study, attending only one of the holiday camps during the data collection period. The study protocol was approved by the University of Wollongong Human Research Ethics Committee and can be accessed at
Informed written consent from parents was obtained for all participants.

The study was a within-subject, randomised, crossover, counter-balanced trial with two media condition arms: multiple media (TV and advergame) or single media (TV-only) (Figure 4.1). Each media arm had two conditions: control (an advergame featuring a non-food brand and/or exposure to ten non-food TV advertisements) and experimental (an advergame featuring an unhealthy food brand and/or exposure to ten unhealthy TV food advertisements). Food products in the experimental condition were classed as high in fat, salt and/or sugar in accordance with the nutrient profiling criteria developed by Food Standards Australia New Zealand (Food Standards Australia New Zealand 2015). Non-food advertisements were selected on the basis that they used persuasive techniques such as fun, action and promotional characters; themes that are commonly used in food advertisements to appeal to children (Jenkin et al. 2014). (A list of the advertised products that were used is detailed in Table 4.1.) The TV advertisements (approximately 30 seconds each) were embedded within a ten minute age-appropriate, gender-neutral cartoon and shown each day. There were no references to, or depictions of, foods or eating in any of the cartoons screened.

In order to isolate the effects of the study advertising exposure, the branded products selected for the experimental condition were real products available in other countries but not available for sale in Australian supermarkets or advertised on commercial TV within Australia. Two groups of 20 children were formed for each camp, with an approximate even spread of gender and age between groups. A simple, manual randomisation method was used, with the first group drawn out of a hat allocated to the single media intervention. This was conducted by an independent researcher not associated with the study. Children undertook both advertising conditions in each intervention arm, with the order of advertising condition counter-balanced across holiday camps. The study protocol, including menu items, was finalised following a pilot study with 30 children in January 2016.
Figure 4.1: Consort flow diagram and study design

An online brand recognition tool was designed to assess children’s recollection of the advertised food brands, both pre- and post-study. Children were asked: a) if they recognised 20 different photographs of both food and non-food logos, and b) to describe the product to which the logo related (Appendix JJ). This tool was based on a validated food brand recognition instrument (Turner et al. 2015).
Table 4.1: Branded products featured in advergames and TV advertisements in each condition

<table>
<thead>
<tr>
<th>Experimental (Food Advertisement Condition)</th>
<th>Control (Non-Food Advertisement Condition)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advergame:</td>
<td></td>
</tr>
<tr>
<td>Nestle Kokokrunch cereal</td>
<td>Lego</td>
</tr>
<tr>
<td>TV advertisements:</td>
<td></td>
</tr>
<tr>
<td>McVities Delichoc biscuit</td>
<td>The North Face sportswear</td>
</tr>
<tr>
<td>Burger King Meal Deal</td>
<td>Vodafone Ireland</td>
</tr>
<tr>
<td>Taco Bell Smart Phone App</td>
<td>Speedo swimwear</td>
</tr>
<tr>
<td>McCoys crisps</td>
<td>Visit England</td>
</tr>
<tr>
<td>Nestle Kokokrunch cereal</td>
<td>O2 telecommunications</td>
</tr>
<tr>
<td>Hersheys chocolate spread</td>
<td>British Airways</td>
</tr>
<tr>
<td>McVities BN biscuit</td>
<td>Bloomingdales</td>
</tr>
<tr>
<td>Walkers Mixups crisps</td>
<td>Mini</td>
</tr>
<tr>
<td>Hula Hoops savoury snacks</td>
<td>Disney Cruise Line</td>
</tr>
<tr>
<td>Maynards Discovery Patch confectionery</td>
<td>Petplan insurance</td>
</tr>
</tbody>
</table>

Children’s height and weight were measured on Day 1 of the study. Children’s body mass index (BMI) was calculated and these values were used to classify children into underweight, normal weight, overweight or obesity categories using international standardised cut-points (Cole and Lobstein 2012).

Children reported how hungry they felt prior to morning tea and lunch each day using a validated picture-rating scale; with the anchors ‘I am really hungry’ and ‘I am not hungry at all’ (Bennett and Blissett 2014) (Appendix KK).

4.4.2 Procedure

Each morning, children arrived fasting at the research centre at 8am, where they were served breakfast. The dining space was set up with 40 individual trays and, each day, children were offered a selection of portioned breakfast cereals, fruit, toast or pikelets, spreads and water to drink. The children were told that they could eat as much or as little as they liked, and were given more of each food item as requested. All additional food items were offered in pre-portioned amounts that were the same size for all children. Children were allocated a unique identifying number which was placed on their meal tray at each eating occasion and used to track how much each child ate daily. After 30 minutes, the children left to participate in the
nearby holiday camp activities. Camp leaders ensured that the physical intensity of camp activities was similar each session and day of the sports camp. Children’s breakfast intake was quantified by assessing whether children had eaten all, more than half, half, less than half or none of each food item. Visual estimation methods have been demonstrated to be a valid and highly reliable method for estimating children’s food and beverage consumption of pre-portioned food items (Kenney et al. 2015). Kilojoules (kJ) were estimated from the proportion of each standardised food item consumed, and children’s mean breakfast intakes for the three days of food and three days of non-food advertising were estimated.

At mid-morning children were directed to their intervention rooms in the research centre with each room supervised by two research assistants. The rooms were bright and colourful with a carpeted floor and a large, wall mounted TV screen. Children in both intervention rooms were asked to take a seat on the floor and to report how hungry they felt by filling out the picture rating scale (Bennett and Blissett 2014). Children were then told that they would be watching a cartoon and some advertisements. Once the cartoon had finished, iPads were distributed to the children in the multiple media condition and, after an explanation on how to play, they played an advergame for 5 minutes. In both rooms, after media exposure was complete, individual trays with six small bowls of snack foods were given out. Bowls contained 50 grams of each of the following foods: high-fat savoury (crinkle-cut crisps, plain potato crisps or chicken-flavoured crackers); low-fat savoury (pretzels, plain crackers or rice crackers); high-fat sweet (milk chocolate, chocolate-covered biscuits or sugar-coated chocolate confectionery); low-fat sweet (assorted jelly lollies); fruit (green and black grapes or peeled mandarin segments); and vegetable (carrot sticks). These selections were in line with previous study designs (Halford et al. 2008). Snack items offered on Day One were matched with those offered on Day Four, Day Two with Day Five and Day Three with Day Six. None of the brands offered to children to eat were featured in any of the advertisements. Children were asked to wait until everyone had their trays before they could start eating. They were, again, told that they could eat as little or as much as they liked, and if they would
like some more they should put their hand up and they would be given more of the requested food. This was the only time either food or eating was referred to by the research assistants. All additional foods were pre-weighed in advance of the morning tea period. Advertisements were not discussed with the children. Eating time was limited to 15 minutes after which children were instructed to leave the room. Afterwards children left to take part in further holiday camp activities and the remaining food on each child’s tray was weighed and recorded.

Lunch was served at 1pm each day back in the research centre. Once again 40 individual trays were set up with pre-weighed food items. There was a different menu for Days One to Three which was repeated on Days Four to Six. Lunch items included fruit, vegetables, yoghurt and healthier versions of fast food, e.g. low-fat beef burger; oven baked chicken pieces and chips. Each day prior to lunch, children completed the picture rating scale to report how hungry they felt (Bennett and Blissett 2014). As with the previous meal occasions, children were told that they could eat as little or as much as they liked and if they would like some more to ask and they would be given more of the requested food. Again, all additional food items were pre-weighed prior to the lunchtime period. Parents arrived to pick children up at 1.30pm. Once children had left, all remaining individual food items were weighed and recorded. We did not collect dietary data from children once they left camp for the day.

Children’s morning snack and lunch intakes were converted from gram amounts to kJ using FoodWorks 8 nutrient analysis software.

Children completed the online brand recognition questionnaires at home prior to the study commencing and in the week following the study’s completion and a brand recognition score was calculated. Parents reported their household weekly income via an online questionnaire at the end of the study (Appendix MM).
4.4.3 Outcomes

There were two primary outcomes: firstly whether there was an increase in snack intake (kJ) after food advertising exposure compared with non-food advertising exposure and secondly, if any increased intake was compensated for at the lunchtime meal. The secondary outcome was whether there was an increased effect on energy intake (kJ) from exposure to food advertising over multiple media compared with a single media source.

4.5 Statistical analysis

The sample size, with sufficient statistical power (80%) to assess the first primary outcome, with a significance of 0.05, was estimated from published data from a similar, short-term advertising exposure feeding trial in the UK using the differences in kJ reported between conditions (Halford et al. 2007).

Each child’s mean snack and lunch intakes for the three days of food advertising exposure and three days of non-food advertising exposure were calculated. All intake data met normality assumptions. Analysis of the primary and secondary outcomes was conducted using linear mixed models, adjusting for the clustered nature of the data (i.e. camp identifier was included as a random intercept in the models). The linear mixed models were used to examine the differences in snack intake (kJ) between the two media groups and the differences in the snack and lunch intakes (kJ) between advertising conditions within each group. Any influence of the impact of age (months), gender, weight status (BMI z-score), children’s baseline brand recognition score, household weekly income or hunger on snack intake was investigated by adding these variables as covariates to the model. All analyses used a significance level of 0.05. All analyses were completed using the Statistical Package for the Social Sciences statistical software package, version 23 (SPSS Inc., Chicago, IL, USA).
4.6 Results

Of the 160 children enrolled in the study, six did not complete all six days of the camp, so their data were not included in the final analysis (Figure 4.1). Table 4.2 depicts the completing participants’ characteristics across the two media condition groups. The proportion of children with overweight or obesity in our study (16%) was lower than the NSW state average (23%) (Hardy et al. 2016). The median household income of all families in the study was between $2000–2499 per week which was substantially higher than the NSW median household income of $800–999 per week (Australian Bureau of Statistics 2011).

As a whole group (n=154), children’s estimated mean kJ intake at breakfast on the food advertising days (1350 ± 500 kJ) was similar to intakes on non-food advertising days (1300 ± 500 kJ) (p=0.079).

### Table 4.2: Participant Characteristics by Media Condition Group

<table>
<thead>
<tr>
<th></th>
<th>TV-only (n=76)</th>
<th>TV and advergame (n=78)</th>
<th>All (n=154)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender, n (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>37 (48.7)</td>
<td>40 (51.3)</td>
<td>77 (50.0)</td>
</tr>
<tr>
<td>Female</td>
<td>39 (51.3)</td>
<td>38 (48.7)</td>
<td>77 (50.0)</td>
</tr>
<tr>
<td>Age, mean ± SD (range), y</td>
<td>9.6 ± 1.5 (7.0–12.3)</td>
<td>9.1 ± 1.8 (6.5–12.9)</td>
<td>9.3 ± 1.6 (6.5–12.9)</td>
</tr>
<tr>
<td>BMI for age, n (%) (Cole and Lobstein 2012)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Underweight</td>
<td>4 (5.2)</td>
<td>1 (1.3)</td>
<td>5 (3.3)</td>
</tr>
<tr>
<td>Normal weight</td>
<td>61 (80.3)</td>
<td>63 (80.8)</td>
<td>124 (80.5)</td>
</tr>
<tr>
<td>Overweight</td>
<td>10 (13.2)</td>
<td>9 (11.5)</td>
<td>19 (12.3)</td>
</tr>
<tr>
<td>Obesity</td>
<td>1 (1.3)</td>
<td>5 (6.4)</td>
<td>6 (3.9)</td>
</tr>
<tr>
<td>Median household weekly income ($)</td>
<td>1500–1999*</td>
<td>2000–2499**</td>
<td>2000–2499</td>
</tr>
</tbody>
</table>

*5% did not answer; **14% did not answer

A significant main effect for media condition was found. Children in the TV and advergame group (n=78) ate more at the snack after food advertising compared with non-food advertising than the TV-only group (n=76) (additional 182 kJ (95% CI 46 to 317)) (p=0.009,
Consequently, data were analysed separately by media condition. Age, gender, brand recognition score at baseline and household weekly income had no significant main effect or interaction and were removed from further analyses.

Table 4.3: The effects of advertisement condition on the kJ intake in all children and by weight status across both media conditions

<table>
<thead>
<tr>
<th></th>
<th>Difference in means between food and non-food ads</th>
<th>Difference in means between food and non-food ads</th>
<th>Additional energy intake per day at the holiday camp after food advertising</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SNACK (kJ)</td>
<td>LUNCH (kJ)</td>
<td>SNACK PLUS LUNCH (kJ)</td>
</tr>
<tr>
<td>Whole group</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All children (n=154)</td>
<td>111 (434)</td>
<td>41 (397)</td>
<td>152 (556)</td>
</tr>
<tr>
<td></td>
<td>p=0.002, d=0.2</td>
<td>p=0.001, d=0.2</td>
<td>p=0.001, d=0.2</td>
</tr>
<tr>
<td>Under-/normal weight (n=129)</td>
<td>90 (414)</td>
<td>1 (388)</td>
<td>91 (521)</td>
</tr>
<tr>
<td></td>
<td>p=0.015, d=0.1</td>
<td>p=0.05, d=0.1</td>
<td>p=0.05, d=0.1</td>
</tr>
<tr>
<td>Overweight/obesity (n=25)</td>
<td>221 (521)</td>
<td>246 (389)</td>
<td>467 (631)</td>
</tr>
<tr>
<td></td>
<td>p=0.045, d=0.3</td>
<td>p=0.004, d=0.4</td>
<td>p=0.001, d=0.4</td>
</tr>
<tr>
<td>TV-only</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All children (n=76)</td>
<td>19 (460)</td>
<td>89 (413)</td>
<td>108 (603)</td>
</tr>
<tr>
<td></td>
<td>p=0.002, d=0.2</td>
<td>p=0.001, d=0.2</td>
<td></td>
</tr>
<tr>
<td>Under-/normal weight (n=65)</td>
<td>4 (427)</td>
<td>29 (378)</td>
<td>33 (522)</td>
</tr>
<tr>
<td></td>
<td>p=0.002, d=0.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overweight/obesity (n=11)</td>
<td>113 (647)</td>
<td>441 (456)</td>
<td>554 (858)</td>
</tr>
<tr>
<td></td>
<td>p=0.009, d=1.1</td>
<td>p=0.058, d=0.6</td>
<td></td>
</tr>
<tr>
<td>TV and advergame</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All children (n=78)</td>
<td>201 (388)</td>
<td>–6 (377)</td>
<td>194 (388)</td>
</tr>
<tr>
<td></td>
<td>p&lt;0.001, d=0.3</td>
<td>p=0.001, d=0.2</td>
<td></td>
</tr>
<tr>
<td>Under-/normal weight (n=64)</td>
<td>178 (385)</td>
<td>–28 (398)</td>
<td>150 (518)</td>
</tr>
<tr>
<td></td>
<td>p=0.001, d=0.3</td>
<td>p=0.024, d=0.2</td>
<td></td>
</tr>
<tr>
<td>Overweight/obesity (n=14)</td>
<td>305 (402)</td>
<td>93 (248)</td>
<td>398 (398)</td>
</tr>
<tr>
<td></td>
<td>p=0.014, d=0.3</td>
<td>p=0.002, d=0.3</td>
<td></td>
</tr>
</tbody>
</table>

Mean (kJ) (SD). All p-values are two tailed. d = effect size, Cohen’s d

Children’s reported hunger prior to advertising exposure was related to their snack intake in both the food advertising and non-food advertising conditions (p=0.000). The difference in snack intake between food and non-food advertising exposures, however, remained significant after controlling for the difference in hunger between the advertising conditions (p=0.008). In the TV-only condition, BMI z-score was related to children’s snack intake after food advertising (p=0.003) and non-food advertising (p=0.038).

In the TV and advergame group (n=78), mean kJ intake was 201 kJ higher at the snack after food advertising exposure (2168 ± 787 kJ) compared with non-food advertising (1968 ± 698 kJ) (p<0.0001, d=0.3). This difference remained significant after controlling for hunger.
Within this media group, children with overweight or obesity (n=14) ate an additional 305 kJ (95% CI 73 to 538) more after food advertising exposure (p=0.014, d=0.3) compared with children with under-/normal weight (n=64) who ate 178 kJ (95% CI 82 to 274) more (p<0.0001, d=0.3). In the TV-only group, children with under-/normal weight (n=65) ate comparable amounts after both food (1933 ± 619 kJ) and non-food (1929 ± 678 kJ) advertising exposures (p=0.947). Likewise, within this group, children with overweight or obesity (n=11) also ate similar amounts in both the food (2220 ± 711 kJ) and non-food advertising (2107 ± 621 kJ) conditions (p=0.576).

Figure 4.2: Mean daily additional kJ (95% CI) consumed at the camp after exposure to food advertising by children with under-/normal weight and overweight or obesity within the two media conditions

* Significant increase in total kJ consumed after food advertising compared with non-food advertising (p= 0.001). ** Significant increase in total kJ consumed after food advertising compared with non-food advertising (p= 0.024). *** Significant increase in total kJ consumed after food advertising compared with non-food advertising (p= 0.002). # Non-significant increase in total kJ consumed after food advertising compared with non-food advertising (p= 0.058).
Children in the TV and advergame group did not compensate for their increased snack intake after food advertising at their lunchtime meal. Children in this group consumed an additional 194 kJ (95% CI 80 to 308) daily at camp (snack + lunch) (p=0.001) after food advertising exposure compared with non-food advertising exposure (Figure 4.2, Table 4.3). The effect of the food advertising appeared to be greater among children with heavier weight status. Children with overweight and obesity in the TV and advergame group consumed an extra 398 kJ (95% CI 168 to 627) daily at camp (p=0.002) compared with children with under-/normal weight who consumed an extra 150 kJ (95% CI 21 to 279) daily (p=0.024) (Figure 4.2). In the TV-only group, children with overweight or obesity ate an extra 441kJ (95% CI 135 to 747) at lunch on food advertising days (p=0.009); this led to an additional 553 kJ (95% CI –23 to 1129) being consumed on food advertising days at camp compared with non-food advertising days (p=0.058).

4.7 Discussion

4.7.1 Principal findings of the study

Exposure to food advertising on TV and the advergame led to significant increases in children’s daily energy intake during their time at camp (194 kJ). This response was magnified among children with overweight and obesity (n=14); consuming over double the additional daily kJ at the camp (398 kJ) than children with under-/normal weight (n=64, 150 kJ). This exaggerated response was also seen among children of a heavier weight status in the TV-only group, with children (n=11) consuming an extra 553 kJ (p=0.058) at the camp on the food advertising days. Given that cohort studies suggest that a positive energy-gap of only 200–300 kJ a day may be all that is required for the development of overweight in children (Plachta-Danielzik et al. 2008, van den Berg et al. 2011), these data raise legitimate concerns about the direct influence that food advertising over long-term exposures may exert on children’s weight.
4.7.2 Interpretation

Whilst not consistently seen across previous studies, children with a heavier weight status have been often shown to have heightened food intake responses to food advertising on TV (Halford et al. 2004, Halford et al. 2008) and branded food packages (Forman et al. 2009). In a UK study, children with overweight (n=15) increased their intake by 1280 kJ after TV food advertising compared with control, and children with obesity (n=11) by 1970 kJ (p<0.001), indicating they were highly influenced by external food cues (Halford et al. 2008). Indeed, children with overweight or obesity, when tested with a ‘stop signal’ task, have been shown to have less inhibitory control in response to food stimuli than children with normal weight (Nederkoorn et al. 2012). The pre-frontal cortex is an area of the brain involved in cognitive control, including impulse inhibition, and making decisions in response to stimuli in the environment (van Meer et al. 2015). Neural imaging studies indicate a lack of activation of this region in children in response to food cues, in contrast to adults where activation is apparent (van Meer et al. 2015). In response to fast food logos, children with obesity have been shown to have lower activation in the pre-frontal cortex compared with children with normal weight (Bruce et al. 2012). These data suggest that a lack of impulsivity inhibition in children, in response to food cues, could make them less able to control eating impulses and, thus, more susceptible to tempting food stimuli such as those found in food marketing. Additionally, it would also appear that children with a heavier weight status have a particular vulnerability to branding and food advertising effects.

Children within the TV and advergame group ate significantly more snack foods after food advertising (201kJ) compared with non-food advertising, whilst children in the TV-only group ate similar amounts at the snack after both the food and non-food advertisements. There was an increased effect seen among children with a heavier weight status in both media groups but at different meal occasions. In the TV and advergame group children with overweight or obesity (n=14) increased their snack intake by a significant 305 kJ after food advertising exposure. In the TV-only group (n=11), although no increased effect was
observed at snack-time, children with overweight and obesity ate an additional 441 kJ at lunchtime on food advertising days compared with non-food advertising days. The advertised foods were not offered to the children, indicating these effects were not brand or product specific but transferred to the foods that were on offer. Significant effects also remained after controlling for hunger. The lack of an advergame-only group meant that we were unable to isolate whether the significant main effect for media condition that we observed was due to the double exposure of TV and the advergame or to the nature of the game itself. The effects of playing an advergame only on snack intake have been previously demonstrated, with children (8–10 years) eating more (286 kJ, p<0.001) after playing a five minute game promoting energy-dense foods (n=69) compared with a non-food game (n=65); although this study did not differentiate between children with different weight statuses (Folkvord et al. 2013). Advergames are designed to be fun and engaging, with brand immersion as the primary objective (Nairn and Hang 2012). Given the consumption responses of children within this group, it would appear children have responded to the food cues prominent within the games.

Our findings suggest insights into child obesity policy at both upstream and mid-stream levels. From a primary prevention perspective, our findings clearly highlight the need for regulatory intervention to restrict children’s exposure to unhealthy food promotions, on TV and across different media platforms, and particularly online media. The recent rules introduced by the UK’s media self-regulatory body, the Committee of Advertising Practice, restricting the advertising of foods high in fat, salt or sugar in children’s non-broadcast media, are a step in the right direction in this regard (Committee of Advertising Practice 2017). From a weight management perspective, the increased vulnerability to food cues we observed among children with a heavier weight status supports the inclusion of interventions which aim to diminish sensitivity to these stimuli in children’s weight loss education programs (Boutelle et al. 2011, Boutelle et al. 2014, Boswell and Kober 2016). Although in their early infancy as an approach for children’s weight management, Cue Exposure
Treatment programs hold promise in supporting children to resist the abundance of food cues in today’s environment (Boutelle et al. 2011, Boutelle et al. 2014, Boswell and Kober 2016). The basic premise of these interventions is to present children with repeated, non-reinforced exposures to highly palatable foods with the aim of weakening the child’s conditioned response, that is, the desire to eat (Boutelle et al. 2011, Boutelle et al. 2014).

4.7.3 Strengths and limitations

A key strength of this study was that we created a natural environment within which to collect the data, and in which the children were comfortable and relaxed. The recreation centre and the dining area would not be dissimilar to the facilities that children would experience when attending school camps during term time. That the children enjoyed taking part in the study and camp is strongly supported by the overwhelmingly positive feedback we received from the parents in their follow-up questionnaire and the low study attrition.

Some limitations in study design point to why significant differences in snack intake between food and non-food advertising conditions in the TV-only group were not seen. Unlike previous studies, which used TV food advertisements aired within their study’s countries (Halford et al. 2004, Halford et al. 2008, Harris et al. 2009a), we elected to use unfamiliar brands. This was to isolate the effect of advertising exposure, without influence from pre-formed brand attitudes or associations. There is strong evidence that repetitive exposure to advertising enhances evaluation of that stimuli (Zajonc 1968, Bornstein 1989), with maximum attitude and affect reached at approximately ten advertising exposures (Schmidt and Eisend 2015). It is possible that exposure to novel brands and, consequently lesser opportunity to form positive affect with that brand or product, may not have cued children’s consumption responses to the extent that has previously been observed where food brands were familiar (Halford et al. 2004, Halford et al. 2008, Harris et al. 2009a), thus resulting in a null effect. The increased effect of prior advertising exposure on children’s food intake exposure via advergames has previously been demonstrated. In an earlier study
from the USA, children who had previous food branded game play experience consumed 577 kJ more from unhealthy snack foods than children who played healthy or non-food advergames in the study (Harris et al. 2012).

The time of day we conducted our study could also have influenced children’s consumption responses. Evidence suggests that self-regulatory capacity lessens across time as the cognitive resources needed to exert inhibition and executive control become depleted over the course of the day (Millar 2017). We measured children’s snack intake in the morning, when children’s ability to self-regulate is, arguably, at its height (Millar 2017). In contrast, previous studies, where significant effects of TV food advertising on children’s food intake were seen, and that reported time of day, were conducted in the afternoon (Gorn and Goldberg 1982, Harris et al. 2009a).

A further limitation may have been that children were given a 15 minute snack eating time, which was not disclosed to them. In two previous studies, where significant effects on snack food intake were seen subsequent to TV food advertising exposure, children (n=42–59, aged 9–11 years) were given unlimited time to eat during the experimental eating period (Halford et al. 2004, Halford et al. 2008). In our study, a number of children had asked for more high-fat sweet or low-fat sweet items and had not eaten all that they had requested. We surmise that having asked for more of these food items that children had the intention of eating them and, hence, would have finished eating the sweets if they had had sufficient time. Indeed, the most proximal determinant of actual behaviour is the intention to carry out that behaviour, according to the Theory of Planned Behaviour (Ajzen 1991). Food enjoyment is inversely correlated with satiety responsiveness and positively correlated with food responsiveness and desire to eat (French et al. 2012). The portion size of the extra food items was only 25g so coupled with the low satiability of energy-dense, sweet and high-fat foods (Rolls et al. 1988, Drewnowski 1998), and with children’s predisposition for these highly palatable foods (Ventura and Worobey 2013), this is a reasonable expectation. Analyses of mean snack food intakes allowing for children to finish the extras that they had asked for, suggests that food...
advertising would have had a significant increased effect on children’s snack intake in the TV-only condition (data not shown).

Furthermore, we were under-represented in the proportion of children with overweight or obesity in our study compared with the state population (Hardy et al. 2016) and, hence, it would appear, under-powered to detect a mean difference in snack intake among this sub-group of children in the TV-only group. A power calculation indicates that we would have needed a sample of 60 children with overweight or obesity to detect a mean difference of the magnitude that we observed (113 kJ), with a significance level of 0.05.

In line with previous studies (Anschutz et al. 2009, Folkvord et al. 2014), we asked children to report how hungry they were feeling prior to the snack period, in order to control for hunger in our analyses. As such, we cannot rule out the potential of confirmation bias, in which children may have been less likely to eat as much if they had previously reported that they were not very hungry (Nickerson 1998). We did, however, ask children about their level of hunger prior to both the food and non-food advertising exposures, so it is likely that any effects would have been non-differential across conditions.

Children did not compensate for their increased snack intake after food advertising during their days at the camp; however it is possible that they may have eaten less at mealtimes later in the day, or on subsequent days. Whilst we assessed children’s breakfast intake and measured their daily snack and lunch intakes we did not capture children’s food intake once they left the camp for the day. The limitations and challenges of collecting dietary intake data among free-living populations, particularly children, are well documented; they pose a high respondent burden, prompt an alteration of usual dietary habits and there is a poor accuracy when reporting food eaten away from home (Magarey et al. 2011). As such, we would not have been able to maintain the precision of the dietary intake data we had collected during camp hours if we had extended dietary data collection outside this controlled environment. There remain questions over whether children would have
compensated for their increased energy intake at later eating occasions. As previously discussed, self-regulation tends to lessen over the course of the day (Millar 2017). Additionally, although research with young children (3 – 6 years) suggests that they adjust their daily food intake according to the energy density of their diets (Kral et al. 2007), studies with older children indicate that this ability to accurately compensate tends to decrease with age (Cecil et al. 2005, Johnson and Taylor-Holloway 2006), and is weaker in children with heavier weight status (Kral et al. 2012). Whilst camp leaders ensured children’s camp activities were of a similar intensity and duration each day, children may have compensated for their additional energy intake after food advertising via increased energy expenditure outside the camp environment. In the absence of physical activity accelerometry data we are unable to determine this.

4.8 Conclusion

Children’s exposure to unhealthy food marketing is directly associated with an imbalance in energy intake that was not compensated for during children’s time at camp. Whilst this energy imbalance may have been compensated for at a subsequent time, it is of a magnitude that, over time, could drive a positive energy gap capable of underpinning excess weight gain in children. This energy gap is higher for children with overweight and obesity, and after exposure to TV food advertising and online advergames. These findings should inform policy specifications, including the need to focus regulatory restrictions across media platforms, and particularly online media, and that behavioural weight management interventions should address heavier children’s vulnerability to food promotions.

4.9 Acknowledgements

We wish to acknowledge Lee Murray and his team at the University of Wollongong Sports Holiday Camp for their flexibility and willingness to partner with us to bring this study to fruition. We thank the operations team at Early Start and all our research assistants for their support and hard work throughout the study. Finally, we wish to acknowledge all our study
participants, without whom the successful completion of this study would not have been possible.

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The Australian Research Council played no part in the study design, collection, analysis and interpretation of data; or the writing of the report; or the decision to submit the paper for publication. The corresponding author has full access to all the data in the study and had final responsibility for the decision to submit for publication. Two researchers from Cancer Council NSW (KC and CH) were study collaborators.

4.11 Competing interests

All authors have completed the ICMJE uniform disclosure form at http://www.icmje.org/conflicts-of-interest/ (available on request from the corresponding author). JN, BK, EB, LB, AB, KC, LK and CH all declare that they have no conflicts of interest.

A-T M reports grants from Australian Meals on Wheels Association, personal fees from Pork CRC, personal fees from Proportion Foods, personal fees from YUM Corp, personal fees from PhD examinations, personal fees from Flagstaff Fine Foods, personal fees from IRT, grants from University of Wollongong grant funds; outside the submitted work.

4.12 Ethical approval

The study was approved by the University of Wollongong Human Research Ethics Committee (HE15/396)
4.13 Availability of data

Data from this study will not be openly available until planned publication outputs have been completed.
CHAPTER FIVE

CHILDREN’S SELF-REGULATION OF EATING PROVIDES NO DEFENCE AGAINST TELEVISION AND ONLINE FOOD MARKETING

5.1 Preface

The preceding chapter reported on the findings from the randomised crossover trial where 160 children participated in one of four, six-day school holiday camps at the University of Wollongong, NSW, Australia. Children were randomised to either a multiple media or a single media condition and exposed to three days of food and three days of non-food advertising in an online game and/or a TV cartoon. Children’s food consumption (kilojoules (kJ)) was measured at a snack immediately after advertising exposure and then at lunch later in the day. All children in the multiple media condition ate more at a snack after exposure to food advertising compared with non-food advertising; this was not compensated for at lunch, leading to additional daily food intake of 194 kJ. This energy imbalance is of an amount that could lead to the development of overweight in children over time. Exposure to multiple media food advertising compared with a single media source increased the effect on snack intake by a difference of 182 kJ. Additionally it was found that food advertising had an increased effect among children with heavier weight status in both media groups.

The content of this chapter addresses the second research question of this thesis. It draws on data collected from the randomised crossover study presented in Chapter Four and investigates whether children whose parents report controlling feed practices have an increased vulnerability to advertising effects.

This chapter was written and published as a peer-reviewed journal article during the course of this degree (see Appendix C). It is presented as it was published with minor alterations in terms of formatting (such as table and figure numbering, and the referencing style) to maintain cohesion within the thesis and to conform to the University of Wollongong’s referencing style which is Harvard.

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Authors’ contributions: B. Kelly is the Chief Investigator of the study and led the writing of the initial study protocol and successful funding application. All authors contributed to the conception and design of the study. B. Kelly and A-T McMahon supervised J. Norman. J. Norman primarily implemented the study protocol, including recruitment. J. Norman led the statistical analysis, supervised by B. Kelly and with advice from A. Bauman and L. Baur. J. Norman had primary responsibility for the final content of the manuscript. All authors contributed to critical revision of this manuscript and approved the final version.

The findings from this paper generated a range of online news articles from news outlets around Australia and extensive social media interest. The media coverage is detailed on Page xvi and Appendices I, J and K.
5.2 Abstract

Exposure to unhealthy food marketing stimulates children’s food consumption. A child’s responsiveness is influenced by individual factors, resulting in an increased vulnerability to advertising effects among some children. Whether these differential responses may be altered by different parental feeding behaviours is unclear. The purpose of this study was to determine the relationship between parental feeding practices and children’s food intake responses to food advertising exposure. A randomised, crossover, counter-balanced, within-subject trial was conducted across four, six-day holiday camps in New South Wales, Australia between April 2016 and January 2017 with 160 children (7-12 years, n=40/camp). Children were randomised to either a multiple media (TV and Internet) or single media (TV) condition and exposed to food (3 days) and non-food (3 days) advertising in an online game and/or a cartoon. Children’s food consumption (kilojoules (kJ)) was measured at a snack immediately after advertising exposure and then at lunch later in the day. Parents completed the Child Feeding Questionnaire, and ‘restriction’ and ‘pressure to eat’ subscale scores were calculated. While food advertising affected all children in the multiple media condition, there was an increased effect on snack intake among children whose parents reported pressuring them to eat, with children consuming an additional 356 kJ after food advertising compared with non-food advertising. This was 209 kJ more than children whose parents did not pressure them to eat. In the single media condition, only children whose parents reported restrictive feeding practices ate more at lunch on food advertising days than non-food advertising days (240 kJ). These data highlight an increased susceptibility to food advertising among children whose parents report controlling feeding practices.

Keywords: Food advertising; food intake; children; parental feeding practice; Child Feeding Questionnaire
5.3 Introduction

Environmental factors strongly influence the establishment of a child’s eating behaviours (Hawkes et al. 2015) and play a critical role in the development of childhood overweight (Swinburn et al. 2011). Food environments are increasingly dominated by cheap, ultra-processed food products, high in fat, sugar and salt; foods which are intrinsically unhealthy yet intensely palatable (Monteiro et al. 2013). The widespread availability of these foods means that we are persistently faced with opportunities to overeat and, furthermore, encouraged and prompted to do so by their heavy promotion across an increasingly wide range of media and settings (Swinburn et al. 2011). As such, we are constantly challenged to self-regulate food intake (Stoeckel et al. 2017).

It is unsurprising that, born into this obesogenic food environment, the present generation of young people are more vulnerable to overweight than ever before (Allman-Farinelli et al. 2007). A sustained daily positive energy balance as small as 200-300 kilojoules (kJ) can lead to the development of overweight in children (Plachta-Danielzik et al. 2008, van den Berg et al. 2011). With this in mind, a plausible expectation would be that all children would develop overweight, and yet not all children do. While this individual variation can be partly explained by gene expression (epigenetics), other individual-level factors may also influence how responsive a child is to environmental influences (Gluckman and Hanson 2008). Therefore, it is important to understand how stimuli that can prompt food intake, such as food advertising, (Boyland et al. 2016) may affect some children more than others.

There is a commonly held belief that as children increase in age and attain greater cognitive maturity, they become more aware of advertising’s persuasive intent and become better equipped to defend themselves against advertising’s negative effects (Calvert 2008). However, in addition to the highly emotive themes and tempting food cues present in food advertising, the subtle and embedded nature of contemporary advertising approaches blurs the distinction between media content and advertising, making critical evaluation of marketing more difficult. A prime example is online branded games (‘advergames’),
commonly found on food industry websites, where cues, in the form of the brand or food item, are integrated into the game play, and as such are less likely to be consciously processed (Terlutter and Capella 2013). This type of advertising can influence behaviour, such as eating, without there being a deliberate or conscious processing of the information presented (Harris and Graff 2012).

Psychosocial theoretical models propose that when children process persuasive messages with low cognitive elaboration (implicit processing), such as those found in advergames, the cues are likely to have a greater effect on their eating behaviour than if they use greater cognitive elaboration (explicit processing) (Nairn and Fine 2008, Buijzen et al. 2010, Folkvord et al. 2016). Intra-individual variations among children, arising from individual susceptibility factors such as attentional bias and impulsivity, lead to differential responses (Valkenburg and Peter 2013, Folkvord et al. 2016).

Short term experimental studies, where children are exposed to food advertising, embedded in a cartoon or online game, consistently show that children have a significantly greater food intake after food advertising exposure compared with non-food advertising (Boyland et al. 2016). In addition, some children appear to respond to food advertising to a greater extent (Halford et al. 2008, Anschutz et al. 2010, Folkvord et al. 2014, Folkvord et al. 2015). Increased effects of food advertising on children’s food consumption have been observed among children with overweight and obesity (Halford et al. 2008, Norman et al. 2018a); those whose mothers exhibit encouragement to be thin (Anschutz et al. 2010); who have high impulsivity (Folkvord et al. 2014); and who show increased attentional bias to food displayed in advertisements (Folkvord et al. 2015).

Interactions between parents and children within the family and home environment shape the development and establishment of children’s eating behaviours and dietary self-regulation (Birch 2006). The approaches that parents use to promote healthy eating habits have been found to influence children’s food behaviours. Feeding practices, such as restricting foods
deemed as unhealthy, and pressuring or coercing children to eat healthier foods such as fruit and vegetables, can be counterproductive (Gerards and Kremers 2015); with both food restriction and pressure to eat shown to be significantly related to a child’s preference for foods high in fat and sugar (Vollmer and Baietto 2017). Additionally, research suggests that children subjected to these feeding practices are less successful in self-regulating their energy intake than children whose parents encourage them to focus on their internal satiety and hunger cues, and as a consequence these children may be more influenced by external food cues (Stoeckel et al. 2017). This gives rise to the question whether children who experience controlling parental feeding practices may be more responsive to unhealthy food advertising. Eating studies that explore relationships between parental feeding practices and children’s food behaviours are typically conducted in the absence of parental supervision (Lansigan et al. 2015). Hence, a school holiday program, which children attend without parents, presents an ideal environment in which to perform a study of this nature.

This paper reports on data collected from a randomised controlled trial (RCT) which investigated whether exposure to food advertising from a single media or a multiple media source increased children’s immediate food consumption (kJ) at a snack directly after exposure compared with non-food advertising, and whether any immediate increased energy intake was compensated for at a later lunchtime meal (Norman et al. 2018a). The aim of the present study was to explore the relationships between parental feeding practices and children’s food intake responses after the different advertising exposures.

5.4 Methods

5.4.1 Study design and participants

The within-subject, crossover, counter-balanced RCT was conducted across four, six-day school holiday camps from April 2016 to January 2017 in New South Wales, Australia. Children attended the morning sessions of the holiday camp every day from 8am to 1.30pm. The full study protocol and main results have been published elsewhere (Norman et al.
We recruited 160 children (78 female, 82 male), aged 7-12 years (9.3 ± 1.6 (mean ± SD)) via local schools, community and university networks and social media, with 40 children attending each holiday camp. Inclusion criteria included no reported food allergies or dietary restrictions. Incentives for participants included payment for their holiday camp fees.

Within each holiday camp, children were allocated to one of two groups of 20, balanced by age and sex, and randomised to participate in either the single media (TV) or multiple media (TV plus Internet advergame) condition. Within each media condition was an experimental condition (unhealthy food advertising (three days)) and a control condition (non-food advertising (three days)). Within each camp children participated in both the experimental and control conditions, with the sequence of advertising condition counter-balanced across holiday camps.

Informed written consent was obtained for all study participants. The study was registered with the Australian New Zealand Clinical Trials Registry (ACTRN12617001230347) and approved by the University of Wollongong Human Research Ethics Committee.

5.4.2 Materials and measures

5.4.2.1 Media and advertising

TV: six age-appropriate, ten minute cartoons were selected; one for each day of the camp. These were embedded with either ten food related TV advertisements or ten non-food related TV advertisements (approximately 30 seconds/advert). The ten TV advertisements were the same each day of the camp, changing only according to experimental or control condition. Pictures or references to food did not appear in any of the cartoons. Internet: an online advergame featuring either a food brand or a non-food brand (five minute game play). The advergames featured the advertised brand or product as active game components, present throughout the duration of the game. The advertised food products were categorised as unhealthy in line with the nutrient profiling criteria developed by Food Standards Australia
New Zealand (Food Standards Australia New Zealand 2015). In order to determine the influence of the study advertising, all branded food products in the experimental condition were for items available for purchase overseas but not in Australian supermarkets. The TV advertisements are not aired on Australian commercial TV stations and the advergames are only available for download through international app stores.

5.4.2.2 Foods and intake measurement

**Snack-time:** children were offered individual trays with six small bowls of preweighed assorted snack foods. Each bowl contained 50 grams (g) of a different food option: high-fat savoury, low-fat savoury, high-fat sweet, low-fat sweet, fruit and vegetable. The snack choices were in line with previous study designs (Halford et al. 2008), and none of the brands featured in any of the advertisements shown. Children were told that they could eat as little or as much as they would like, and were given more of any food item on request. The snack period was strictly limited to 15 minutes. For each child the leftovers of the individual foods were weighed (g).

**Lunch-time:** children were presented with a tray of pre-prepared, pre-weighed standardised food items. There were three different lunch menus: items included fruit, vegetables, yoghurt and healthier types of fast food e.g. cheese and tomato pizza, oven baked chips and chicken pieces. Menus on Days One to Three were repeated on Days Four to Six of the camp. As with snack-time, extra food items were available on request and there was a thirty minute time limit. All leftovers were individually weighed (g).

Gram amounts were converted to kJ using FoodWorks nutrient analysis software (Version 8, Xyris Pty Ltd, Australia). Each child’s mean snack and lunch intakes for the three days of food advertising exposure and three days of non-food advertising exposure were calculated.

5.4.2.3 Children’s hunger

Children reported how hungry they felt before snack-time and lunch each day using a validated 5-point picture-rating scale; with the anchors ‘I am really hungry’ (1) and ‘I am not
hungry at all’ (5) (Bennett and Blissett 2014) (Appendix KK). Mean hunger scores were calculated for snack and lunch for the two advertising conditions.

5.4.2.4 Children’s weight and height

Children’s weight and height were measured on Day One of the camp. Children’s body mass index (BMI; weight/height²) and BMI z-scores (World Health Organization 2007) were calculated. The BMI for age was used to classify weight status into underweight, normal weight, overweight or obesity categories using international standardised cut-points (Cole and Lobstein 2012).

5.4.3 Daily procedure

At mid-morning on each day of the holiday camp, children were shown to either the single media or multiple media intervention room, according to randomisation. Each day children in both rooms watched the same cartoon with the same TV advertisements embedded. The children in the multiple media condition then played an Internet advergame for five minutes. Snack-time immediately followed children’s advertising exposure. Lunch was served in the main camp dining room at 1pm, after which children went home for the day. Camp leaders ensured that the duration and intensity of children’s camp activities, which were conducted between meal periods, were similar each day.

5.4.4 Parental feeding practices

Parental feeding practices were self-reported online by parents at baseline using the Child Feeding Questionnaire (CFQ) (Birch et al. 2001) (Appendix LL). The controlling feeding practices ‘restriction’ and ‘pressure to eat’ are two of the most commonly researched subscales of the CFQ and were the two that were used in this analysis. There are eight questions relating to the restriction subscale (e.g. ‘If I did not guide or regulate my child’s eating he/she would eat too much of their favourite foods’) and four questions relating to the pressure to eat subscale (e.g. ‘My child should always eat all of the food on his/her plate’). Item response options were rated as 1 = disagree, 2=slightly disagree, 3 = neither disagree
nor agree, 4 = slightly agree, and 5 = agree. The internal consistency of items within these subscales has been confirmed in earlier research (pressure to eat: $\alpha = 0.70$; restriction: $\alpha = 0.73$ (Cronbach’s alphas)) (Birch et al. 2001). Mean scores for each subscale were calculated. Subsequently, the subscale mean feeding scores were dichotomised into ‘no’ for scores of 3 or lower for each child and ‘yes’ for greater than 3, with ‘yes’ indicating that parents exerted a higher level of parental control on their children’s eating behaviours, either by restricting or pressuring food intake. A similar approach to dichotomising responses to the CFQ has been used in earlier studies (Park et al. 2015).

### 5.4.5 Outcome variables

The main outcomes were children’s mean snack intake (kJ) after food advertising exposure (3 days) and non-food advertising exposure (3 days), their mean lunch intake (kJ) on food advertising and non-food advertising days, and combined mean snack and lunch intakes (kJ) on food advertising and non-food advertising days.

### 5.5 Statistical analysis

Data were analysed separately by media condition. Linear mixed models with repeated measures were used to examine relationships between children’s consumption responses (kJ) at the different eating occasions and dichotomised feeding practice scores. The three different primary outcomes were kJ consumed at the snack, lunch, and snack and lunch combined repeated across the two advertising conditions. The fixed-factor effects used in all models were advertising condition (food or non-food advertising) and feeding practice scores. The interaction between advertising condition and feeding practice scores was tested for significance in all models. Camp identifier was included as a random intercept in the models in order to adjust for the clustered nature of the data. Any influence of the impact of age, sex, weight status (BMI z-score), or hunger on snack and lunch intake were investigated by adding these variables as covariates to the models.
Descriptive statistics are reported as means (± SDs) for continuous variables or as percentages for categorical variables. Results from the linear mixed models analyses are presented as means (95% CIs) unless otherwise indicated. Reported p-values are two-sided, and p<0.05 was considered significant in all tests. Analyses were completed using SPSS Statistics version 23.0 for Windows (SPSS Inc., Chicago, IL, USA).

5.6 Results

Six children did not complete all six days of the camp, leaving 154 children in the final analysis (78 female, 76 male, 9.3 ± 1.6 years (mean ± SD)). Participant characteristics and parental feeding practice scores are shown in Table 5.1. There were no significant differences between the descriptive statistics for the two media condition groups.

Table 5.1: Descriptive statistics for participant characteristics and parental feeding practices by media condition group

<table>
<thead>
<tr>
<th></th>
<th>Single media (n=76)</th>
<th>Multiple media (n=78)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex, n (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Girls</td>
<td>40 (51.3)</td>
<td>38 (48.7)</td>
</tr>
<tr>
<td>Boys</td>
<td>37 (48.7)</td>
<td>39 (51.3)</td>
</tr>
<tr>
<td>Mean age (years)</td>
<td>9.5 ± 1.5</td>
<td>9.1 ± 1.75</td>
</tr>
<tr>
<td>Mean WHO BMI z-score</td>
<td>0.27 ± 1.2</td>
<td>0.29 ± 1.1</td>
</tr>
<tr>
<td>BMI for age, n (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Underweight</td>
<td>4 (5)</td>
<td>1 (1)</td>
</tr>
<tr>
<td>Normal weight</td>
<td>61 (80)</td>
<td>63 (81)</td>
</tr>
<tr>
<td>Overweight</td>
<td>10 (13)</td>
<td>9 (12)</td>
</tr>
<tr>
<td>Obesity</td>
<td>1(1)</td>
<td>5 (6)</td>
</tr>
<tr>
<td>Mean Restriction subscale score</td>
<td>3.1 ± 1.1</td>
<td>3.3 ± 1.0</td>
</tr>
<tr>
<td>Restrictive parents (dichotomised), n (%)</td>
<td>36 (47)</td>
<td>45 (58)</td>
</tr>
<tr>
<td>Mean Pressure to eat subscale score</td>
<td>2.4 ± 1.0</td>
<td>2.6 ± 1.0</td>
</tr>
<tr>
<td>Pressure to eat parents (dichotomised), n (%)</td>
<td>19 (25)</td>
<td>20 (26)</td>
</tr>
</tbody>
</table>

As previously reported, the increase in snack intake after food advertising (compared with non-food advertising) was significantly greater in the multiple media condition than the single media condition (p<0.01) (Norman et al. 2018a) hence data were analysed separately by media condition. Age and sex had no significant main effect or interaction on food consumption and were removed from further analyses. In the single media condition BMI z-
score was positively related to the difference in mean lunch food intake (p<0.05) and mean snack plus lunch intake (p<0.01) between food advertising and non-food advertising days. There were no associations between parental feeding practice scores, either restriction or pressure to eat, and BMI z-score, nor were restriction and pressure to eat scores related.

In the single media condition all children ate similar amounts at the snack after food advertising and non-food advertising, with no differential effect among different feeding practice sub-groups (Table 5.2).

Table 5.2: The effects of advertisement condition on the kJ intake in all children and by feeding practices across media conditions (means (95% CIs))

<table>
<thead>
<tr>
<th></th>
<th>Difference in mean kJ intake between food and non-food advertisements SNACK</th>
<th>Difference in mean kJ intake between food and non-food advertisements LUNCH</th>
<th>Daily additional kJ consumed at the holiday camp after food advertising</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Single media</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All children (n=76)</td>
<td>19 (-85–125)</td>
<td>89 (-5–183)</td>
<td>108 (-30–246)</td>
</tr>
<tr>
<td>No restriction (n=40)</td>
<td>-7 (-161–147)</td>
<td>-47(-161–67)</td>
<td>-54 (-215–108)</td>
</tr>
<tr>
<td>Restriction (n=36)</td>
<td>48 (-101–197)</td>
<td>240** (96–384)</td>
<td>288* (65–511)</td>
</tr>
<tr>
<td>No pressure to eat (n=57)</td>
<td>50 (-70–169)</td>
<td>66 (-35–166)</td>
<td>115 (-36–266)</td>
</tr>
<tr>
<td>Pressure to eat (n=19)</td>
<td>-71 (-309–166)</td>
<td>159 (-85–403)</td>
<td>88 (-431–256)</td>
</tr>
<tr>
<td><strong>Multiple media</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All children (n=78)</td>
<td>201**** (113–288)</td>
<td>-6 (-91–79)</td>
<td>194*** (80–308)</td>
</tr>
<tr>
<td>No restriction (n=33)</td>
<td>257*** (114–399)</td>
<td>56 (-79–191)</td>
<td>313*** (145–480)</td>
</tr>
<tr>
<td>Restriction (n =45)</td>
<td>160** (46–274)</td>
<td>-52 (-163–59)</td>
<td>108 (-263–48)</td>
</tr>
<tr>
<td>No pressure to eat (n=58)</td>
<td>147** (44–251)</td>
<td>-4(-101–93)</td>
<td>143* (7–280)</td>
</tr>
<tr>
<td>Pressure to eat (n =20)</td>
<td>356**** (197–515)</td>
<td>-14(-205–177)</td>
<td>342** (135–548)</td>
</tr>
</tbody>
</table>

*p<0.05, **p<0.01, ***p<0.001, ****p<0.0001
Significant differences between b and a (p=0.002); d and c (p=0.013); f and e (p=0.038)

Results published in (Norman et al. 2018a)

However there was a positive significant association between restrictive parental feeding practices and increased lunch intake (p<0.01) and snack plus lunch intake (p<0.05) on the food advertising days compared with non-food advertising days. Children whose parents
were restrictors ate 240 kJ more at lunch on food advertising days versus non-food
advertising days (p<0.01), remaining significant after controlling for hunger and BMI z-
score (p<0.01). The children whose parents were non-restrictors did not consume any
additional kJ at lunch in response to the food advertising, with a difference observed between
the two groups (restrictors vs. non-restrictors) of 287 kJ (p<0.01). Children with restrictive
parents in this media condition ate an additional 288 kJ overall (snack plus lunch) (p<0.05)
on food advertising days compared with non-food advertising days. This was an additional
334 kJ more than the children with non-restrictive parents, who did not consume any
additional kJ overall in response to the food advertising (p<0.05). Pressure to eat did not
have a differential effect on children’s lunch consumption in the single media condition.

As previously reported, all children in the multiple media condition ate more at the snack
after food advertising than after non-food advertising (201 kJ, p<0.0001) (Norman et al.
2018a). This was not compensated for at lunch which led to an additional daily food intake
of 194 kJ (p<0.001) (snack plus lunch) on food advertising days for children within this
media condition. There was an increased effect seen among children whose parents reported
high pressure to eat feeding practices. These children ate an additional 356 kJ (p<0.0001) at
the snack after food advertising exposure compared with non-food advertising exposure,
remaining significant after controlling for hunger and BMI z-score (p<0.0001); an extra 209
kJ (p<0.05) more than children whose parents did not pressure them to eat. This led to a total
additional daily food intake of 342 kJ (p<0.01) on food advertising days among children
whose parents pressured them to eat. Children in both the restrictive and non-restrictive
groups ate more at a snack after food advertising compared with non-food advertising, with
no significant difference in snack intake between these two groups. Children consumed
similar amounts at lunch on food and non-food advertising days in the multiple media
condition, with no differential effect among the feeding practice sub-groups.
5.7 Discussion

This study identifies that children who experience parental feeding practices that impede their self-regulation of eating have an increased vulnerability to the effects of unhealthy food advertising; with these children consuming more in response to food advertising exposure over a sustained period, compared with non-food advertising. In the multiple media condition, parental pressure to eat did heighten the effect of advertising, however all children had increased snack intakes after food advertising exposure, compared with non-food advertising, which was not compensated for at a later meal. This suggests that marketing effects override children’s learned self-regulatory responses to eating, especially when this is sustained and repeated across multiple media platforms. It also highlights that none of the parental feeding practices children experienced, whether controlling or non-controlling, were sufficient to negate the impact of food advertising on their eating behaviours. As this multiple media advertising condition is closer to children’s real world exposures (Boyland and Whalen 2015), this is a particularly important finding. The differential susceptibility was most pronounced in the single media group and resulted in children who experienced restrictive parental feeding practices eating more at a lunchtime meal following food advertising exposure.

Previous studies have identified other groups of children who also have increased vulnerability to the effects of food advertising, including those with heavier weight status (Halford et al. 2008, Norman et al. 2018a) and those whose mothers exhibit encouragement to be thin (Anschutz et al. 2010). BMI z-score was not associated with parents’ restriction or pressure to eat in our study, and so was not a confounder in the relationship between controlling feeding practices and children’s responses to marketing. We have separately found weight status to influence the magnitude of children’s responses to food advertising (Norman et al. 2018a). This study finds a separate group of vulnerable children whose responses to marketing occur independently of weight status.
Psychosocial processing models propose that unhealthy food advertising prompts cravings for food and induces subsequent food intake via previously conditioned responses, with the level of processing of the embedded food cues influencing the magnitude of the effect of the food advertising (Nairn and Fine 2008, Buijzen et al. 2010, Folkvord et al. 2016). This may explain the different intake responses at the snack after advertising exposure across the two media conditions and why all children were affected by the food advertising in the multiple media condition. The integrated nature of the food advertising within the advergame may have had a greater effect on children’s food intake as the promotional content involved low levels of elaborative processing, initiating physiological responses which motivated food consumption without children being aware that they were being cued to eat (Buijzen et al. 2010, Folkvord et al. 2016). Of course, children in the multiple media condition also received double the dose of advertising exposure compared with the single media condition, so it may be that volume of exposure, as well as the different media platforms, is also important in influencing the magnitude of responses. Empirical data on sustained exposures to food advertising are scarce, however, an early study found that repetitive exposures to an ice cream TV advertisement embedded within a cartoon did not increase children’s subsequent food consumption compared with single exposure (Gorn and Goldberg 1980). The authors report that this could have been a factor of study design, with children appearing irritated by the repetitive nature of the advertisement and that this may have directly affected children’s eating behaviours. More recent research suggests that when online and offline media marketing communications are used in tandem, their interaction can enhance consumer behavioural responses through synergistic cross-effects (Batra and Keller 2016). Indeed, an aim of integrated multimedia campaigns is to increase consumer effects in such a way that the coordinated effect is greater than if the individual marketing platforms were experienced independently of each other (Keller 2016). The lack of an ‘advergame-only’ single media condition means that we were unable to confirm this effect.
Identifying increased vulnerability to food advertising among children who experience controlling parental feeding practices is a novel finding. Not only does it highlight a group of children with differential susceptibility to the negative effects of food advertising but it emphasises the importance of promoting feeding practices that help support a child’s self-regulatory development in regards to their eating. It has been suggested that responsive, structure-based feeding practices, where parents offer guidance, provide routines, set boundaries and take into account the child’s perspective, can be helpful in promoting self-regulation (Rollins et al. 2015, Frankel et al. 2017). It is questionable, however, given the immersive nature of the promotional messages within contemporary food advertising, and in light of our findings for multiple media exposures particularly, whether the results of any parenting practices could be effective in protecting children from advertising’s negative influences.

The sustained energy imbalances observed in this study after food advertising exposure are of a magnitude that could contribute to the development of overweight (Plachta-Danielzik et al. 2008, van den Berg et al. 2011). Our findings clearly highlight the requirement for more stringent regulatory policy to restrict children’s exposure to unhealthy food marketing across offline and, particularly, online media. Despite restriction of food marketing to children being identified at the highest levels of international policy-making (World Health Organization 2010, United Nations General Assembly 2011), few territories have enforced statutory restrictions, with most countries relying on industry-led codes for responsible marketing (Galbraith-Emami and Lobstein 2013). Evidence indicates that industry self-regulation has not been effective in protecting children from food advertising exposures (Galbraith-Emami and Lobstein 2013), with children continuing to be exposed to high levels of food marketing across a wide range of media platforms (Boyland and Whalen 2015, Vandevijvere et al. 2017).

There were different responses to food advertising on snack and then on meal consumption across the single and multiple media groups. While the multiple media group ate more snack
food in the food advertising condition, the single media group ate more at the next meal and not at the snack. In these children it is possible that the activation of prior advertising-based memory structures could have been triggered in the presence of palatable lunch foods, prompting a greater intake of foods (Büttner et al. 2014). Both restrictive and pressure to eat feeding practices were associated with greater intakes at the lunchtime meal for children in the single media condition, however this was only significant for children who experienced restrictive practices. Posteriori calculations estimate that a sample of 80 children in the pressure to eat sub-group would be needed to detect this effect on lunch consumption.

As previously reported, a study limitation may have been the time-limited, undisclosed snack eating period of 15 minutes, which may have accounted for the lack of effect on children’s snack intake in the single media condition (Norman et al. 2018a). Previous studies, where significant consumption responses after TV food advertising exposure were observed had unlimited snack eating times (Halford et al. 2004, Halford et al. 2008). As children within the single media condition ate similar amounts at the snack after both food and non-food advertising (Norman et al. 2018a), it is unsurprising that no interactions with advertising condition or feeding practices were found here.

A possible limitation in using the CFQ was the reliance on parental report that may have been subject to social desirability bias. A former study which utilised a child version of the CFQ, in addition to the parents’ version of the CFQ, found a lack of agreement between parental and child reports and perceptions of restrictive eating habits (Carper et al. 2000); though this may have simply related to subjective differences between the two groups.

In conclusion, this study indicates that children who experience controlling parental feeding practices may be less able to self-regulate their food intake after exposure to food advertising than children who experience less controlling feeding practices. However our findings show that all children within the multiple media condition, no matter their parents’ feeding practices, ate more at a snack after food advertising, which was not compensated for at the
next meal. The ubiquitous nature of contemporary food marketing means that children are frequently faced with unhealthy food cues in their daily lives. While structure-related parental feeding practices hold promise in supporting a child’s self-regulatory development (Frankel et al. 2017), if children respond to real world marketing stimuli the same way they did to the food advertising in our study, then their responses could, indeed, lead to weight gain. These data clearly suggest that policy interventions that focus singularly on improving the at-home feeding environment will be ineffective in the absence of broader regulatory controls on food marketing. A more practicable solution is for policy makers to enforce stronger regulations on children’s food advertising exposure, across all media platforms, particularly online media.

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The Australian Research Council played no part in the study design, collection, analysis and interpretation of data; or the writing of the report; or the decision to submit the paper for publication. The corresponding author has full access to all the data in the study and had final responsibility for the decision to submit for publication. Two researchers from Cancer Council NSW (KC and CH) were study collaborators.

5.9 Competing interests

All authors have completed the ICMJE uniform disclosure form at http://www.icmje.org/conflicts-of-interest/ (available on request from the corresponding author). JN, BK, EB, LB, AB, KC, LK and CH all declare that they have no conflicts of interest.
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CHAPTER SIX

REMEMBER ME? AN ANALYSIS OF THE ROLE OF MARKETING TECHNIQUES IN DRIVING CHILDREN’S BRAND RECOGNITION, ATTITUDES AND DESIRE TO EAT FOODS AFTER ADVERTISING EXPOSURE: A RANDOMISED CROSSOVER TRIAL

6.1 Preface

Chapters Four and Five reported on children’s food intake data that was measured during their participation in the randomised crossover trial conducted at the University of Wollongong, NSW, Australia. During this study, 160 children were randomised to either a multiple media or a single media condition and exposed to three days of food and three days of non-food advertising in an online game and/or a TV cartoon. The findings showed that children in the multiple media condition left camp on the food advertising days with a positive energy imbalance of 194 kJ; an amount that could cumulatively lead to the development of overweight. An increased effect of advertising was observed among children in the multiple media condition. Furthermore children with overweight and obesity and children whose parents reported controlling feeding practices had an increased susceptibility in both media conditions.

In order to isolate the effects of the study advertising exposure the branded products selected for the experimental condition were real products available in other countries but not available for sale in Australian supermarkets or advertised on commercial TV within Australia. Using unfamiliar brands may have dampened the effect of advertising on children’s consumption responses. However, utilising novel brands provided the opportunity to investigate how children responded to the creative content within the advertisements with the knowledge that children did not have pre-formed brand attitudes or associations. The content of this chapter addresses the final group of research questions, outlined in Chapter One, to investigate how persuasive techniques within unfamiliar TV food advertisements and
online advergames affect children’s recall and attitudes towards brands. This chapter is a manuscript that was submitted to a peer-reviewed journal (Journal of the Academy of Nutrition and Dietetics) during the course of this degree and is currently under review (as at 31 August 2018).


Authors’ contributions: B. Kelly is the Chief Investigator of the study and led the writing of the initial study protocol and successful funding application. All authors contributed to the conception and design of the study. B. Kelly and A-T McMahon supervised J. Norman. J. Norman primarily implemented the study protocol, including recruitment. J. Norman led the statistical analysis, supervised by B. Kelly. J. Norman had primary responsibility for the final content of the manuscript. All authors contributed to critical revision of this manuscript and approved the final version.
6.2 Research snapshot

6.2.1 Research question

How do persuasive techniques within unfamiliar TV and online food advertisements affect children’s recall and attitudes towards brands?

6.2.2 Key findings

In this randomised crossover study, there was a significant increase in children’s recognition of all brands following exposure (p<0.0001). All brands were rated positively, with the majority of brands appealing to children of all ages and children wanting to eat the advertised products. Common appeals included fantasy, happiness and palatability. Humour, anti-adult themes, parent-pleasing and parental-themes were persuasive techniques used in the most recognised and highly rated advertisements.

6.3 Abstract

Background: A range of techniques are used in unhealthy food marketing and contribute to the impact of food advertising on children. Yet current regulatory arrangements do not sufficiently address the use of marketing techniques.

Objective: To investigate children’s recall and attitudinal responses to unfamiliar food brands following exposure to marketing techniques in TV and online advertisements, and to describe the techniques used.

Design: A within-subject, randomised, crossover, experimental trial

Setting: Four, six-day holiday camps in New South Wales, Australia

Participants: Children, 7-12 years.

Intervention: Children played an online food ‘advergame’ (branded game) and/or viewed 10 TV food advertisements in a cartoon on three occasions. Children completed a brand recognition and attitude survey pre-and post-intervention.
Main outcome measures: Children’s recognition and attitudes towards advertised brands and brand consumers; their desire to eat the product; description of marketing techniques.

Statistical analysis: Pre- and post-brand recognition were compared using McNemar tests. Chi-square tests and Spearman correlations were used to examine associations between brand recognition, attitudes and desire to eat product by child age group and media condition.

Results: 154 children completed the study. There was a significant increase in the recognition of all brands post-exposure (p<0.0001). All brands were rated positively. The majority of brands appealed to children of all ages, with children wanting to eat the advertised products. Brand consumers were rated as more cool by children who played the advergame compared with those who viewed the TV advertisements only ($X^2_1 = 4.172$, p=0.041). Anti-adult themes, fun/humour and parent-pleasing were techniques unique to the most recognised and highly rated advertisements.

Conclusion: Persuasive techniques delivered a marketer’s objective of building brand-equity by stimulating children’s brand recognition and positive affect. Yet these techniques are not excluded under current regulatory schemes. These findings highlight the need for stricter regulation on the extent and power of food marketing to children.
6.4 Introduction

The food marketing that children are exposed to is dominated by energy-dense, nutrient-poor food products, and promotional messages reach children via a wide range of sources, including TV and, increasingly, the Internet and social media (Boyland and Whalen 2015). This pervasive marketing creates societal norms for children about which foods are acceptable and desirable to eat (Harris et al. 2009b). These normative influences have a strong impact on children’s food preferences and choices, further strengthened by children’s desire for conformity with their peers (Valkenburg and Cantor 2001, Roberts and Pettigrew 2013).

A key recommendation from the World Health Organization’s report on Ending Childhood Obesity is not only to restrict the amount of unhealthy food advertising that children are exposed to but also to reduce the power of marketing communications (World Health Organization 2016a). Persuasive power of marketing refers to the creative content, design and execution of advertisements (World Health Organization 2012). Globally, however, there are limited statutory regulations restricting the extent of food marketing to children and neither government nor industry-led regulatory codes sufficiently cover the use of persuasive marketing techniques that appeal to children (Boyland et al. 2012, World Cancer Research Fund International 2018). This lack of regulation results in children continuing to be exposed to a high frequency of persuasive advertising for unhealthful foods on TV and online (Harris et al. 2017, Obesity Policy Coalition 2018).

As branding is a powerful influencer of product choice, especially for children and youth, most child-oriented food marketing campaigns take a brand-building approach (Connor 2006, Kelly et al. 2015b). Fundamentally the role of branding is to establish positive associations and attributes to a product that will differentiate it from other similar products (Keller 2013). This is referred to as brand equity; that is, the added value attached to a product as a result of being coupled with the brand (Keller 2013). As brand preference precedes purchase requests and consequent consumption, marketing aims to build children’s
awareness of food brands and products and their desire for them, thus building brand equity (Schwartz et al. 2013, Kelly et al. 2015b).

Social cognitive theories propose that repeatedly pairing food brands with highly appealing stimuli will transfer positive attitudes towards the brand (Harris et al. 2009b). Furthermore, this positive affect transfer can occur without conscious perception or processing of the marketing stimuli (Goode 2007). Contemporary food advertisements are designed with implicit psychological processing in mind, utilising an array of persuasive appeals and affect-based content to promote both brand and product (Hebden et al. 2011, Harris and Graff 2012, Jenkin et al. 2014). Research in adults has shown that it is not rational message content within advertising that drives strong brand equity, but rather these emotional and creative appeals (Heath et al. 2006).

Developmental theories indicate that at around eight years of age children recognise the selling intent of advertising but are only just beginning to become aware of its persuasive intent (Carter et al. 2011). Children’s understanding that advertisers are trying to persuade them to want brands and products by using appealing marketing techniques emerges later in childhood, between the ages of 11 and 12 years (Carter et al. 2011). Traditional thinking has been that this advertising literacy provides children with the cognitive defences to make them less vulnerable to advertising effects (Rossiter and Robertson 1974). However, children of all ages are susceptible, as research shows they are more likely to process food advertisements implicitly, without conscious awareness, and therefore, are less likely to use their advertising literacy as a critical defence (Buijzen et al. 2010, Rozendaal et al. 2011b).

Positive attitudes developed towards unhealthy food products as a result of advertising exposure in childhood have been demonstrated to persist into adulthood (Connell et al. 2014), with early brand exposure lasting the longest (Ellis et al. 2010). This is a major concern given recent research, where children who wore wearable cameras were exposed to almost 30 unhealthy food brands each day (Signal et al. 2017), a figure that is likely
underestimated given that screen content, including TV, smart phones, tablets and computers, was not typically captured.

The range of persuasive techniques used in food marketing to appeal to children is well documented (Jenkin et al. 2014). They include catchy music, mouth-watering food images and happy, fun-loving characters; and there is good evidence to show that the use of these techniques promotes brand awareness and loyalty in children (Jenkin et al. 2014). Brand awareness is the first step in a hierarchy of advertising effects that likely prompts a cascade of behaviours ultimately leading to the consumption of these foods (Kelly et al. 2015b). Use of promotional characters, such as celebrities and brand mascots, is a well-recognised advertising technique known to appeal to children (Kraak and Story 2015, Smits et al. 2015). However, the appeal of other persuasive elements in contemporary advertising are yet to be elucidated (e.g. humour, parental-themes or action) (De Jans et al. 2017). Understanding which specific (and combinations of) persuasive appeals most affect children would provide additional evidence to inform effective policy to reduce the power of these marketing communications.

Clearly for advertising exposure to have a consequential effect, the audience needs to know which brand is being advertised and for that brand name to register in the viewer’s memory, whether implicitly or explicitly (Romaniuk 2009). The primary mechanism for communicating the brand is direct branding execution, which is how the brand name is presented through the course of an advertisement (Romaniuk 2009, Hartnett et al. 2016). This execution includes the visual frequency (the number of times the brand is visually represented), the verbal frequency (the number of times the brand name is verbalised) and early branding (how soon the brand appears in the advertisement; either visually or verbally) (Romaniuk 2009). To our knowledge, the relationship between specific direct food branding execution tactics and children’s brand recall and recognition has not previously been examined.
This paper reports on data collected from a randomised controlled trial (RCT) which, primarily, investigated whether exposure to three days of food advertising from a single media (TV-only) or a multiple media (TV and online game) source increased children’s immediate food consumption at a snack directly after exposure, compared with three days of non-food advertising, and whether any immediate increased energy intake was compensated for at a later lunchtime meal (Norman et al. 2018a). The aim of the present study was to investigate how the different food advertisements influenced children’s free-recall and recognition of brands and their perceptions and attitudes towards the advertised brands. We then explored which persuasive techniques and direct branding execution tactics within the advertisements most appealed to children and captured their attention. In order to isolate the effects of the study advertising, we used overseas brands that were unfamiliar to children. In addition, we investigated whether particular advertisements influenced children differently according to their developmental stage, as determined by age (Carter et al. 2011).

6.5 Methods

6.5.1 Study design and participants

The within-subject, crossover, counter-balanced RCT was conducted across four, six-day school holiday camps from April 2016 to January 2017 in New South Wales, Australia. Children attended the morning sessions of the holiday camp every day from 8am to 1.30pm. The full study protocol, main results and other findings have been published elsewhere (Norman et al. 2018a). One-hundred and sixty children (78 female, 82 male), aged 7–12 years were recruited through local schools, social media and university and community networks. Forty children attended each holiday camp. Within each holiday camp, children were allocated to one of two groups of 20, with an even spread of sex and age, and randomised to either the single media (TV-only) or multiple media (TV and advergame) condition. Within each media condition was an experimental condition (three days of unhealthy food advertising exposure) and a control condition (three days of non-food advertising exposure).
advertising exposure). Within each camp, children took part in both the experimental and control conditions, with the order of advertising condition counter-balanced across holiday camps.

Informed written parental consent was obtained for all study participants. The study was registered with the Australian New Zealand Clinical Trials Registry (ACTRN12617001230347) and approved by the University of Wollongong Human Research Ethics Committee.

6.5.2 Materials and measures

6.5.2.1 Media and advertising

Six, 10 minute, age-appropriate cartoons were selected, with a different cartoon shown each day of the camp. Ten food advertisements were embedded into three cartoons, and 10 non-food advertisements were embedded into the other three cartoons. Each advertisement was approximately 30 seconds in length. The 10 TV advertisements were the same each day of the camp for both media conditions, changing only according to experimental or control condition; however, the order that the advertisements were shown within the cartoon varied each day. Cartoons did not contain any pictures or references to food. Online ‘advergames’ were chosen featuring either a food brand or a non-food brand and rated as suitable to be played by all age groups. An advergame is an online branded game, commonly found on food industry websites (Culp et al. 2010). The selected advergames featured the advertised brand or product as active game pieces, present throughout the duration of the game (five minutes of game play daily). Three different food advergames were used, all representing the same brand. The TV advertisements were sourced from overseas and had never been aired on Australian commercial TV stations and the advergames were only available for download through international app stores. The advertised food products were classified as ‘unhealthy’ as per nutrient profiling scoring criteria developed for health claims regulation in Australia (Food Standards Australia New Zealand 2015). All advertisements would be permitted for
broadcast during children’s peak viewing times under current regulatory standards in Australia, which does not preclude the types of foods that can be promoted (Australian Association of National Advertisers 2009, Australian Communications and Media Authority 2009 , Australian Food and Grocery Council 2014b, Australian Food and Grocery Council 2014a). The advertised food types and nutrient profiles are listed in Table 6.1.

Table 6.1: Product description and nutrient profile of food products advertised in advergames and TV advertisements

<table>
<thead>
<tr>
<th>Brand</th>
<th>Food category</th>
<th>Advertised product</th>
<th>Advertisement country of origin</th>
<th>kcal+</th>
<th>Saturated Fat (g)</th>
<th>Sugars (g)</th>
<th>Sodium (mg)</th>
<th>NPSC# met</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Advergames</td>
<td>Breakfast cereal</td>
<td>Malaysia</td>
<td>371</td>
<td>3.2</td>
<td>30</td>
<td>160</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Advergames</td>
<td>Chocolate flavoured cereal</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>TV</td>
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</tr>
<tr>
<td></td>
<td>TV</td>
<td>Chocolate flavoured cereal</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>Confectionery</td>
<td>Chocolate spread</td>
<td>USA</td>
<td>514</td>
<td>4.1</td>
<td>51.4</td>
<td>135</td>
<td>No</td>
</tr>
<tr>
<td>C</td>
<td>Confectionery</td>
<td>Animal shaped jelly sweets</td>
<td>UK</td>
<td>336</td>
<td>0.1</td>
<td>74</td>
<td>20</td>
<td>No</td>
</tr>
<tr>
<td>D</td>
<td>Fast food</td>
<td>Burger, fries, soft drink meal deal</td>
<td>USA</td>
<td>271</td>
<td>5.9</td>
<td>5.9</td>
<td>602</td>
<td>No</td>
</tr>
<tr>
<td>E</td>
<td>Fast food</td>
<td>Mexican fast food smart phone app</td>
<td>USA</td>
<td>287</td>
<td>5.7</td>
<td>2.3</td>
<td>499</td>
<td>No</td>
</tr>
<tr>
<td>F</td>
<td>Savoury snack</td>
<td>Salted potato ring snacks</td>
<td>UK</td>
<td>507</td>
<td>2.5</td>
<td>0.4</td>
<td>700</td>
<td>No</td>
</tr>
<tr>
<td>G</td>
<td>Savoury snack</td>
<td>Ridge-cut potato crisps</td>
<td>UK</td>
<td>525</td>
<td>2.8</td>
<td>2.3</td>
<td>1500</td>
<td>No</td>
</tr>
<tr>
<td>H</td>
<td>Savoury snack</td>
<td>Assorted potato/corn savoury snacks</td>
<td>UK</td>
<td>497</td>
<td>2.5</td>
<td>4.3</td>
<td>1670</td>
<td>No</td>
</tr>
<tr>
<td>I</td>
<td>Sweet snack</td>
<td>Chocolate-filled ‘smiley-face’ biscuits</td>
<td>UK</td>
<td>467</td>
<td>9.5</td>
<td>32.1</td>
<td>490</td>
<td>No</td>
</tr>
<tr>
<td>J</td>
<td>Sweet snack</td>
<td>Chocolate-coated biscuits</td>
<td>UK</td>
<td>479</td>
<td>10.6</td>
<td>46.6</td>
<td>370</td>
<td>No</td>
</tr>
</tbody>
</table>

+ kilocalories; # Nutrient Profiling Scoring Criterion (NPSC) for health claims regulation (Food Standards Australia New Zealand 2015)

6.5.2.2 Free brand recall, brand recognition and attitude

Children completed an online, purpose-designed questionnaire and brand recognition tool at home both pre- and one week post-study (Appendix JJ). This tool was based on a validated
food brand recognition instrument for children of this age group (Turner et al. 2015) and based on questions used in previous research on children’s food brand attitudes (Kelly et al. 2016). A pilot study conducted with 30 children in January 2016, confirmed that the pictorial format and simple language used in the questionnaire could be comprehended by children as young as seven years. Parents were told they could sit with their child if their child needed some guidance, but to not answer for their child as we were only interested in hearing the child’s responses.

The first section of the questionnaire assessed children’s free-recall of brands for different product categories. Children were asked to name three brands of breakfast cereal, confectionery and snack food, in addition to some non-food brands (e.g. running shoes), without any prompts.

The second section asked children: i) if they recognised 20 different photographs of both food logos (the advertised brands) and non-food logos, and ii) to describe the product to which the brand logo related. If they did correctly identify the advertised food logos, they were then asked to rate: i) their perceptions of the brand on five-point semantic differential scales of ‘very cool’ to ‘very uncool’, ‘very exciting’ to ‘very unexciting’ and ‘very fun’ to ‘very boring’; ii) their perceptions of consumers of the food brands, using five-point semantic differential scales of ‘very popular’ to ‘very unpopular’, ‘very sporty’ to ‘very unsporty’ and ‘very cool’ to ‘very uncool’; and iii) to indicate whether they would like to eat this product sometime soon (yes or no). Children’s sex and date of birth were reported by parents at the time of recruitment. Children’s weight and height were measured on Day One of the study. Children’s body mass index (BMI) was calculated and these values were used to classify children into underweight, normal weight, overweight or obesity categories using international standardised cut-points (Cole and Lobstein 2012).
6.5.2.3 Marketing techniques and direct brand execution tactics used in advertisements

Hebden et al.’s taxonomy was used to code the marketing techniques and themes in the individual TV food advertisements and advergames (Hebden et al. 2011). In addition to this, direct brand execution measures for each TV advertisement were recorded (i.e. visual and verbal frequency of brand appearances and timing of first visual and verbal occurrence). Brands were de-identified for the results section and the food categories only were described.

6.6 Statistical analyses

A child who correctly identified a study food brand logo at baseline was excluded from that individual brand analysis. This was to isolate the effect of the food advertising in the study on children’s free brand recall, brand recognition, perceptions and attitudes. Children’s correct recognition of the different food brands pre- and post-intervention was analysed by performing a series of non-parametric McNemar tests. The proportions of children who correctly identified each food brand logo; with favourable brand perception ratings (cool, exciting, fun); with favourable brand consumer perception ratings (popular, sporty or cool); and desire to eat the product soon by child age group (under 8 years vs. 8–11 years vs. over 11 years), and by media condition for Brand A (the featured brand in the advergames and a TV advertisement), were compared using chi-square tests. In addition, associations between children’s perceptions of brands and consumers and reported desire to eat that product were examined with chi-square tests. Findings were considered significant at the α=0·05 level, with Bonferroni adjustments for multiple comparisons. Mean ratings of children’s perceptions of food brands and perceptions of people who would eat that brand were calculated for each brand. Spearman correlation coefficient tests were employed to assess associations between mean rating scores and children’s desire to eat the product. Analyses were completed using SPSS Statistics version 23.0 for Windows (SPSS Inc., Chicago, IL, USA).
Marketing techniques and direct brand execution tactics used in all the advertisements were described and examined in detail.

6.7 Results

6.7.1 Sample characteristics

Complete data were collected for 154 children (50% girls) with a mean age of 9.3 (SD 1.6) years (Table 6.2). Six children did not complete all days of the study so their data were not included in the final analysis. A spread of developmental age groups was achieved (27% under 8 years, 53% 8–11 years, 20% over 11 years). A comparable number of children were in each media condition group (TV-only: n=76; TV and advergame: n=78) with similar child age, sex and weight status distributions between these two groups.

Table 6.2: Descriptive statistics for participant characteristics by media condition group

<table>
<thead>
<tr>
<th></th>
<th>All (n=154)</th>
<th>TV-only (n=76)</th>
<th>TV and game (n=78)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex, n (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boys</td>
<td>77 (50.0)</td>
<td>37 (48.7)</td>
<td>40 (51.3)</td>
</tr>
<tr>
<td>Girls</td>
<td>77 (50.0)</td>
<td>39 (51.3)</td>
<td>38 (48.7)</td>
</tr>
<tr>
<td>Age (years)¹</td>
<td>9.3 ± 1.6</td>
<td>9.5 ± 1.5</td>
<td>9.1 ± 1.8</td>
</tr>
<tr>
<td>Under 8 years, n (%)</td>
<td>42 (27.3)</td>
<td>16 (21.1)</td>
<td>26 (33.3)</td>
</tr>
<tr>
<td>8 – 11 years</td>
<td>81 (52.6)</td>
<td>44 (57.9)</td>
<td>37 (47.4)</td>
</tr>
<tr>
<td>Over 11 years</td>
<td>31 (20.1)</td>
<td>16 (21.1)</td>
<td>15 (19.2)</td>
</tr>
<tr>
<td>BMI for age², n (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Underweight</td>
<td>5 (3.3)</td>
<td>4 (5.2)</td>
<td>1 (1.3)</td>
</tr>
<tr>
<td>Normal weight</td>
<td>124 (80.5)</td>
<td>61 (80.3)</td>
<td>63 (80.8)</td>
</tr>
<tr>
<td>Overweight</td>
<td>19 (12.3)</td>
<td>10 (13.2)</td>
<td>9 (11.5)</td>
</tr>
<tr>
<td>Obesity</td>
<td>6 (3.9)</td>
<td>1 (1.3)</td>
<td>5 (6.4)</td>
</tr>
</tbody>
</table>

¹Values are means ± SDs; ²(Cole and Lobstein 2012)

6.7.2 Marketing techniques and direct brand execution tactics in TV advertisements

A summary of the advertisements descriptions, persuasive marketing and brand execution techniques used in the TV advertisements and online advergames can be found in Table 6.3. Supplementary Tables 6.1 and 6.2 give the full advertisement descriptions and a catalogue of all the marketing and brand execution techniques used and can be found in Appendix RR and Appendix SS.
Table 6.3: Summary table of advertisement descriptions, persuasive techniques and direct brand execution elements by children’s recognition and attitude ratings

<table>
<thead>
<tr>
<th>Brand &amp; product</th>
<th>Summary of advertisement</th>
<th>Recognition score</th>
<th>Overall brand rating*</th>
<th>Overall consumer rating*</th>
<th>Eat soon, n (%)</th>
<th>Emotional appeals (n)</th>
<th>Food product appeals (n)</th>
<th>Dominant persuasive techniques</th>
<th>Direct brand execution: visual†</th>
<th>Direct brand execution: verbal‡</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Advergames</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A Cereal:</td>
<td>Screen features brand equity character (lion) and a boy grinning whilst game loads. The player (you) is the brand equity character. Chocolate, cereal pieces and packets are central to games. Gums have different challenges and players collect points to progress to next level.</td>
<td>1 TV and advergame group</td>
<td>2.7</td>
<td>2.8</td>
<td>25 (42)</td>
<td>3</td>
<td>0</td>
<td>Brand equity characters, fantasy, accomplishment, palatability</td>
<td>Branded product central to game play</td>
<td>Verbal fx: 0 Mention: 0</td>
</tr>
<tr>
<td>Restaurant</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B Cereal:</td>
<td>There are people dressed in lawn mowers and an objectille character stands kako eating the cereal. The man is eating the cereal whilst mother smiles at child.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Restaurant</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TV advertisements</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F Savoury snack: Potato rings</td>
<td>Female child shown controlling female adult dancer. Child’s fingers are the dancer’s legs and advertised potato rings are the dancer’s shoes. Closes in home with child eating packet of potato rings whilst mother smiles at child.</td>
<td>2</td>
<td>2.7</td>
<td>3.0</td>
<td>45 (48)</td>
<td>7</td>
<td>4</td>
<td>Fun, fantasy, anti-adult, parent-pleasing, parental-themes, palatability</td>
<td>Visual fx: 4 Appearance: late</td>
<td>Verbal fx: 0 Mention: 0</td>
</tr>
<tr>
<td>H Savoury snack: Assorted potato/corn snacks</td>
<td>UK celebrity in a hospital bed eating big bag of assorted savoury snacks, naming each one as he eats them. His 3 children enter. Dad does not share snacks. Children snap the bed shut with the bed controller, trapping the Dad inside. Children eat the snacks, looking pleased.</td>
<td>3</td>
<td>2.5</td>
<td>2.9</td>
<td>60 (64)</td>
<td>6</td>
<td>2</td>
<td>Celebrity, humor, anti-adult, parental-themes, palatability</td>
<td>Visual fx: 15 Appearance: early</td>
<td>Verbal fx: 6 Mention: early</td>
</tr>
<tr>
<td>K Sweet snack:</td>
<td>Action cartoon with a villain chasing a branded train driven by a brand equity character (a lion) and a boy. The villain steals the large container of liquid chocolate from the back of the train. The lion rescues the chocolate. Cereal pieces are then coated in chocolate. Closes with lion and boy eating cereal and smiling.</td>
<td>4 TV-only group</td>
<td>2.8</td>
<td>3.0</td>
<td>21 (50)</td>
<td>3</td>
<td>1</td>
<td>Brand equity characters, action, fantasy, palatability</td>
<td>Visual fx: 6 Appearance: early</td>
<td>Verbal fx: 4 Mention: early</td>
</tr>
<tr>
<td>L Sweet snack:</td>
<td>Each meal deal component enthusiastically introduced and described by voiceover: burger, nuggets, fries, cookies, soft drink. Value of meal deal emphasised.</td>
<td>4</td>
<td>2.7</td>
<td>3.0</td>
<td>17 (55)</td>
<td>0</td>
<td>2</td>
<td>Palatability, economical</td>
<td>Visual fx: 15 Appearance: early</td>
<td>Verbal fx: 2 Mention: early</td>
</tr>
<tr>
<td>N Confectionery:</td>
<td>Fast upbeat music throughout. Human characters of all ages, including children, eating chocolate spread in different locations; in homes and outdoors. All characters smiling and laughing. Voiceover throughout the advert.</td>
<td>8</td>
<td>2.6</td>
<td>2.8</td>
<td>17 (55)</td>
<td>1</td>
<td>3</td>
<td>Creativity, novelty, convenient</td>
<td>Visual fx: 1 Appearance: late</td>
<td>Verbal fx: 1 Mention: late</td>
</tr>
<tr>
<td>O Confectionery:</td>
<td>Fast upbeat music throughout. Human characters of all ages, including children, eating chocolate spread in different locations; in homes and outdoors. All characters smiling and laughing. Voiceover throughout the advert.</td>
<td>9</td>
<td>2.4</td>
<td>2.7</td>
<td>15 (68)</td>
<td>5</td>
<td>1</td>
<td>Happiness, parent-pleasing, parental-themes, palatability</td>
<td>Visual fx: 4 Appearance: early</td>
<td>Verbal fx: 1 Mention: late</td>
</tr>
<tr>
<td>P Confectionery:</td>
<td>Garden party. Young adult character barbecuing next to character with a tiger head. Other young adults are eating crisps, laughing. Young adult character runs through garden (watched by child) to steal the crisps. Closes with young adult on branch in tree (like a tiger) eating the crisps.</td>
<td>10</td>
<td>2.6</td>
<td>3.2</td>
<td>18 (58)</td>
<td>2</td>
<td>2</td>
<td>Fantasy, palatability, new product</td>
<td>Visual fx: 4 Appearance: early</td>
<td>Verbal fx: 2 Mention: late</td>
</tr>
<tr>
<td>Brand &amp; product</td>
<td>Summary of advertisement</td>
<td>Recognition score</td>
<td>Overall brand rating*</td>
<td>Overall consumer rating*</td>
<td>Eat soon, n (%)</td>
<td>Emotional appeals (n)</td>
<td>Food product appeals (n)</td>
<td>Dominant persuasive techniques</td>
<td>Direct brand execution: visual</td>
<td>Direct brand execution: verbal</td>
</tr>
<tr>
<td>----------------</td>
<td>--------------------------</td>
<td>------------------</td>
<td>----------------------</td>
<td>------------------------</td>
<td>-----------------</td>
<td>-----------------------</td>
<td>------------------------</td>
<td>-----------------------------</td>
<td>-------------------------------</td>
<td>-------------------------------</td>
</tr>
</tbody>
</table>

*1 signifies very positive perceptions and 5 signifies very negative perceptions

Persuasive technique definitions (Hebden et al. 2011): Fantasy = shows imaginary characters, situations or events; Anti-adult = child characters portrayed laughing at or dominating adult characters; Parental pleasing = shows parents are pleased that their child (animated or human) is consuming the product; Parental-themes = themes of family life; Palatability = Food product is described/depicted as tasting or smelling good;

*Early = before 10 seconds, late = after 10 seconds.

Visual fx = visual frequency (seconds)
Verbal fx = verbal frequency (seconds)
6.7.2.1 Emotional appeals

Emotional appeals appeared in all 10 of the TV advertisements, except for Brand D (fast food). The mean number of emotional appeals across all advertisements was four (SD 2.4), with eight of the 10 food advertisements containing two or more. All advertisements that portrayed characters’ faces showed them smiling or laughing (n=8). The second most frequently used emotional appeal (n=6) was fantasy/imagination where the advertisements showed imaginary characters, situations or events. Examples include Brand I and J’s (sweet snacks) promotional owls and llamas that pop out of the advertised sweet biscuit packets when opened, or cartoon hedgehogs that featured in Brand C’s advertisement (confectionery). Humour, parent-pleasing and parental-themes were used in five of the advertisements. Three advertisements (Brands C (confectionery), F and H (savoury snacks)) used anti-adult themes, but in very different ways: a mother and a baby cartoon hedgehog were seen ridiculing the father hedgehog; a child controlled an adult dancer whose legs were the child’s fingers and the advertised product her shoes; and children were shown stealing a packet of savoury snacks from their Dad (a former English footballer turned TV presenter).

6.7.2.2 Food product appeals

All TV advertisements included at least one food product appeal. The most frequently used appeal was palatability, where the food product is described or depicted as tasting or smelling good (n=9). For example, the Dad in Brand H’s (savoury snack) advertisement saying ‘Ooh, I like those’, or the young adults in Brand J’s (sweet snack) advertisement saying ‘Mmm’, and nodding their heads in approval as they ate the advertised products.

6.7.2.3 Visual elements

Child or youth actors appeared as the central characters in five of the TV advertisements, whilst six of the TV advertisements contained a promotional character (cartoon (n=2), animal character (n=3) and sports person (n=1)). Seventy percent of the advertisements portrayed food being eaten as a snack at non-meal times, with five of the advertisements set
in the home and four in a public place such as a hospital or outdoors. Supplementary healthy food references (i.e. where a healthy food appears within the advertisement secondary to the promoted unhealthy food) appeared in 50% of the advertisements (e.g. grapes on the side of the Dad’s hospital bed in Brand H’s (savoury snack) advertisement). The food product was central to the advertisement in five of the advertisements (Brands A, B, D, F and H) whilst the other advertisements focussed on promotional characters, such as brand equity and cartoon characters, and a smart phone app.

6.7.2.4 Audio elements

Music or jingles appeared in eight of the TV advertisements. All advertisements concluded with an audience address with the verbalisation of the brand slogan or brand name and product. Brand H (savoury snack) was the only advertisement where this audience address was spoken by a child.

6.7.2.6 Direct brand execution

The mean visual frequency that a brand was on screen was seven appearances (SD 4.7). The TV advertisements with the most frequent brand appearances were Brand D (fast food) (15) and Brand H (savoury snack) (15). In contrast, the mean verbal brand frequency was two (SD 1.8), with Brand H’s advertisement containing the highest number of brand mentions (6). The brand logo appeared within one second, in four of the advertisements (Brands A, B, D and H); with the latest brand appearance being 28 seconds (Brand E (fast food)) (Mean = 7 seconds (SD 9.7)). The earliest that a brand was spoken in an advertisement was one second (Brand A (cereal) and D (fast food)) and the latest, Brand J (sweet snack) (27 seconds). Brand F’s (savoury snack) advertisement did not verbalise the brand name at all.

6.7.3 Marketing techniques and direct brand execution tactics in online advergames

All three of the online advergames used the same emotional appeals: brand equity characters were portrayed smiling and players were rewarded for collecting branded products or demolishing rows of chocolate by progressing to another level. In all of the advergames,
branded food items and products were a central part of the game play and the brand logo or product was on screen for the full duration of the exposure.

6.7.4 Excluded cases based on baseline recognition

Brand D (fast food) and Brand B (confectionery) logos were recognised by 58% and 32% of children, respectively, at baseline (Table 6.4). This resulted in smaller samples of children in the analyses for these two brands.

6.7.5 Free brand recall

Brand H (savoury snack) was cited as an unprompted snack brand by 23% (n=33) of children in the free brand recall phase of the post-intervention questionnaire (Table 6.4). All other brands were mentioned between 0 and 5 times (< 0.1%).

6.7.6 Brand recognition

There was a significant increase in the number of brand logos correctly recognised by children from baseline to post-intervention for all food brands (p<0.0001). The brand logo most frequently identified post-intervention was Brand A (cereal), which was recognised by 74% (n=56) of children in the TV and advergame group (Table 6.4). A lower proportion of children in the TV-only group recognised the Brand A logo (60%, n=42), although this was not significantly different from the TV and advergame condition ($X^2_1 = 3.09, p=0.079$).

Among the TV advertisements, five brands (A, D, F, H and J) were recognised by at least 60% of children who had not previously recognised the logo at baseline. Brands B, E, G and I were comparatively less recognised post-intervention (<21%). The low numbers of children able to correctly recognise Brands B, E, G and I post-intervention resulted in sample sizes that were too small to yield meaningful percentages to compare proportions across or within brand categories and consequently these brands were not included in these sub-analyses.

Compared with younger children (less than 8 years), a greater proportion of older children (over 11 years) correctly identified 3 brands (Brand J (sweet snack) (86% vs. 40%),
$X^2_1=14.931$, $p=0.001$); Brand C (confectionery) (68% vs. 32%, $X^2_1= 9.197$, $p=0.002$) and Brand G (savoury snack) (42% vs. 16%, $X^2_1 = 15.097$, $p<0.0001$)). Similar proportions of children across age groups could correctly identify the remaining logos.

**Table 6.4: Free brand recall and logo recognition by children aged 7–12 years**

<table>
<thead>
<tr>
<th>Most recognised</th>
<th>Brand^</th>
<th>Recognised logo at baseline</th>
<th>Sample of children in brand analyses</th>
<th>Free brand recall</th>
<th>Recognised logo post-intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A: cereal * TV &amp; online game</td>
<td>0 0</td>
<td>76</td>
<td>6</td>
<td>&lt;0.1</td>
</tr>
<tr>
<td>2</td>
<td>F: savoury snack</td>
<td>15 10</td>
<td>139</td>
<td>2</td>
<td>&lt;0.1</td>
</tr>
<tr>
<td>3</td>
<td>H savoury snack</td>
<td>10 7</td>
<td>144</td>
<td>33 23</td>
<td>94 65</td>
</tr>
<tr>
<td>4</td>
<td>J: sweet snack</td>
<td>10 7</td>
<td>144</td>
<td>5</td>
<td>&lt;0.1</td>
</tr>
<tr>
<td>4</td>
<td>A: cereal * TV-only</td>
<td>8 11</td>
<td>70</td>
<td>3</td>
<td>&lt;0.1</td>
</tr>
<tr>
<td>4</td>
<td>D: fast food</td>
<td>90 58</td>
<td>64</td>
<td>N/A</td>
<td>38 60</td>
</tr>
<tr>
<td>7</td>
<td>C: confectionery</td>
<td>2 1</td>
<td>152</td>
<td>0</td>
<td>&lt;0.1</td>
</tr>
<tr>
<td>8</td>
<td>E: fast food</td>
<td>24 16</td>
<td>130</td>
<td>N/A</td>
<td>31 24</td>
</tr>
<tr>
<td>9</td>
<td>B: confectionery</td>
<td>49 32</td>
<td>105</td>
<td>1</td>
<td>&lt;0.1</td>
</tr>
<tr>
<td>10</td>
<td>G: savoury snack</td>
<td>0 0</td>
<td>154</td>
<td>1</td>
<td>&lt;0.1</td>
</tr>
<tr>
<td>11</td>
<td>I: sweet snack</td>
<td>0 0</td>
<td>154</td>
<td>1</td>
<td>&lt;0.1</td>
</tr>
</tbody>
</table>

Significant difference in logo recognition post-intervention by age group (<8 years vs. 8-11 years vs. >11 years): *$p<0.01$, **$p<0.001$, ***$p<0.0001$
^Brands listed in order of most recognised to least recognised logo by % children who identified logo post-intervention

### 6.7.7 Perceptions of brands

Children who correctly identified the different food brand logos post-intervention were then asked to rate their perceptions towards these brands. The mean overall brand ratings ranged from 2.5–2.8, with 1 signifying very positive perceptions and 5 signifying very negative perceptions (Table 6.5). This shows that children perceived all brands to be somewhat positive. Across all three attitude ratings (cool, exciting and fun), Brand H (savoury snack) was the most positively perceived (49–54% rated this as ‘very’ or ‘a little’ cool/exciting/fun) (Table 6.6) and had an overall brand rating of 2.5 (Table 6.5). There was only one within brand attitude difference by age-group: compared with younger children (less than 8 years),
a greater proportion of older children (over 11 years) perceived Brand H to be very or little fun (75% vs. 16%, $X^2 = 15.097$, p<0.0001) (Table 6.6).

Table 6.5: Overall brand and person ratings and desire to eat product by children aged 7–12 years, post-intervention

<table>
<thead>
<tr>
<th>Most recognized Brand*</th>
<th>Overall brand rating</th>
<th>Overall consumer rating</th>
<th>Desire to eat product soon</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n^</td>
<td>Mean        SD</td>
<td>Mean        SD</td>
</tr>
<tr>
<td>1 A: cereal TV &amp; game</td>
<td>56</td>
<td>2.7d        0.96</td>
<td>2.8b        0.81</td>
</tr>
<tr>
<td>2 F: savoury snack</td>
<td>94</td>
<td>2.7d        0.88</td>
<td>3.0d        0.60</td>
</tr>
<tr>
<td>3 H: savoury snack</td>
<td>94</td>
<td>2.5d        0.89</td>
<td>2.9c        0.66</td>
</tr>
<tr>
<td>4 J: sweet snack</td>
<td>87</td>
<td>2.8d        0.70</td>
<td>2.9d        0.60</td>
</tr>
<tr>
<td>4 A: cereal TV-only</td>
<td>42</td>
<td>2.8a        0.77</td>
<td>3.0        0.63</td>
</tr>
<tr>
<td>4 D: fast food</td>
<td>38</td>
<td>2.7b        0.83</td>
<td>3.0b        0.80</td>
</tr>
<tr>
<td>7 C: confectionery</td>
<td>85</td>
<td>2.7d        0.90</td>
<td>3.1d        0.64</td>
</tr>
<tr>
<td>8 E: fast food</td>
<td>31</td>
<td>2.6        0.55</td>
<td>2.8        0.52</td>
</tr>
<tr>
<td>9 B: confectionery</td>
<td>22</td>
<td>2.4        0.71</td>
<td>2.7        0.72</td>
</tr>
<tr>
<td>10 G: savoury snack</td>
<td>31</td>
<td>2.6c        0.69</td>
<td>3.2        0.68</td>
</tr>
<tr>
<td>11 I: sweet snack</td>
<td>16</td>
<td>2.9        0.76</td>
<td>2.9        0.59</td>
</tr>
</tbody>
</table>

Significant difference in desire to eat soon, by age group (<8 years vs. 8-11 years vs. >11 years: ^p<0.01, ** p<0.001, *** p<0.0001
Significant association between overall brand and consumer rating and children’s desire to eat the product soon: ^p<0.05, ^p<0.01, ^p<0.001, ^p<0.0001

^n=number of children who identified logo post-intervention
*Brands listed in order of most recognized to least recognized logo by % children who identified logo post-intervention

6.7.8 Perceptions of product consumers

Children’s perceptions of product consumers for the majority of brands were also somewhat positive, though, overall, children rated the type of person who would eat the product more negatively than they rated the brand itself (p<0.05) (Table 6.5). This was reflected by the lower numbers of children who reported positive consumer perceptions across all products (on popular/sporty/cool scales), particularly in the ‘sporty’ consumer category (7–18%) (Table 6.6). The highest ratings for positive consumer perceptions were for Brand A (cereal) by children in the TV and advergame group (‘very’ or ‘a little’ popular 32%, n=18, ‘very’ or
‘a little’ cool 36%, n=20). Compared with children who just watched the TV advertisement, a greater proportion of children who played the online advergames as well as watching the TV advertisement, perceived a person who would eat Brand A to be very or little cool (36% vs. 19%, $X^2_1 = 4.172, p=0.041$). There were no within brand differences by age-group for perceptions of product consumers.

Table 6.6: Children’s brand and product consumer attitude ratings and desire to eat product post-intervention

<table>
<thead>
<tr>
<th>Brand*</th>
<th>Cool n</th>
<th>%</th>
<th>Exciting n</th>
<th>%</th>
<th>Fun n</th>
<th>%</th>
<th>Popular n</th>
<th>%</th>
<th>Sporty n</th>
<th>%</th>
<th>Cool n</th>
<th>%</th>
<th>Eat soon n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>H: savoury snack</td>
<td>94</td>
<td>51</td>
<td>54</td>
<td>46*</td>
<td>49</td>
<td>47*</td>
<td>50</td>
<td>26b</td>
<td>28</td>
<td>10</td>
<td>11</td>
<td>24*</td>
<td>26</td>
<td>60</td>
</tr>
<tr>
<td>F: savoury snack</td>
<td>94</td>
<td>36</td>
<td>42</td>
<td>39d</td>
<td>42</td>
<td>35</td>
<td>37</td>
<td>24</td>
<td>26</td>
<td>11b</td>
<td>12</td>
<td>23d</td>
<td>25</td>
<td>45</td>
</tr>
<tr>
<td>J: sweet snack</td>
<td>87</td>
<td>30b</td>
<td>35</td>
<td>35d</td>
<td>40</td>
<td>29</td>
<td>33</td>
<td>26</td>
<td>30</td>
<td>11</td>
<td>13</td>
<td>16</td>
<td>18</td>
<td>52</td>
</tr>
<tr>
<td>C: confectionery</td>
<td>85</td>
<td>41c</td>
<td>48</td>
<td>36b</td>
<td>42</td>
<td>34a</td>
<td>40</td>
<td>15</td>
<td>18</td>
<td>6*</td>
<td>7</td>
<td>15</td>
<td>18</td>
<td>47</td>
</tr>
<tr>
<td>A: cereal: TV &amp; game</td>
<td>56</td>
<td>19c</td>
<td>34</td>
<td>24a</td>
<td>43</td>
<td>20b</td>
<td>36</td>
<td>18</td>
<td>32</td>
<td>10</td>
<td>18</td>
<td>20as</td>
<td>36</td>
<td>25</td>
</tr>
<tr>
<td>TV-only</td>
<td>42</td>
<td>18</td>
<td>43</td>
<td>15</td>
<td>36</td>
<td>15</td>
<td>36</td>
<td>10</td>
<td>24</td>
<td>8</td>
<td>19</td>
<td>8</td>
<td>19</td>
<td>21</td>
</tr>
</tbody>
</table>

Significant difference in perception of brand by age group (<8 years vs. 8-11 years vs. >11 years): * = p<0.0001
Significant association between children’s brand and consumer ratings and desire to eat the product soon: a = p<0.05, b = p<0.01, c = p<0.001, d = p<0.0001
Significant difference between media conditions and consumer rating (TV-only vs. TV and advergame) $^5 = p<0.05$

\*n=number of children who identified logo post-intervention

6.7.9 Desire to eat soon

The proportion of children reporting that they wanted to eat a particular product soon ranged between 38% and 68% (Table 6.5). Brand H (savoury snack) was the product that the highest number of children wanted to eat (n=60, n=64%). There were within brand differences by age-group for three brands. Compared with older children (over 11 years), a greater proportion of younger children (less than 8 years), expressed a desire to eat Brand F (savoury snack) (71% vs. 22%, $X^2_1 = 10.932, p=0.001$), Brand J (sweet snack) (69% vs. 36%, $X^2_1 = 4.188, p=0.041$) and Brand C (confectionery) (69% vs. 24%, $X^2_1 = 6.839, p=0.009$) soon.
There were significant associations between overall brand ratings and the desire to eat the product for seven brands and between overall consumer rating and desire to eat the product soon for six brands (Table 6.5). The associations between individual brand attributes (cool/exciting/fun) and consumer attributes (popular/sporty/cool) and the desire to eat the product differed between food brands (Table 6.6).

6.8 Discussion

The results of this study demonstrate how persuasive marketing techniques used in TV and online food advertisements can powerfully affect children’s recall and attitudes towards unfamiliar brands after just three exposures. There was a significant increase in children’s recognition of all brands following exposure (p<0.0001) and all brands were rated positively. Six of the brand logos were correctly identified by almost two-thirds of children who hadn’t previously recognised them. Furthermore, Brand H (savoury snack) stood out as the only prominent brand in children’s free recall. Recognition and recall of brands are two primary effects that advertisers aim to elicit from marketing exposures (Rozendaal et al. 2011a). They are both important in making purchase and consumption decisions, required for children to be able to function as consumers in the marketplace (Valkenburg and Buijzen 2005). When a child is presented with shelves of food products within the same category (e.g. snacks) to choose from, brand recognition can be the nudge that is needed to prompt a specific purchase request or decision (Campbell et al. 2014). Additionally, TV food advertisement exposures have been shown to be strong predictors of children’s food requests within the supermarket environment (Aktas Arnas 2006). Moreover, for the most recognised brands, an average of 50% of children said they would like to eat that product soon. Expressed intention is a proximal determinant of actual behaviour and likely predicts children’s consumption behaviors if they were presented with the branded product (Ajzen 1991).

Common persuasive techniques used across the TV advertisements included fantasy, smiling, happy characters and highly palatable food products. Snacking outside meal times
was the dominant theme. Three of the most favoured TV advertisements (Brand C (confectionery), F and H (savoury snacks)) also combined these with anti-adult themes, humour, parent-pleasing and parental-themes; seemingly a memorable and powerful mix of techniques that appealed to children of all ages in our study. The use and combination of these techniques clearly increased the persuasive power of the marketing communications, however use of these techniques is not covered by current regulatory codes (World Cancer Research Fund International 2018).

As mentioned, the Dad character in Brand H’s advertisement (savoury snack) featured a UK sports celebrity who portrays a whimsical character at the mercy of his children who steal his snack foods. Current UK regulations, whilst considered to be the ‘gold standard’ in legislative control over unhealthy food marketing to children, permit such an endorsement as this celebrity is deemed to be of ‘general appeal’ and not ‘just popular with children’ (Committee of Advertising Practice 2010, Mason 2012). In our study, this advertisement evoked the most attention and positive feelings, yet this celebrity would not have been familiar to Australian children. In the UK where this celebrity is more well-known, children’s attitudes and responses toward the advertisement and brand may well have been even more pronounced as, indeed, was demonstrated by Boyland et al. (2013).

In line with previous studies (Arredondo et al. 2009, Ueda et al. 2012), older children recognised more logos than younger children, and particularly for three brands (C (confectionery), G (savoury snack) and J (sweet snack)). Notably, the branded food products were not a central part of the advertisements for these brands but rather the advertisements focused on the brand equity characters. Similarly, in the two least recognised brands (G (savoury snack) and I (sweet), brand characters were central to the advertisement. It is plausible that younger children did not fully attend to the brand logos given they were not the main focus of the different advertisements and, as such, they did not have sufficient information to store the brand names in their short-term or working memory (Lang 2000). However, it is well established that the use of brand equity characters in advertising acts as
‘shorthand’ for children, with the character itself representing the brand rather than the logo (Lawrence 2003). Therefore, while children did not recognise the respective brand logos in the post-study questionnaire when it was detached from the brand equity character, it is likely that the characters would prompt a purchase request or decision for the product if that brand character was seen by the child on a package within a store (Kraak and Story 2015). Indeed, a greater proportion of younger children expressed a desire to eat Brand C (confectionery) and J (sweet snack), that featured brand equity characters, than their older peers.

Among the direct brand execution factors used across the TV advertisements, there were no common patterns amidst the most recognised brands for the visual and verbal brand frequency, nor the timing of the first brand appearance. However, in the popular Brand H’s (savoury snack) advertisement, the direct brand execution elements of high visual frequency, high verbal frequency, early brand visual appearance and verbal mention produced an advertisement with high attention and positive attitude. Notably, within all the advertisements for which the brand logos were least recognised, the first time the brand was mentioned was at least 10 seconds after the advertisement commenced. This finding is in line with previous research which shows that early branding, where the brand name is identified in the first third of the advertisement, is positively associated with brand recall (Romaniuk 2009). Hence, the late verbalisation of the brand may have played a role in fewer children recognising the brand logo post-intervention.

In line with previous research that found children rated unhealthy brands as more cool, fun and exciting than healthier brands (Kelly et al. 2016), all brands were rated positively overall. Additionally our finding that lower proportions of children viewed people who would eat the product as sporty or cool was consistent with prior research where users of ‘healthier’ food brands were perceived to be more sophisticated and sporty than users of unhealthier brands (Kelly et al. 2016). There were only two advertisements that featured physical activity (Brands C (confectionery) and F (savoury snack)) with its inclusion
seemingly prompting a ‘health halo effect’ response in children (Sütterlin and Siegrist 2015). These were the only two brands where there was a positive association between a typical consumer of the branded product being characterised as very or a little sporty and children’s desire to eat the product soon. Positioning healthy/healthier foods and physical activity alongside advertised energy-dense, nutrient-poor products is a commonly used approach by food marketers (Whalen et al. 2018). This ‘health halo effect, as we observed, can result in positive impressions from healthier content transferring to the less healthy advertised brand or product (Sütterlin and Siegrist 2015).

Unsurprisingly advergames strengthened children’s positive perceptions towards Brand A (cereal). These advergames provided an immersive, brand-rich experience where children’s interest was stimulated through challenge and reward (Moore 2006). In an advergame the distinction between entertainment content and a persuasive message are blurred, increasing a child’s susceptibility to influence (Hye-Jin et al. 2014). Indeed, previous studies have also found that children had more positive attitudes towards a brand after playing an advergame compared with watching a TV advertisement (Waiguny et al. 2011, Neyens et al. 2017). The incentives of challenge and reward and the invitation to ‘play again’, that we observed, are used by game designers in the real-world setting to encourage extended and repeated game play, and consequently to achieve more advertising exposure (Moore 2006).

Child and youth characters were central in over 80% of the most popular advertisements (Brands A (cereal), C (confectionery), F, H (savoury snacks) and J (sweet snack)). In Australia, the inclusion of child actors or characters is rarely seen to be a sufficient argument that an advertisement is directed to and of appeal to children, with industry self-regulatory bodies dismissing complaints that unhealthful food advertisements are targeting children even if they include children (Lumley et al. 2012, Watson et al. 2014).

Apart from those mentioned, there were no other differences between age groups for brand recognition or brand attitudes; an indication that the majority of advertised brands appealed
to children of all ages in our study. Therefore, whilst older children may have more advertising literacy than younger children, they do not necessarily use it to defend themselves against advertising’s effects (Rozendaal et al. 2011b). Indeed, the use of persuasive marketing techniques that associate products with fun, humour and being cool (which are important motivators for this age group of children) makes it likely that children’s motivation to conform to the messages may be much stronger than their desire to resist (Harris et al. 2009b). This is indicated in our study where, for the majority of brands there were significant associations between at least one positive attitude towards the brand and children’s expressed desire to eat that product.

There are both strengths and limitations to the fact that we only investigated children’s attitudes and perceptions towards the advertised brands if they could correctly identify the brand logo. A clear strength was that we were able to isolate specific effects of experimental advertising exposure from children’s prior brand relationships, an achievement in children’s brand saturated worlds (Signal et al. 2017). However, a consequence was that we did not capture how the experimental advertisement exposure may have influenced those participants who did not recognise brand logos, and we were also not able to conduct across or within brand category analyses for some brands, given the low numbers of children that identified some logos. Even though the excluded children may not have been able to explicitly recognise the brand logo, positive affect may have been transferred outside the child’s awareness and without a conscious processing of the brand itself; an important effect nonetheless (Nairn and Fine 2008). In fact, there is strong evidence that high attention actually weakens the effect of emotional appeals within an advertisement, thus stronger brand relationships may well be established when advertisements are processed at lower levels of attention (Heath et al. 2006, Buijzen et al. 2010). Of course, what marketers most want is for positive attitudes to be formed, linked to the advertised brand and firmly secured in the viewer’s working memory (Heath 2009).
6.9 Conclusions

The findings in the current study were observed after just three advertising exposures. There is strong evidence that repeated exposures to advertising augments evaluation of that stimuli (Zajonc 1968, Bornstein 1989) and that maximum attitude and affect is reached at around ten advertising exposures (Schmidt and Eisend 2015). Therefore, it is likely that the effect of marketing campaigns on children, which typically span multiple media and strive for repetition and ubiquity, would have even greater impacts on children’s brand perceptions than measured here.

The WHO defines power as ‘the extent to which a message achieves its communications objectives’ (World Health Organization 2012). This study has illustrated a broad range of persuasive techniques used in multiple combinations that clearly affected and appealed to all children and, hence, in achieving these outcomes, can be considered to be powerful. It is the WHO’s recommendation that these persuasive techniques be restricted (World Health Organization 2016a) yet, they clearly are not. In order for any restrictions on persuasive techniques to be effective, this full range of techniques needs to be considered. However, without a scale or framework to characterise and apportion a ‘power-score’ to each advertisement according to the different techniques and combinations used this remains a difficult and ambiguous task. As stated by Hebden et al. (2011) the complexity of coding advertisements with the multitude of techniques used by marketers would be challenging, and monitoring advertisers’ compliance would be very difficult. Nevertheless, given that large numbers of children continue to be exposed to a high frequency of very influential unhealthy food advertisements (King et al. 2013, Australian Communications and Media Authority 2017) finding a policy solution to curb the power of marketing is of the utmost urgency. In a time when we are facing a significant obesity epidemic (OECD 2017) and when the evidence linking children’s exposure to unhealthy food marketing with the development of overweight and obesity has never been stronger (Boyland et al. 2016,
Norman et al. 2016, Norman et al. 2018a, Norman et al. 2018b), clearly it is a time for strong government action and for food marketers to be held to account.

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6.11 Conflict of interest disclosures

J. Norman, B. Kelly, E. Boyland, K. Chapman and L. King all declare that they have no conflicts of interest.

A-T McMahon reports grants from Australian Meals on Wheels Association, personal fees from Pork CRC, personal fees from Proportion Foods, personal fees from YUM Corp, personal fees from PhD examinations, personal fees from Flagstaff Fine Foods, personal fees from IRT, grants from University of Wollongong grant funds; outside the submitted work.

6.12 Acknowledgements

We wish to acknowledge Professor Adrian Bauman and Professor Louise A Baur from the Prevention Research Collaboration, University of Sydney for their excellent contribution to the conception and design of the study protocol and ongoing support throughout the duration of the study.

6.13 Availability of data

Data from this study will not be openly available until planned publication outputs have been completed.
CHAPTER SEVEN

DISCUSSION OF OVERALL FINDINGS AND RECOMMENDATIONS

7.1 Introduction

The primary aim of this thesis was to investigate the direct effects of sustained exposure to unhealthy food advertising on TV and online advergames on children’s dietary intake and its potential influence on children’s weight. Additionally, this research sought to examine whether there was an increased effect of advertising among children with overweight and obesity and/or among children who experienced controlling feeding practices. To this end, a within-subject, randomised, crossover, counter-balanced experimental trial was conducted with 160 children (7-12 years) across four, six-day holiday camps at the University of Wollongong (Chapters Four and Five). To isolate the effects of advertising, international food brands, not available for sale in Australia nor advertised on Australian commercial television stations, were used. Finally, this thesis explored how the creative content within the unfamiliar advertisements used in the research study affected children’s recognition of, and attitudinal responses towards, the advertised brands (Chapter Six).

This body of research adds new evidence to the public policy debate about the need to restrict children’s exposure to unhealthy food marketing. Most importantly, it does this by demonstrating the causal links between children’s food advertising exposure and children’s food preferences and consumption behaviours. Significantly this research demonstrated that the increased energy consumed by children as a result of exposure to unhealthy food advertising from multiple media platforms over three days, was not compensated for at later eating occasions (Chapter Four). This energy imbalance was of a kilojoule (kJ) amount that over time would lead to the development of unhealthy weight gain in children.

This thesis provides convincing new evidence that food advertising to children should be restricted. Specifically, this evidence identifies that:
• Exposure to food marketing is causally related to children’s food behaviours (Chapter Two);

• Exposure to food marketing results in children having a positive energy imbalance capable of driving the development of overweight in children (Chapter Four);

• Exposure to multiple media advertising increases the effect on all children’s food consumption responses (Chapter Four);

• Children with overweight and obesity and children who experience parental feeding practices that impede their self-regulation of eating have increased susceptibility to advertising effects (Chapters Four and Five);

• Exposure to unfamiliar food brands in TV advertising and online advergames increases children’s brand recognition and recall after exposure; and influences children’s perceptions and attitudes towards advertised brands and consumers of those brands, and their desire to eat the advertised products (Chapter Six); and

• The use and combination of persuasive techniques influences advertisements’ appeal to children (Chapter Six).

This chapter provides a summary of the key findings from the research that constitutes this thesis. Based on these findings and their implications, recommendations for government regulation to restrict the extent and power of food advertising to children are proposed. Opportunities for future research in this field are also discussed.
7.2 Key findings

7.2.1 The direct effects of sustained exposure to unhealthy food advertising on TV and online advergames on children’s dietary intake and its potential influence on children’s weight

The direct effects of food advertising exposure on children’s dietary intake were demonstrated experimentally with children (7–12 years, n=160) in a within-subject, randomised, crossover, counter-balanced study across four, six-day holiday camps at the University of Wollongong (Chapter Four). A key strength of this study was that we created a natural environment, similar to school camps that Australian children would attend during school term-time. The children appeared comfortable and relaxed; an observation that was reinforced by the low study attrition and the positive parental feedback in their follow-up questionnaire.

7.2.1.1 Food advertising exposure resulted in children having a positive energy imbalance

Children’s exposure to advertising on TV and an online advergame led to a positive energy imbalance of a magnitude capable of driving unhealthy weight gain in children (Chapter Four). All children in the multiple media condition ate more at a snack after exposure to food advertising compared with non-food advertising. Children did not compensate for this increased intake at lunch and this led to children leaving camp on the food advertising days having eaten an additional 194 kJ more than they did on the non-food advertising days. Cohort studies suggest that a sustained daily positive energy balance as small as 200-300 kJ can lead to the development of overweight in children (Plachta-Danielzik et al. 2008, van den Berg et al. 2011). To our knowledge this is the first experimental research study to demonstrate a direct link between children’s exposure to food advertising and their dietary intakes, beyond measuring a snack consumed at the time of or immediately after the advertising exposure. The value of the study design was in illuminating the lack of compensation for increased intakes at a subsequent snack at a later eating occasion (lunch).
This lack of compensation means that the energy imbalance was likely sustained and, over time, could lead to the development of childhood overweight.

7.2.1.2 Exposure to multiple media advertising increased the effect on children’s consumption responses

Online (‘advergame’) advertising combined with TV advertising exerted a stronger influence on children’s food consumption than TV advertising alone; exposure to multiple media food advertising compared with a single media source increased the effect on children’s snack intake by a difference of 182 kJ (Chapter Four).

The lack of an ‘advergame-only’ single media condition meant that we were unable to specify whether the significant main effect for media condition that we observed was due to the double exposure of TV and the advergame or to the immersive nature of the game itself. Nevertheless, the multiple media advertising condition is closer to children’s real world advertising exposures (Boyland and Whalen 2015), hence children’s behavioural responses within this group are of particular importance.

Potential explanations why significant differences in snack intake between food and non-food advertising conditions in the TV-only group were not seen were discussed in Chapter Four and included: the use of unfamiliar brands may not have cued children’s food consumption responses to the extent that has previously been observed in studies where food brands were familiar (Halford et al. 2004, Halford et al. 2008, Harris et al. 2009a); data collection occurred in the morning when children’s self-regulatory capacity is, arguably, at its height (Millar 2017); and children had a limited snack eating time, which was not disclosed to them, in contrast to previous short-term TV advertising exposure feeding studies where a limit was not imposed (Halford et al. 2004, Halford et al. 2008).
7.2.1.3 Children with overweight and obesity have increased susceptibility to advertising effects

Food advertising had an increased effect on food consumption among children with heavier weight status in both media groups (Chapter Four). Children with overweight and obesity in the TV and advergame group left camp on the food advertising days having eaten an extra 398 kJ, over double the amount of children with under-/normal weight (additional 150 kJ daily). This exaggerated response was also seen among children of a heavier weight status in the TV-only group, with children consuming an extra 553 kJ (p=0.058) at the camp on the food advertising days.

Children with a heavier weight status have previously been shown to have heightened food intake responses to food advertising on TV (Halford et al. 2004, Halford et al. 2008), although, to our knowledge, not previously in response to unhealthy food marketing in advergames.

7.2.1.4 Children who experienced parental feeding practices that impede their self-regulation of eating have increased vulnerability to advertising effects

Children whose parents reported controlling parental feeding practices had increased food consumption responses to food advertising exposure compared with children who experienced non-controlling feeding practices (Chapter Five). The differential vulnerability was most distinct in the TV-only group and resulted in children who experienced restrictive parental feeding practices leaving camp on the food advertising days having eaten 288 kJ more than they did on the non-food advertising days.

In the TV and advergame condition, parental pressure to eat heightened the effect of advertising, with children consuming more at a snack after food advertising exposure, compared with non-food advertising (356 kJ). However, all children in this media condition were affected regardless whether they experienced controlling or non-controlling feeding practices, suggesting that marketing effects overrode children’s learned self-regulatory
responses to eating. As previously stated, all children in this media group left camp on the
food advertising days with a positive energy imbalance capable of driving the development
of overweight in children.

7.2.2 Children’s brand recognition, attitudes and desire to eat foods after advertising
exposure

The effect of exposures to unfamiliar TV and online food advertisements on children’s recall
and attitudes towards advertised brands was demonstrated from data collected during the
randomised, crossover trial that constituted the research study in this thesis (Chapter Six).
Furthermore, persuasive techniques common within the most recognised and highly rated
advertisements were identified and described.

7.2.2.1 Exposure to unfamiliar food brands in TV advertising and online advergames
increased children’s brand recognition and recall after exposure

After only three advertisement exposures, there was a significant increase in the number of
brand logos correctly recognised by children from baseline to post-intervention for all food
brands (Chapter Six). Among the TV advertisements, six of the brand logos were correctly
identified by almost two-thirds of children who had not previously recognised them. The
brand logo most frequently identified post-intervention was Kokokrunch (Brand A) breakfast
cereal, which was the featured brand in the online advergames; this was recognised by 74%
of children in the TV and advergame group. Also of note, was that almost one in four
children cited Walkers Mixups (Brand H, savoury snacks) in the free brand recall exercise
post-advertising exposure; a brand previously unknown to these children.

7.2.2.2 Exposure to unfamiliar food brands in television advertising and online advergames
affected children’s perceptions and attitudes towards brands and consumers of those brands
and desire to eat the advertised products

Following just three advertisement exposures children perceived all brands and consumers of
those brands somewhat positively, with children across all age-groups (7-12 years) similarly
affected (Chapter Six). Walkers Mixups (Brand H, savoury snacks) was the brand most positively perceived. Playing the online advergame appeared to enhance children’s opinions of a person who would eat the promoted brand, with the highest ratings for positive consumer perceptions for Kokokrunch (Brand A, breakfast cereal) by children in the TV and advergame group. Furthermore, those children who played the online advergames as well as watched the TV advertisement were more likely to perceive a person who would eat Kokokrunch to be very or little cool than children who just watched the TV advertisement. The influence of the advertisements extended to prompting children to want to eat the advertised products. For eight of the advertised brands, over 50% of children said they would like to eat that product soon. Walkers Mixups were the product that the highest proportion of children wanted to eat (64%). This latter brand was also the most positively perceived and that prompted the highest recall, indicating that this advertisement certainly appealed to children within our study.

7.2.2.3 The use and combination of persuasive techniques influenced advertisements’ appeal to children

Common persuasive techniques used across the TV advertisements included brand equity characters, fantasy, happiness and highly palatable food products (Chapter Six). Snacking outside meal times was the dominant theme. Three of the most favoured TV advertisements (Maynard’s Discovery Patch (Brand C, confectionery), Hula Hoops (Brand F, savoury snacks) and Walkers Mixups (Brand H, savoury snacks)) also combined these persuasive techniques with anti-adult themes, humour, parent-pleasing and parental-themes. The use and combination of these techniques demonstratably increased the persuasive power of the marketing communications to the children in the study; however, use of these techniques is not covered by existing regulatory codes for marketing to children in Australia.
7.3 Implications of research findings

7.3.1 Current food marketing landscape and regulatory approaches

Despite the restriction of children’s food marketing exposure having been identified as an international policy priority for the prevention of childhood overweight and obesity (World Health Organization 2010, United Nations General Assembly 2011), very few countries have enforced statutory regulations and industry-led pledges for responsible advertising are the default option for most countries (Galbraith-Emami and Lobstein 2013, World Cancer Research Fund International 2018). Industry pledges are the preferred approach of food corporations (Moodie et al. 2013), yet have been wholly ineffective in reducing children’s exposures to unhealthy food marketing (Galbraith-Emami and Lobstein 2013, Harris et al. 2017, Hickey et al. 2018).

Integrated marketing campaigns across an array of media platforms saturate children with unhealthy food marketing (Lumley et al. 2012, Kelly et al. 2015c); creating social norms (Schwartz et al. 2013) and powerfully enhancing consumer behavioural responses through synergistic cross-effects (Batra and Keller 2016). In the randomised trial, exposure to advertising on TV and the advergame exerted a stronger influence on children’s food consumption than TV advertising alone. Furthermore the children who also played the advergame reported more favourable attitudes toward consumers of the advertised brand. The multiple media group in this study likely most closely emulates the experiences of young people (Boyland and Whalen 2015, Boelsen-Robinson et al. 2016). Multi-screen use is commonplace; 53% of children aged 5-9 years and 74% of 10-14 year-olds are using other devices while watching TV programs (Australian Communications and Media Authority 2017).

7.3.2 New evidence to support regulatory reform

The difficulty in quantifying the relative contribution of food marketing on childhood obesity and the establishment of a causal relationship between the two has been cited as a
key reason for the lack of meaningful regulation in Australia (Australian Communications
and Media Authority 2009). In 2009, in their final report of the review of the Children’s
Television Standards, the Australian Communications and Media Authority (ACMA)
rejected submissions in favour of greater restrictions on food marketing to children, stating
that ‘there is currently no consensus in the research that the ACMA is aware of as to whether
the association [between food marketing and childhood obesity] is anything more than ...
“modest’” (Australian Communications and Media Authority 2009). The body of evidence
within this thesis strongly refutes this contention and demands a review of regulation.
Children’s food consumption data from the experimental study in this thesis provides strong
new evidence of a causal relationship between food advertising exposure and the links to
unhealthy weight. Furthermore, the data identifies that children who already have overweight
or obesity have a particularly heightened risk. There is compelling evidence from the decade
of global research since ACMA’s review, and drawn together in the literature review in
Chapter Two, for food marketing’s direct relationship with children’s negative food
behaviours and unhealthy weight gain in childhood. Thus, children’s exposure to unhealthy
food marketing can clearly be seen as an important modifiable risk factor for the
development of childhood overweight.

7.3.3 A call for government regulatory reform

The historical government and food industry standpoint has been to emphasise that
children’s exposure (and response) to food marketing is a matter of parental responsibility
rather than industry or government responsibility (Baker et al. 2017, Handsley and Reeve
2018). However, given that differences in the prevalence of obesity can be attributed to
obesogenic environmental determinants (including unhealthy food marketing) (Swinburn et
al. 2011), the locus of responsibility arguably lies with the major influencers within this
environment, namely government and the food industry (Baker et al. 2017). This call for
government intervention is backed up by empirical behavioural and psychological studies
that show that obesogenic environments interfere with an individual’s ability to act in their
long-term self-interest by promoting unhealthy food preferences and impairing self-regulation (Schwartz et al. 2017). Consequently, government regulatory action is not just desirable but necessary to protect individuals’ abilities to make healthy choices (Greenfield 2011). Recent experimental studies identified in the updated literature review presented in Chapter Two substantiate this call, with children with a genetic predisposition to obesity showing an increased susceptibility and responsivity to food advertising exposure (Gilbert-Diamond et al. 2017, Rapuano et al. 2017).

7.3.3.1 The children’s rights-based argument

Articles within the United Nations Convention on the Rights of the Child (UNCRC) (1990) clearly support government action on unhealthy food marketing to children in order to uphold children’s rights related to food, health and nutrition (United Nations General Assembly 1990, Handsley and Reeve 2018). Article 17 of the UNCRC states that: ‘Children have the right to reliable information from the media. Mass media such as television, radio and newspapers should provide information that children can understand and should not promote materials that could harm children’ (United Nations General Assembly 1990). The food consumption and attitudinal responses we observed among children to the implicit, persuasive messages and food cues in the food advertising in our study clearly suggest that exposing children to advertising of this nature infringes their rights under Article 17.

Furthermore, Article 18 (2) of the UNCRC requires states to ‘render appropriate assistance to parents and legal guardians in the performance of their child-rearing responsibilities’ (United Nations General Assembly 1990). In view of this, government regulation of unhealthy food marketing to children can be seen as states supporting parents to help their children adopt healthy dietary behaviours. Indeed, it is this rights-based approach that jurisdictions such as Sweden, Norway and Quebec, Canada have adopted where all advertising to children is restricted on all or most media platforms (Handsley et al. 2014).
7.3.4 Policy options for government regulation

Strong government leadership and regulatory reform is needed to protect children from unhealthy food marketing (World Health Organization 2016b, Handsley and Reeve 2018). Moreover, limiting food and beverage advertising to children has significant potential as a cost-effective intervention to reduce the prevalence of childhood obesity (Magnus et al. 2009, Brown et al. 2018). A recent report by the Obesity Policy Coalition in Australia (Hickey et al. 2018) presents a comprehensive suite of recommendations, with international examples, for government policy options that would help reduce the volume, reach and influence of food marketing to children. Furthermore, the Regional Office for Europe of the World Health Organization identifies eight key components for effective policies to protect children from unhealthy digital food marketing, urging government statutory regulation and international cross-jurisdiction strategies (World Health Organization 2016b, World Cancer Research Fund International 2018).

7.3.5 Policy options for family or individual interventions

In light of the increased susceptibility seen among children with a heavier weight status and among children who experienced controlling parental feeding practices, Chapters Four and Five made suggestions for children’s weight management programs to incorporate food cue desensitisation treatments (Boutelle et al. 2011, Boutelle et al. 2014) and for feeding practices that support child’s self-regulatory development (Frankel et al. 2017). However, given the extent and power of contemporary food marketing to children, and particularly in light of our findings among all children in the multiple media condition, it is unlikely that any policy interventions that focus on the individual or family unit would be effective in the absence of broader regulatory controls on food marketing.

7.4 Recommendations for future research

This section makes recommendations for future experimental study research options that would further clarify the relationship between children’s food marketing exposures and their
food behaviours. Table 7.1 presents a summary of the experimental studies included in the narrative literature review (Chapter Two) plus those conducted within this thesis, mapped against the distal behavioural outcomes of marketing exposure (food preferences and choices, short term food consumption and longer-term food consumption and dietary intake) as identified in a logic model of promotional effects by Kelly et al (2015). Table 7.2 presents a summary of the experimental studies that were reported in Chapter Six that investigated children’s recall and attitudinal responses to unfamiliar food brands in TV advertisements and advergames and the persuasive techniques used. Additionally, both tables subdivide these studies according to advertising media platform and children’s age-group. Related research questions, possible experimental study designs to address these questions and examples of published experimental studies are described. From this outline of experimental evidence on the effects of food marketing exposures on children’s behavioural outcomes, a number of experimental study research gaps can be identified. A discussion of these gaps is the focus of this section.

7.4.1 Experimental study research gaps

As determined by the literature review, current experimental research has focussed predominately on the effects of short-term advertising exposures on children’s food behaviours (food preferences and choices and short term food consumption) among children aged less than thirteen years of age (Table 7.1). There is a lack of experimental studies that have investigated outcomes in adolescents; the effects of online food marketing (apart from advergames) among children of all ages; and very limited multiple media studies. Furthermore, the only experimental studies that have investigated children’s longer-term responses to food advertising was the study at a Canadian holiday camp in 1982 (Gorn and Goldberg 1982) and those included in this thesis (Chapters Four and Five).
7.4.1.1 Online advertising

Whilst television remains the main source of food advertising (Cairns et al. 2013, Powell et al. 2013a), the proliferation of digital technologies, including the Internet and mobile devices, has seen a steep increase of food advertising in this ‘new media’ space (Kelly et al. 2015c). Digital media present an unrivalled marketing opportunity for industry, offering 24-hour connectivity, user-generated content, immersive environments and targeted, personalised advertisements (Montgomery et al. 2012, Tsimonis and Dimitriadis 2014, Kelly et al. 2015c, Knoll 2016). A recent study of the frequency and healthfulness of food advertisements appearing on 10 of the most popular Canadian youth websites found that, over the course of a year, 14.4 million food advertisements were shown; most advertised products were unhealthy (83.5%) and high in either sugar, fat, or sodium (93.3%) (Potvin Kent and Pauzé 2018).

Conducting experimental studies using different online marketing platforms, particularly social media, is an important consideration for future research. Children of all ages, particularly adolescents, are using digital media avidly and increasingly (World Health Organization 2016b). It is, therefore, of paramount importance to understand the effects that exposures from these platforms are having on all children’s behavioural outcomes.

7.4.1.2 Multiple media advertising platforms

Cross-media advertising campaigns are commonplace (Taylor et al. 2013). For example, the Walkers brand (that was popular among children in our study) in addition to advertisements during TV peak-time viewing, uses ‘on-pack’ promotions such as movie downloads and gift vouchers, in-store promotions, celebrity endorsement and social media promotions (Selwood 2018). Integrated media campaigns can amplify consumer behavioural responses (Batra and Keller 2016, Voorveld et al. 2018) yet studies that investigate how multiple media advertising affects children’s food behaviours are lacking. With the exception of the experimental studies reported in this thesis, only one other study has investigated this
phenomena, and only after short-term exposure (one occasion) (Uribe and Fuentes-García 2015). The lack of an advergame-only media condition in the current randomised trial meant that we were unable to clearly identify whether the increased effect we saw in the multiple media condition was due to the double media exposure (TV and advergame) or the immersive qualities and power of the game itself. Future studies could explore this question by replicating our study design with the addition of an advergame-only condition.

7.4.1.3 Possible research designs

Using a study camp approach, such as the scenario used in the randomised crossover trial presented in this thesis, could provide opportunity to study children’s responses to an experimental version of a cross-media advertising campaign in a naturalistic setting. Using brands that are unfamiliar to children (overseas brands), as we did in our study, would give opportunity to control the media environment to manipulate marketing exposures across groups. This would be an important aspect of the study design given that children are exposed to such high levels of food advertising in their everyday lives (Signal et al. 2017). Of course, conducting experimental studies of this nature are challenging and resource intensive and sufficient funding would need to be secured to conduct such a trial.

Given the expense of conducting studies over many days, consideration could be given to conducting similar within-subject study camps where children attend just two days (experimental and control conditions, counter-balanced across participants). In addition, future studies could measure children’s food consumption responses at an afternoon snack and evening meal to investigate whether the null-findings that were observed in the TV-only condition were, indeed, due to the morning data collection time-period.
<table>
<thead>
<tr>
<th>Exposure outcomes by advertising media platform</th>
<th>Under 7 years</th>
<th>7-13 years</th>
<th>Over 13 years</th>
<th>Research questions</th>
<th>Research design</th>
<th>Experimental evidence examples</th>
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</thead>
<tbody>
<tr>
<td>Children’s food preferences or immediate intention to purchase/consume (choice)</td>
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<tr>
<td>Advergame</td>
<td>X</td>
<td>✓</td>
<td>X</td>
<td></td>
<td></td>
<td>Esmaeilpour et al. 2018</td>
</tr>
<tr>
<td>Internet pop-up advertisement</td>
<td>X</td>
<td>✓</td>
<td>X</td>
<td></td>
<td></td>
<td>Tarabashkina et al. 2015</td>
</tr>
<tr>
<td>Product placement in movies</td>
<td>✓</td>
<td>✓</td>
<td>X</td>
<td></td>
<td>Experimental studies with children to measure their preference for a food product, or type of food from a range of products, after short-term (or sustained exposure) to different advertising content (e.g. unhealthy food, healthy food, non-food advertising or no promotion); comparison between advertising conditions and/or within media platforms</td>
<td></td>
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<tr>
<td>Premium offers</td>
<td>✓</td>
<td>✓</td>
<td>X</td>
<td></td>
<td></td>
<td>Auty and Lewis 2004</td>
</tr>
<tr>
<td>Branded packaging/licensed media/brand equity characters</td>
<td>✓</td>
<td>✓</td>
<td>X</td>
<td></td>
<td></td>
<td>Dixon et al. 2014, Dixon et al. 2017b, Dixon et al. 2017a</td>
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<tr>
<td>Multiple media:</td>
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<tr>
<td>TV-only and TV and advergames</td>
<td>X</td>
<td>✓</td>
<td>X</td>
<td></td>
<td>Experimental studies (as detailed above) with comparison between single media and multiple media platforms</td>
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<tr>
<td>Multiple media:</td>
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<tr>
<td>TV-only plus TV plus product placement</td>
<td>X</td>
<td>✓</td>
<td>X</td>
<td></td>
<td>Experimental studies (as detailed above) with comparison between multiple media platforms</td>
<td></td>
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</tbody>
</table>

*Chapter Six: Norman et al. 2018c
<table>
<thead>
<tr>
<th>Exposure outcomes by advertising media platform</th>
<th>Under 7 years</th>
<th>7-13 years</th>
<th>Over 13 years</th>
<th>Research questions</th>
<th>Research design</th>
<th>Experimental evidence examples</th>
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<tbody>
<tr>
<td><strong>Children’s short-term food consumption</strong></td>
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<tr>
<td>TV</td>
<td>✓</td>
<td>✓</td>
<td>X</td>
<td>How does exposure to food advertising in [X advertising media platform] affect children’s actual short-term food/drink consumption behaviours? Do sub-groups of children (e.g. with overweight and obesity; genetic predisposition to obesity) show an increased susceptibility to food advertising effects?</td>
<td>Experimental studies with children to measure their consumption of snack foods following short-term exposure (or sustained exposure) to different advertising content (e.g. unhealthy food, healthy food, non-food advertising or no promotion; or celebrity endorsers)</td>
<td>Haldorf et al. 2004, Haldorf et al. 2007, Haldorf et al. 2008, Harris et al. 2009a, Boyland et al. 2013, Dovey et al. 2011, Anschutz et al. 2010, Gilbert-Diamond et al. 2017, Boyland et al. 2016 (<em>Chapters Four and Five: Norman et al. 2018a, Norman et al. 2018b)</em></td>
</tr>
<tr>
<td>Product placement in movies</td>
<td>X</td>
<td>✓</td>
<td>X</td>
<td></td>
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<td>Matthes and Naderer 2015, Brown et al. 2017</td>
</tr>
<tr>
<td>Branded food packaging</td>
<td>X</td>
<td>✓</td>
<td>X</td>
<td></td>
<td></td>
<td>Keller et al. 2012</td>
</tr>
<tr>
<td><strong>Multiple media:</strong></td>
<td>X</td>
<td>✓</td>
<td>X</td>
<td>How do children’s food consumption responses after food advertising in [X advertising media platform] differ to their food consumption responses after food advertising in [X media platform]? How do different forms of food advertising in different media platforms add to and reinforce one another?</td>
<td>Experimental studies (as detailed in row above) with comparison between single media and multiple media platforms</td>
<td>Chapters Four and Five: Norman et al. 2018a, Norman et al. 2018b</td>
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<tr>
<td>TV-only and TV and advergames</td>
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<tr>
<td><strong>Children’s longer-term food consumption and dietary intake</strong></td>
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<tr>
<td>TV</td>
<td>X</td>
<td>✓</td>
<td>X</td>
<td>How does exposure to food advertising in [X advertising media platform] affect children’s actual longer-term food/drink consumption behaviours and/or dietary intake?</td>
<td>Experimental studies with children to measure if any increased intake of food following exposure to food advertising is compensated for at subsequent meals</td>
<td>Chapters Four and Five: Norman et al. 2018a, Norman et al. 2018b</td>
</tr>
<tr>
<td>Multiple media: TV-only and TV and advergames</td>
<td>X</td>
<td>✓</td>
<td>X</td>
<td>How do children’s responses to food advertising in [X advertising media platform] differ to their responses to</td>
<td>Experimental studies (as detailed in row above) with comparison between single media and multiple media</td>
<td>Chapters Four and Five: Norman et al. 2018a, Norman et al. 2018b</td>
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<td>Exposure outcomes by advertising media platform</td>
<td>Under 7 years</td>
<td>7-13 years</td>
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<td>Research questions</td>
<td>Research design</td>
<td>Experimental evidence examples</td>
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<td></td>
<td>food advertising in [X media platform]? How do different forms of food advertising in different media platforms add to and reinforce one another?</td>
<td>platforms</td>
<td></td>
</tr>
</tbody>
</table>
7.4.2 Experimental studies to investigate the persuasive power of marketing

Chapter Six presented findings on the persuasive marketing techniques unique to the advertisements that were most popular with children (Table 7.2). Similar studies with advertisements selected with specific persuasive content (e.g. humour vs. product information only) could be conducted to explore the full range of techniques used in contemporary advertising and how they affect children’s attitudes across the age spectrum. An online study design approach could also be explored. Research of this nature would progress the challenge of devising a framework to characterise and allocate a ‘power-score’ to different advertisements according to the different persuasive techniques and combinations used in each. As described in Chapter Six, this would be a step forward to finding a policy solution to curb the power of food marketing to children as recommended by the WHO (World Health Organization 2012).

The experimental study gaps that have been highlighted in this section present unique opportunities for future research in this area, with the aim to investigate how food marketing influences children and, therefore, insight how best to intervene with policy in order to protect children from marketing’s negative effects.
Table 7.2: Experimental study research domains to investigate the effects of food marketing exposures on children’s awareness and attitudes by media platform and age-group

<table>
<thead>
<tr>
<th>Exposure outcomes by advertising media platform</th>
<th>Under 7 years</th>
<th>7-13 years</th>
<th>Over 13 years</th>
<th>Research questions</th>
<th>Research design</th>
<th>Experimental evidence examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Children’s awareness*</td>
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<tr>
<td>TV</td>
<td>X</td>
<td>✓</td>
<td>X</td>
<td>To what extent does exposure to food brands in [X advertising media platform] increase children’s brand recognition and recall after exposure? What persuasive techniques are used within the food advertisements that were most recognised by children and captured their attention?</td>
<td>Experimental studies with children to measure their free-recall and identification of food brand logos following familiar/unfamiliar food advertising exposure; comparison of different advertising content within media platforms</td>
<td>Chapter Six: Norman et al. 2018c</td>
</tr>
<tr>
<td>Multiple media: TV-only and TV and advergames</td>
<td>X</td>
<td>✓</td>
<td>X</td>
<td>How do children’s recognition and recall of food brands in [X advertising media platform] differ to their recognition and recall of food brands in [X advertising media platform]? How do different forms of food advertising in different media platforms add to and reinforce one another?</td>
<td>Experimental studies (as detailed in row above) with comparison between single media and multiple media platforms</td>
<td>Chapter Six: Norman et al. 2018c</td>
</tr>
<tr>
<td>Children’s attitudes*</td>
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<tr>
<td>TV</td>
<td>X</td>
<td>✓</td>
<td>X</td>
<td>How does exposure to food brands in [X advertising media platform] affect children’s perceptions and attitudes towards brands? How does exposure to food brands in [X advertising media platform] affect children’s perceptions and attitudes towards consumers of those brands? What persuasive techniques are used within the food advertisements that most appealed to children?</td>
<td>Experimental studies with children to measure their attitudes to brand, brand consumers, food products by using semantic differential scales before and after sustained exposure to familiar/unfamiliar food advertising; comparison of different advertising content within media platforms</td>
<td>Chapter Six: Norman et al. 2018c</td>
</tr>
<tr>
<td>Exposure outcomes by advertising media platform</td>
<td>Under 7 years</td>
<td>7-13 years</td>
<td>Over 13 years</td>
<td>Research questions</td>
<td>Research design</td>
<td>Experimental evidence examples</td>
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<tr>
<td>Multiple media: TV-only and TV and advergames</td>
<td>X</td>
<td>✓</td>
<td>X</td>
<td>How do children’s perceptions and attitudes towards food brands in [X advertising media platform] differ to their perceptions and attitudes towards food brands in [X advertising media platform]? How do different forms of food advertising in different media platforms add to and reinforce one another?</td>
<td>Experimental studies (as detailed in row above) with comparison between single media and multiple media platforms</td>
<td>Chapter Six: Norman et al. 2018c</td>
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</tbody>
</table>
7.5 Conclusion

This body of research adds new evidence to the policy debate about the need to restrict children’s exposure to unhealthy food marketing. Most importantly, this research has experimentally demonstrated the direct links between children’s food advertising exposure and an increase in children’s food consumption, of an amount that cumulatively could lead to the development of childhood overweight. All children in the multiple media condition in the study were affected by exposure to unhealthy food marketing regardless of their self-regulatory capacity. Furthermore, children with overweight and obesity had an increased susceptibility to the food advertising, leaving camp on the food advertising days with an energy imbalance over double the amount of children with normal weight. As described, the multiple media condition most closely models young people’s present-day media experiences; hence these findings are of particular importance.

The experimental research gaps that were identified by no means diminish the strength of the evidence base that already exists indicating a causal relationship between children’s food marketing exposures and negative food behaviours. Certainly, the literature review in this thesis confirmed the strong experimental evidence that exists for children aged 3-12 years, with exposure to marketing across a wide-range of media platforms consistently demonstrating significant, negative effects on children’s food preferences, choices and short term food consumption. These findings were reinforced by observational studies conducted among children 3-18 years, showing significant positive associations between marketing exposures and poorer usual dietary intakes. The studies that constitute this thesis make an important addition to this evidence. Indeed, as stated by the WHO, ‘there is unequivocal evidence that childhood obesity is influenced by unhealthy food marketing’ (World Health Organization 2016a). A strong regulatory response is clearly needed in Australia to protect children from unhealthy food marketing.
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APPENDICES

Appendix A: The published literature review

The Impact of Marketing and Advertising on Food Behaviours: Evaluating the Evidence for a Causal Relationship

Jennifer Norman1 · Bridget Kelly1 · Emma Boyland2 · Anse-T McMahon3

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Abstract The prevention of overweight in childhood is paramount to long-term heart health. Food marketing predominately promotes unhealthy products which, if over-consumed, will lead to overweight. International health expert calls for further restriction of children’s exposure to food marketing remain relatively unheeded, with a lack of evidence showing a causal link between food marketing and children’s dietary behaviours and obesity an oft-cited reason for this policy inertia. This direct link is difficult to measure and quantify with a multiplicity of determinants contributing to dietary intake and the development of overweight. The Bradford Hill Criteria provide a credible framework by which epidemiological studies may be examined to consider whether a causal interpretation of an observed association is valid. This paper draws upon current evidence that examines the relationship between food marketing, across a range of different media, and children’s food behaviours, and appraises these studies against Bradford Hill’s causality framework.

Keywords Food · Beverage · Child · Marketing · Advertising · Obesity · Causation · Bradford Hill

Introduction Cardiovascular disease (CVD) is largely preventable, yet, globally, it contributes to the greatest burden of premature mortality [1]. Modifiable, diet-related CVD risk factors include overweight and obesity and high consumption of saturated and trans fatty acids, refined carbohydrates and sodium [2, 3]. Establishing healthy dietary behaviours and maintaining a healthy weight in childhood is paramount for maximising heart health [4]; however, within our current food environment, this has never been more challenging.

Overweight is a natural response to today’s obesogenic environment [5]. Our food supply is dominated by inexpensive, highly processed, yet highly palatable, energy-dense nutrient-poor food products [6]. This food environment is all our current generation of young people have ever known; they are high soft drink, snack and fast food consumers [7, 8] and are more susceptible to overweight than ever before [9]. A risk that is highlighted by the fact that a positive energy gap of approximately 200–300 kJ a day is all that is needed for the development of overweight in children [10, 11].

The public face of this toxic food environment is food marketing. The ubiquitous promotion of unhealthy food establishes societal norms around acceptable and desirable foods [12, 13] and adverts serve as conditioned stimuli that trigger food cravings and cue an increase in food consumption [14•], particularly in children [15•]. The disparity between
food advertising expenditure for different food groups is extreme [13]; government campaigns promoting fruit and vegetables are dwarfed by the billions of dollars spent on fast food and ‘junk’ food marketing each year [16, 17]. The majority of these advertised foods and drinks are high in added fat, sugar and salt; are contrary to dietary recommendations; and, if eaten in excess, can contribute to overweight and the risk of developing CVD [18–21].

Restricting food marketing to children has been identified at the highest levels of international policy setting as a priority public health nutrition intervention [22, 23]. It is one of 25 targets set by the World Health Organisation to reduce non-communicable disease premature mortality by 2025 [24]. Some countries have shown leadership in policy action reform; however, the global response as a whole remains limited [25], stymied by the food and advertising industries actively contesting and undermining public health policies and programmes [12, 26, 27].

A large number of reviews over the past decade have assessed the relationship between different aspects of food marketing and its effect on children [15•, 28•, 29•, 30•, 31–34]. The most recent comprehensive systematic review concluded that there is strong evidence that food marketing affects children’s food purchases both at a food category and brand level and found modest evidence that it influences their food knowledge, preferences and choices; consumption behaviours; and diet-related health [32].

Despite this evidence, the difficulty in quantifying the relative contribution of food marketing on childhood obesity, and the establishment of a causal relationship between the two, are oft-cited reasons, by both governments [35, 36] and the food industry [37], for the limited action to restrict children’s exposure to unhealthy food marketing. The development of obesity is multi-factorial [5] and the pathway linking food marketing exposures to children’s weight is complex; most likely operating through sequenced and cumulative impacts over time, ultimately influencing the consumption of unhealthy foods [30•]. As such, the direct link to obesity is difficult to measure and quantify [30•]. Examining the evidence in relation to children’s food behaviours, in particular food consumption and intake, is, therefore, an appropriate way to investigate a causal link between unhealthy food marketing and children’s weight [31].

Ascribing cause and effect in many areas of epidemiology is difficult, where observational studies that identify associations between exposure and outcomes may be a result of reverse causation, chance, bias or confounding [38]. Conducting experimental studies with high ecological validity in this field of research is also difficult. Given the prolific and integrated exposure to food marketing in everyday life, isolating its effect in an experimental setting is challenging and, in the longer-term, expensive and methodologically difficult [39]. The ‘Bradford Hill Criteria’, first published 50 years ago, are a recognised and widely used framework against which epidemiological studies may be examined to consider whether a causal interpretation of an observed association is valid [40, 41].

In this vein, these guidelines have been widely used in the public health arena to explore whether causal links exist between an exposure of interest and a behaviour or health outcome [42–45]. This paper draws upon current evidence from meta-analyses, reviews and empirical studies that examine the relationship between food marketing, across a range of different media, and children’s food behaviours, including food preferences and choices, short-term food consumption and usual dietary intake. Included data are those published since the last systematic review in 2009, plus seminal papers prior to this date. Each study was reviewed and appraised according to the relevant Bradford Hill Criteria (Table 1). In this way, we categorise the evidence and examine whether there is a case to be made that a causal relationship exists between children’s exposure to food promotion and their subsequent food behaviours.

Evidence Review of a Causal Relationship Between Food Promotion Exposure and Food Behaviours

We considered the following Bradford Hill Criteria in our appraisal of the evidence: strength of association, experimental evidence, dose-response relationship, consistency, temporality, biological plausibility and coherence. As noted by Bradford Hill himself, these are not pre-requisites that must be satisfied before an association can be judged as causal but rather serve as prompts for considering the weight of the evidence to assess if cause and effect is a realistic and credible deduction [40].

Bradford Hill Criteria: Strength of Association

Observational Evidence

Observational studies have found statistically significant positive associations between children’s (3–18 years) exposure to food marketing and their food choice, consumption and usual intake [46–51], with effect sizes ranging from small (odds ratio (OR) <2) to moderate-strong (OR ≥3 or <4) [52]. Marketing exposure was assessed through either parental or self-report or using data on advertising patterns, including Gross Ratings Points (GRPs). GRPs give the proportion of the target audience reached by advertising for the category of interest in a specific geographic area during a certain time period (using this measure, an advertisement that reached 80 % of the specified audience and was shown 100 times during the year would have a GRP of 8000 (80 % × 100)) [50].

Longitudinal studies are considered to be the strongest non-randomised study design as these eliminate the possibility of
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<th>Bradford Hill Criteria</th>
<th>Relation to causality</th>
<th>Study type/evidence base</th>
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<th>Bradford Hill Criteria</th>
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<td>Temporality</td>
<td>Temporality is the one necessary criterion that must be met, that is, the exposure must precede the outcome [40].</td>
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<td>Longitudinal studies, experimental studies</td>
<td>Product placement: Mathies et al. 2015 [71]; Ahty and Lewis 2004 [72]</td>
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<td>Meta-analyses, experimental studies</td>
<td>Brand endorsements: Reviews: Smiths et al. 2015 [28]; Knuk and Stooy 2015 [29]</td>
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<td>Experimental studies (not included in the above reviews): Dixen et al. 2014 [73]; Elliott et al. 2013 [74]; Boyland et al. 2013 [75]</td>
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<td>Plausibility and Coherence</td>
<td>The presumptive causal relationship is strengthened if the suspected connection is biologically plausible and does not seriously conflict with currently recognised theory or knowledge [40].</td>
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<td>Premium offers: Gregori et al. 2014 [85]; Gregori et al. 2013 [84]; McAuliffe and Cornwall 2012 [76]; Hobin et al. 2012 [77]</td>
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<td>Specificity</td>
<td>Absence of specificity is not sufficient to reject causality—Hill notes that one-one relationships are not frequent [40].</td>
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<td>Internet pop-up ad: Tarbashkina et al. 2015 [82]</td>
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<td>This criterion was not evaluated in this review.</td>
<td>Longitudinal studies: Ouladou et al. 2014 [83]</td>
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reverse causality. However, we found limited evidence in this regard, identifying only one prospective cohort study from Sweden (baseline \( n = 1733 \) mean age 5.7 years) and 2-year follow-up \( n = 1333 \) [46]. Consuming sweetened beverages at least weekly at follow-up was predicted by exposure to commercial TV at baseline \( OR = 1.4, 95 \% CI 1.1–1.9 \) \((p < 0.001)\), independent of parental sweetened beverage consumption norms. In this study, cross-sectional analyses of baseline data found stronger effects, with exposure to commercial TV associated with drinking sweetened beverages at least weekly \( OR = 1.6, 95 \% CI 1.3–2.1 \)(\( p < 0.001 \)), compared with no commercial TV exposure. Where parents did not fully limit their children's exposure to commercials, the likelihood of drinking sweetened beverages at least weekly was more than double compared with children whose parents restricted their exposure completely \( OR = 1.9, 95 \% CI 1.4–2.6 \) \((p < 0.001)\). Parent proxy reports may have been subject to social desirability bias with reported screen time and sweetened drink intakes lower than national comparative data. As such, the strength of the association would have been attenuated.

Similar trends were seen in the following studies when children self-reported exposure to food marketing (either on TV, print, on public transport, at school or digitally) and their usual food intake and/or purchase requests for promoted products [47–49].

An Australian study \( n = 12,188, 12–17 \) years found that compared with children who did not watch commercial TV, average viewers \( \leq 2 \) h/day were more likely to report asking for a food product they had seen advertised in the last month.
(OR 1.25, 95% CI 1.10–1.42 (p < 0.01)), whilst more frequent viewers (>2 h/day) were more likely to have both asked for (OR 1.61, 95% CI 1.38–1.88 (p < 0.001)) and tried a new food product they had seen advertised (OR 1.48, 95% CI 1.27–1.71 (p < 0.001)) [49]. Stronger associations were seen between exposure to all forms of non-broadcast (non-TV) marketing and children’s food choices, particularly in children with greater than two exposures in the last month (ORs 2.48–3.74 (p < 0.001)). The stronger association with digital marketing could be as a result of the personalisation of these messages and the interactive content [53].

Another Australian study (n = 417, 10–16 years) showed a significant positive association between watching commercial TV when children did not skip through advertisements, and unhealthy dietary intake (F [3, 307] = 5.44, p = 0.001). In contrast, watching commercial TV without advertisements was not linked to poor diet and non-commercial TV was only weakly associated with unhealthy foods and drink intake [47]. This pattern was also observed in a study of young people from three European countries (n = 2851, age 8–21 years) with those exposed to all types of unhealthy TV food advertising having a higher consumption of fast food, snacks and soft drinks of up to 1 unit per week compared to unexposed participants (p = 0.001) across all countries [48].

The reliance of these studies on self-report and recall gives potential for measurement error with underreporting of dietary intake [54] and for true exposure to marketing to be underestimated [55] likely diminishing the strength of associations and attenuating results to null hypothesis. Conversely, there is also the possibility of some recall bias, with children who consume more unhealthy foods potentially being more likely to remember advertisements for these products.

A US study (n = 9760, mean age 11.2 years) took a different approach [50]. Dietary intake data from a national cohort study was compared with annual GRPs for spot advertising for sugary drinks and fast food restaurants purchased for the survey year and the preceding 2 years. For soft drink intake, an increase in exposure to advertisements for soft drink by 10,000 GRPs over the 3 years (equivalent to 100 advertisements over 3 years) was associated with a 9.4% increase in children’s consumption of soft drinks (p < 0.01). Advertisements for fast food were also associated with increased soft drink intake.

There is a risk that observed associations may have been due to confounding by other correlated dietary and lifestyle factors; however, factors such as such as age, gender, weight, socio-demographic characteristics and total TV viewing were typically adjusted for in multivariate analyses across the studies described.

Experimental Evidence

Associations seen in observational studies are supported by a strong, rigorous experimental evidence base. A recent meta-analysis reviewed the effects of acute exposure to unhealthy food advertising on food and drink consumption in children and adults [15]. Sixteen experimental studies reported outcomes in children: 12 on TV and 4 on Internet advergames (an advergame is an industry designed online game with the brand embedded as a central component, such as a game piece). Twelve of these studies found unhealthy food advertising had a significant effect on food consumption, with children consuming a greater amount of food after seeing food advertising compared with controls (standardised mean difference 0.56; p = 0.003; 95% CI 0.18, 0.94; F2 = 98%). Publication bias was ruled out with no signs of missing studies. Food advertising on TV and advergames was seen to have a significant effect on children’s food consumption with a moderate magnitude.

Similarly, our review of experimental evidence, presented below, uncovered that exposure to marketing across multiple platforms strongly influenced children’s food preferences, choices or food consumption. This included studies that manipulated exposures to TV advertising [56–66]. Internet advergames [67–70], product placement in movies [71, 72], brand endorsers [29, 29], [73–75] and premium offers [76, 77].

Experimental Studies Using TV Advertising A series of studies by a UK research group consistently showed significant increases in children’s immediate food consumption (p < 0.001) following exposure to unhealthy food advertising embedded in cartoons, across two different age ranges (5–7 and 8–11 years) [63–65]. In these studies, children, on average, consumed 16% more kilojoules after exposure to food adverts compared with control toy adverts, in within-person crossover design trials. An increased effect was commonly observed amongst overweight and obese children, although this difference in intake by weight status was only seen in unhealthy food advertising conditions.

A more recent UK study examined TV advertising effects amongst children who had higher than usual exposures to marketing, as determined by volume of TV watched [57]. This study (n = 281, 6–13 years) demonstrated that food advertisements increased the preference for branded, energy-dense foods particularly in children who watched more TV (>21 h per week) (p < 0.001) [57].

Similarly in the USA, children (n = 108, 7–11 years) were shown cartoons embedded with either food or non-food advertisements and were given a bowl of crackers, which they could eat whilst watching [62]. Children ate 45% more during the food advertising condition (p = 0.01), regardless of weight status.

Experimental Studies Using Internet Advergames The significant effect of unhealthy food Internet advergames on children’s subsequent food intake has been demonstrated [67–70].
A US study \((n = 121, 7-12\text{ years})\) found that children who played a branded unhealthy food game ate over 50% more energy-dense snack foods (322 kJ) than those who played a similar healthy food game \((p < 0.05)\) [70]. Likewise, children \((n = 270, 8-10\text{ years})\) in a Dutch study ate more \((p < 0.001)\) after playing a game promoting energy-dense foods compared with a non-food game \((284\text{ kJ} (55\%))\) and with the no-game control group \((316\text{ kJ} (57\%))\) [67].

**Experimental Studies Using Product Placement** Two European studies have shown the effect of product placement in movies on subsequent soft drink selection [72] and food choice and consumption [71]. After watching a two minute movie, children \((n = 57, 11-12\text{ years}; n = 48, 6-7\text{ years})\) who were exposed to a Pepsi product placement were more likely to choose Pepsi as a drink \((p = 0.04)\) [72]. The second study showed children \((n = 121, 6-14\text{ years})\) a 7-min excerpt from a popular children’s movie that contained a product placement for the savory snack, Utz Cheese Balls. Exposure to the product placement exerted a significant effect on snack consumption \((p < 0.05)\).

**Experimental Studies Using Brand Endorsers** The strength of the effect of branding, in the form of brand mascots and characters, cartoon media characters, and celebrity or sports endorsers, on children’s food behaviours has been reported in two recent systematic reviews [28*•, 29]. The reviews examined 18 experimental studies (for children aged between 3 and 12 years) with a wide heterogeneity of design. They concluded that the evidence clearly demonstrates that brand endorsers have the persuasive capability of increasing children’s liking of, and preference for, foods they endorse. Particularly strong effects were seen when familiar media characters were paired with energy-dense, nutrient-poor foods.

The power of branding was demonstrated in a study of American pre-schoolers \((n = 63, 3-5\text{ years})\), where they were asked to rate the taste of identical foods, with or without the McDonalds logo [78]. After tasting the foods, children were significantly more likely to state that the McDonalds branded foods tasted better than the matched plain-packaged pair \((p < 0.001)\) for both healthy and non-healthy foods. This study was replicated in Canadian children \((n = 65, 3-5\text{ years})\) with similar findings, but noting highly colourful packaging, as typically found in non-healthy foods targeting children, was also influential [74].

A UK study \((n = 181, 8-11\text{ years})\) demonstrated the strength of the effect of exposure on TV to a sports celebrity endorser and found that significant consumption effects \((p < 0.05)\) were not only seen after exposure to the endorsed commercial but also after TV footage of the endorser in his role as a presenter [75].

**Experimental Studies Using Premium Offers** The strength of toy premiums on children’s food choices has been demonstrated in two different age ranges. When presented with ‘meal-deal’ images, young children \((n = 56, 3-5\text{ years})\) were more likely to favour both healthy \((p < 0.01)\) and unhealthy \((p < 0.001)\) meals when they were paired with a collectible toy, compared with foods paired with a non-collectible toy or no toy [76]. At a holiday camp, older children \((n = 337, 6-12\text{ years})\) were offered a choice from two unhealthy and two ‘healthier’ McDonalds Happy Meals [77]. When all meals were paired with a toy, 19% of children chose the ‘healthier meals’ compared with 40% when the toy was only offered with the ‘healthier’ meals \((OR = 3.19, 95\% CI 1.89-5.40)\) \((p < 0.0001)\).

**Bradford Hill Criteria: Experimental Evidence** A vast body of robust experimental research has been conducted, largely by research groups in the UK [57, 59, 63-65, 72, 75, 79] and also in the USA [62], the Netherlands [60, 61], Australia [73], Austria [71], Canada [58, 66, 74], and Chile [56] amongst a range of different ethnic populations [28•, 29, 62, 70]. All these studies demonstrated significant effects on children’s food behaviours from exposure to a wide range of advertising media and promotions. As reported above, the majority of these studies examined the acute, short-term effects of marketing on children’s food behaviours (3-12 years). Many utilised between-subject study designs with children randomised to conditions \((n = 63-1302)\) [56, 60-62, 66-77]; the remainder within-subject, counterbalanced designs with randomisation to condition order with a washout period of more than 2 weeks \((n = 42-281)\) [57, 59, 63-65, 79]. In the main, studies have been conducted in familiar settings such as schools, childcare centres or school camps [57, 59-65, 68, 69, 71-73, 75, 79].

As previously mentioned, conducting experimental studies in this domain over longer periods is methodologically challenging and expensive [39] and, as such, research of this nature is limited. Two studies, however, give insight to the longer effects of food advertising exposure. The first study conducted at a Canadian children’s camp over a 14-day period in 1982 \((n = 288, 5-8\text{ years})\) saw children who were exposed to 5 min of candy advertisements daily select significantly less fruit as a snack, compared with children in other advertising conditions (healthy food and non-food ads) \((33-36\%, p < 0.001)\) [66]. A second Canadian ecological study compared household food purchases in the predominantly French-speaking province of Quebec \((n = 5024)\) (which has a ban on food advertising to children) with the neighbouring, predominantly English-speaking province of Ontario \((n = 9177)\) (without a ban) [58]. French-speaking households with children in Quebec had a 13% \((p < 0.05)\) lower propensity for purchasing fast food compared with equivalent
French-speaking households in Ontario: this equates to 40,691 fewer households in Quebec purchasing fast food per week in 1992, translating to an estimated reduction of fast food purchases of $88 million per year.

**Bradford Hill Criteria: Dose-Response**

Dose-response relationships were identified in a number of cross-sectional studies. An Australian study (n = 417, 10–16 years) [47] demonstrated that every hour of commercial TV viewing per week was associated with a 0.067 unit increase in unhealthy diet score; with food and drink scores calculated from reported frequencies for commonly advertised unhealthy products.

This trend was also observed amongst young Swedish children (n = 1733, mean age 5.7 years) with the odds ratio for at least weekly consumption of sweetened beverages being 1.5 (1.2–1.9) for each hour of TV watched per day. Further, exposure to commercial channels was independently associated with sweetened beverage consumption, regardless of the amount watched [46].

Another US study (n = 9760, mean age 11.2 years), which used purchased advertising data [50], found an increase in exposure to fast food ads by 100 advertisements over 3 years was associated with a 1.1% increase in children’s consumption of fast food (p < 0.1). The same increase in exposure to adverts for soft drinks increased fast food consumption by 7.4% (p < 0.05).

This pattern was further shown in another Australian study (n = 12,188, 12–17 years) [49]. As children’s exposure to both commercial TV and non-broadcast advertising increased, so too did their intakes of commonly advertised foods or likelihood of requesting or trying advertised foods (all p < 0.001). For example, with an increase from one to two digital marketing exposures, the odds ratios increased from 1.34 to 3.19 for children being likely to ask for an advertised food and from 1.47 to 2.54 for children being likely to try them. Likewise, this trend was also observed in a recently published Malaysian study (n = 402, 7–12 years), for every additional hour of TV viewing, there was a 6% increase (OR 1.06 (1.04–1.08) (p < 0.05) in the likelihood of children liking and asking their parents for advertised non-core food products [80].

Experimental studies have also demonstrated dose-response relationships across different media. The effects from playing branded advergames were increased for children who had played them previously: these children consumed 577 kJ more from unhealthy snack foods than those who played healthy or non-food advergames [70]. The authors suggest that familiarity makes game play more automatic and, potentially, the advertising message becomes more noticeable strengthening the effect.

High-frequency product placement in a movie had an increased effect on consumption. Given the choice of three similar snacks, 45% of children consumed the advertised product after high-frequency exposure compared with 31% after a lower-frequency product placement and 18% in the control condition (p < 0.05) [71]. Similarly, combined exposure to McDonald’s food product placement plus McDonald’s TV advertising saw children’s (n = 483, 9–15 years) intention to consume fast food increase from 18% (control condition) to 47% (single exposure) to 54% (p < 0.05) [56], and for their intention to consume McDonald’s increase from 38% (control) to 45% (single exposure) to 57% (combined exposure) (p < 0.05).

**Bradford Hill Criteria: Consistency of Evidence**

Evidence from observational and experimental studies on the association between food marketing exposure and food consumption behaviours is highly consistent. Significant positive associations were seen in observational studies across a range of populations and countries, using a variety of instruments and methods to measure exposures to marketing and food behaviours in children aged 3–18 years [47–51, 80, 81]. Similarly, experimental studies have shown significant effects from exposure to TV advertising, Internet advergames, product placement, branding and premium offers on children’s food preferences, choices and short-term food consumption in children aged 3–12 in a variety of different populations [28, 29, 56–78, 82]. These results have been demonstrated consistently across heterogeneity of study designs: within- and between-subjects, varying lengths of advertising exposure, and in a large variety of conditions and settings.

A small percentage of studies were inconsistent with other findings. A Korean cross-sectional study (n = 2419, 11–13 years) found that all associations between food advertising and reported intake disappeared after adjusting for the amount of television watched [83]. Two identical experimental studies in Latin America (n = 609, 3–10 years) [84] and India (n = 1680, 3–11 years) [85] found no significant association between TV food advertising exposure and children’s subsequent snack food consumption. In these studies, children were exposed to varying amounts of food adverts embedded within a cartoon programme, presumably to assess if snack intake increased with increasing exposures. However, the absolute exposure to food advertisements was minimal (between 0 and 3 ads). Half of the children were also given a toy with their snack and this did not increase intake of the food. However, toy premiums are known to encourage purchase and choice rather than stimulate consumption once the product is obtained [33, 76]. Further, an Australian study (n = 354, 7–13 years) which explored the effect of a pop-up Internet advertisement on children’s subsequent snack choice found that although exposed children chose the advertised food more frequently than the control group, differences did not reach significance [82]. Further analysis revealed a significant result (p < 0.001) in a subset of children who had low nutrition.
knowledge and were hedonism-oriented, with obese children more likely to belong to this group \( (p = 0.037) \).

**Bradford Hill Criteria: Temporality**

The temporal relationship between food advertising and subsequent food behaviours is clearly established. A number of randomised controlled studies, discussed in this paper, have shown significant effects on children’s food behaviours after showing them unhealthy food advertising on TV \([37, 59, 63-66, 79]\), in advergames \([67, 69, 70]\), as product placements \([71, 72]\) and as branding in the form of celebrity endorsements \([73, 75]\). The one longitudinal study included in this paper also confirms this relationship \([46]\).

**Bradford Hill Criteria: Biological Plausibility and Coherence**

Evidence suggests that young children are predisposed to prefer foods that are sweet and salty, particularly those that are high in energy density (e.g. high fat) \([86]\). These food preferences, however, are malleable and can be shaped through experiential learning from exposure to different foods \([87]\). Food and beverage advertising is predominately for foods that are high in added fat, sugar and salt \([18-21]\), and exposure promotes these foods as being a normal part of daily intake and potentially undermines healthy nutrition messages \([13]\).

Eating patterns are established early in life, generally extending into adulthood, and there is evidence that food marketing negatively influences the food environment and has a bearing on how children’s dietary patterns evolve \([33]\). It is a hedonistic, not a homeostatic need, that is the main driver to consume these types of foods, with highly processed foods of this nature more likely to prompt overeating than healthier, less processed foods \([88]\).

Food promotion is typically characterised by mouth-watering images of food, catchy music, humour, positive imagery and celebrity endorsements: content likely to promote positive, emotional associations, with both brands and products \([89]\). Contemporary social cognitive theories suggest that repeated exposure to this type of promotion can lead to changes in attitudes, beliefs and behaviours without a conscious, deliberate processing of the information presented \([90-92]\). Children are more likely to process food advertisements through this implicit route and so less likely to be able to defend themselves against its effects \([93, 94]\).

Cue- Reactivity Theory proposes that food-related cues prompt cravings for food and induce subsequent food intake via previously conditioned responses \([95, 96]\). The strength of the influence of cue-reactivity and how it can explain behavioural responses to food advertising has been demonstrated in a recently published quantitative meta-analysis that assessed the predictive effects of food cue reactivity and craving on eating and weight-related outcomes \([11, 12]\). Results found that cue-condition and cue-reactivity paradigms had medium to large effects on eating \( (r = 0.32, 95\%\ CI \ 0.26-0.39, z = 9.38, p \ < 0.001) \) and weight outcomes \( (r = 0.51, 95\%\ CI \ 0.26-0.69, z = 3.69, p < 0.001) \). Visual food cues (e.g. images and videos) were as strongly related to food behavioural outcomes as reactivity to real-food exposure.

These theories are reinforced by recent functional magnetic resonance imaging (fMRI) studies. Areas of the brain related to both reward and cognitive control have been shown to be activated in children in response to food commercials \([97]\) and food logos \([98, 99]\), with obese children showing more pronounced responses to food logos \( (p < 0.01) \) \([98]\).

**Bradford Hill Criteria: Specificity**

This criterion was not evaluated in this review. Food marketing is one of many intra-, inter- and environmental determinants which have the potential to affect dietary behaviours \([5, 100]\). Bradford Hill notes that the absence of specificity is not sufficient to reject causality with one-to-one relationships not frequently observed \([40]\).

**Conclusions**

The current evidence on exposure to food marketing and children’s food behaviours, when examined together, satisfies all key criteria commonly used to evaluate causal relationships in epidemiology. As such, there is compelling evidence that the two are causally related. The experimental evidence base is particularly strong for children aged 3–12 years, with exposure to marketing across all media platforms consistently demonstrating significant, negative effects on food preferences, choices and short-term food consumption. Observational evidence for children aged 3–18 years, in addition to confirming these findings, also shows the presence of significant positive associations between marketing exposure and poorer usual dietary intakes.

This review also highlights where gaps in the evidence base exist. Specifically, there is a lack of longitudinal evidence and experimental studies that investigate outcomes in adolescents and in the longer term, particularly whether the demonstrated acute increases in food consumption are not compensated for at later eating occasions leading to net energy imbalance. However, as previously noted, studies of this nature would be methodologically challenging and, in the case of longer studies, expensive. There is also a scope for further studies to assess the impact of other forms of online marketing. Despite these evidence limitations, the sum of the evidence appraised against the Bradford Hill criteria, and the particularly strong evidence base for children aged 3–12 years, substantiates the call at the highest levels for tighter
restrictions on all forms of food marketing to children. We concur with other public health advocates that it is time to shift the locus of responsibility for childhood obesity away from the individual and towards those that control the food system and resultant obesogenic environment [27].

Compliance with Ethical Standards

Conflict of Interest Jennifer Norman declares that she has no conflict of interest.

Emma Boyland declares that she has no conflict of interest.

Anne-T McMahon has received financial support through grants from the Australian Meals on Wheels Association and the University of Wollongong and has received compensation from Pork CRC, Proportion Foods, Fagstaff Fine Foods, and IRT for conducting qualitative research studies and from Yum! Corporation for service as a consultant in the development of a Nutrition Advisory Board.

Human and Animal Rights and Informed Consent This review contains some studies with human subjects performed by Dr Kelly and Dr Boyland. There are so animal studies included in this article.

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Papers of particular interest, published recently, have been highlighted as: • Of importance

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Appendix B: The published article: Sustained impact of energy-dense TV and online food advertising on children’s dietary intake

Sustained impact of energy-dense TV and online food advertising on children’s dietary intake: a within-subject, randomised, crossover, counter-balanced trial

Jennifer Norman1*, Bridget Kelly1, Anne-T McMahon2, Emma Boyland3, Louise A. Baur4, Kathy Chapman5, Lesley King6, Clare Hughes7 and Adrian Bauman8

Abstract

Background: Policies restricting children’s exposure to unhealthy food marketing have been impeded by the lack of evidence showing a direct link between food advertising exposure and children’s energy intake and body weight. Food advertising exposure increases children’s immediate food consumption, but whether this increased intake is compensated for at later eating occasions is not known; consequently the sustained effect on diets remains unclear.

Methods: We conducted a within-subject, randomised, crossover, counterbalanced study across four, six-day holiday camps in New South Wales, Australia between April 2016 and January 2017. Children (7–12 years, n = 160) were recruited via local schools, email networks and social media. Two gender- and age-balanced groups were formed for each camp (n = 20), randomised to either a multiple- or single-media condition and exposed to food and non-food advertising in an online game and/or a television cartoon. Children’s food consumption (kilojoules) was measured at a snack immediately after exposure and then at lunch later in the day. Linear mixed models were conducted to examine relationships between food advertising exposure and dietary intake, taking into account gender, age and weight status.

Results: All children in the multiple-media condition ate more at a snack after exposure to food advertising compared with non-food advertising; this was not compensated for at lunch, leading to additional daily food intake of 154 kJ (95% CI 80–308, p = 0.001, d = 0.2). Exposure to multiple-media food advertising compared with a single-media source increased the effect on snack intake by a difference of 182 kJ (95% CI 46–317, p = 0.009, d = 0.4). Food advertising had an increased effect among children with heavier weight status in both media groups.

Conclusion: Online (advergame) advertising combined with TV advertising exerted a stronger influence on children’s food consumption than TV advertising alone. The lack of compensation at lunch for children’s increased snack intake after food advertising exposure suggests that unhealthy food advertising exposure contributes to a positive energy-gap, which could cumulatively lead to the development of overweight.

Trial registration: Australian New Zealand Clinical Trials Registry, number ACTRN12617001230347 (Retrospectively registered).

Keywords: Food advertising, Advergame, Children, Food intake, Dietary intake, Childhood overweight, Childhood obesity

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Background

Overweight is, arguably, the natural response to our food environment [1] which is dominated by low-cost, ultra-processed, energy-dense, highly palatable food products [2]. Food marketing most commonly promotes these high fat, high salt and high sugar foods [3]. Worldwide, television is still the main platform for food advertising [3, 4], however, the proliferation of digital technologies, including the Internet and mobile devices, has seen an increasing prevalence of food advertising on ‘new media’ [5]. In recent years, advergames have been introduced as an online marketing tool, where the brand and/or product is a prominent feature [6]. This high prevalence of unhealthy food promotion propagates societal norms where advertised high energy and low nutrient dense foods are acceptable and desirable [6]. Advertisements also serve as conditioned stimuli, which stimulate food cravings and cue consumption [7].

Restricting children’s food marketing exposure has been identified as an international policy priority for the prevention of childhood overweight and obesity [8, 9]. However, few countries have enforced statutory regulations and, globally, major regulatory reform essentially remains un-implemented, with most countries relying on industry-led pledges for responsible advertising [10]. Research evidence indicates that these industry pledges have not been effective in reducing children’s exposures to unhealthy food marketing [10, 11]. As such, children continue to be exposed to high levels of unhealthy food marketing across a wide variety of media and settings [11], to promotions they find highly appealing and engaging [3]. A growing body of evidence indicates that food marketing affects children’s food attitudes, preferences and consumption [3, 12], most likely through a logical, cumulative sequence of cognitive and behavioural responses [13]. A key issue impeding policy change, however, is the shortage of evidence showing a direct link between food marketing and children’s energy intake and the sustained effect of exposures on children’s body weight [14]. Brief exposure to food advertising on TV or Internet advergames has an immediate direct effect on children’s food consumption, significantly increasing their intake of snack foods [15], but whether or not this increased energy intake is compensated for at later eating occasions is not known. Many of these single exposure experimental studies have been conducted in laboratory settings and have not accounted for the cumulative effects of media exposures or the impact of repeated exposures across multiple media.

Economic modelling suggests that limiting food marketing to children would be one of the most cost-effective population-based strategies to reduce the prevalence of childhood obesity, resulting in both children’s health gains and health-service savings [16]. Data that were used to calculate these cost-benefits are now over three decades old, being derived from the only longer-term experimental study in this field, conducted at a children’s holiday camp in Canada in 1982 [17]. The advertising landscape of 2018 is vastly different [5] and up-to-date data is needed for contemporary economic modelling studies. Conducting longer-term experimental studies in this field, however, is methodologically challenging and resource intensive and, as such, research of this nature is limited [13].

This study aimed to document children’s dietary intake over a period of six days during their time at a holiday camp, following exposure to food and non-food advertising from online (advergames) and/or TV media platforms. There were three main objectives for this study. First, we tested the hypothesis that children would eat more at a snack after food advertising exposure compared with non-food advertising. Secondly, we hypothesised that exposure to food advertising across multiple media would have an increased effect on children’s immediate snack intake compared with those only exposed to food advertising from a single media source. Thirdly, this study measured if any increased energy consumed as a result of exposure to food advertising was compensated for by children consuming less energy at the later lunchtime eating occasion, and hence identified whether food advertising exposure resulted in a positive energy balance during their time at camp.

Methods

Study design, participants and materials

The study took place across four, six-day school holiday camps, from 8 am to 1.30 pm each day, between April 2016 and January 2017, at a single location in New South Wales (NSW), Australia. We partnered with the University of Wollongong Children’s Sports Holiday Camp and the Early Start research centre. Early Start is a child-focused research facility incorporating a large commercial kitchen, dining area and community engagement rooms. Both the camp and research centre are located on the same campus, within five minutes’ walk of each other.

Participant recruitment took place in the month preceding each holiday camp period, in March, June, July and December 2016. A total of 160 children, (78 female, 82 male), aged 7–12 years (9.3 ± 1.6 (mean ± SD)), were recruited into the camp (n = 40/camp) via local schools, community and university networks and social media. Children were deemed eligible if they were able to attend the camp on all days; did not report having any food allergies or intolerances or medical conditions affecting what they could eat; had no dietary restrictions or dislike of the study foods; and were able to sit still and focus on a task for at least 15 min. Incentives for participants included payment for their holiday camp fees and the opportunity to enter a draw to win an iPad at the end of each camp.
Children were only permitted to participate once in the study, attending only one of the holiday camps during the data collection period. The study protocol was approved by the University of Wollongong Human Research Ethics Committee and can be accessed at http://www.ANZCTR.org.au/ACTRN12617001230347.aspx. Informed written consent from parents was obtained for all participants.

The study was a within-subject, randomised, crossover, counterbalanced trial with two media condition arms: multiple media (TV plus adventure game) or single media (TV only) (Fig. 1). Each media arm had two conditions: control (an adventure game featuring a non-food brand and/or exposure to ten non-food TV advertisements) and experimental (an adventure game featuring an unhealthy food brand and/or exposure to ten unhealthy TV food advertisements). Food products in the experimental condition were classed as high in fat, salt and/or sugar in accordance with the nutrient profiling criteria developed by Food Standards Australia New Zealand [18]. Non-food advertisements were selected on the basis that they used persuasive techniques such as fun, action and promotional characters; themes that are commonly used in food advertisements to appeal to children [19]. (A list of the advertised products that were used is detailed in Table 1.) The TV advertisements (approximately 30 s each) were embedded within a ten minute age-appropriate, gender-neutral cartoon and shown each day. There were no references to, or depictions of, foods or eating in any of the cartoons screened. In order to isolate the effects of the study advertising exposure, the branded products selected for the experimental condition were real products available in other countries but not available for sale in Australian supermarkets or advertised on commercial TV within Australia. Two groups of 20 children were formed for each camp, with an approximate even spread of gender and age between groups. A simple, manual randomisation method was used, with the first group drawn out of a hat allocated to the single media intervention. This was conducted by an independent researcher not associated with the study. Children undertook both advertising conditions in each intervention arm, with the order of advertising condition counterbalanced across holiday camps. The study protocol, including menu items, was finalised following a pilot study with 30 children in January 2016.

An online brand recognition tool was designed to assess children’s recollection of the advertised food brands,
Table 1 Branded products featured in advertisement and TV advertisements in each condition

<table>
<thead>
<tr>
<th>Experimental (Food Advertisement Condition)</th>
<th>Control (Non-Food Advertisement Condition)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nesle Kokokunch cereal</td>
<td>Lego</td>
</tr>
<tr>
<td>McCWies Delicorrr biscuit</td>
<td>The North Face sports warm</td>
</tr>
<tr>
<td>Burger King Meal Deal</td>
<td>Vodafone/Ireland</td>
</tr>
<tr>
<td>Taco Bell Smart Phone App</td>
<td>Speedo sportwear</td>
</tr>
<tr>
<td>Mc Coy’s crisps</td>
<td>Visit England</td>
</tr>
<tr>
<td>Nesle Kokokunch cereal</td>
<td>O2 telecommunications</td>
</tr>
<tr>
<td>Hershey’s chocolate spread</td>
<td>British Airways</td>
</tr>
<tr>
<td>McCWies BN biscuit</td>
<td>Bloomingbales</td>
</tr>
<tr>
<td>Wilkens Allup rice</td>
<td>Mini</td>
</tr>
<tr>
<td>Hula Hoops savoury snack</td>
<td>Disney Cruise Line</td>
</tr>
<tr>
<td>Maynards Dicorcery Patch confectionery</td>
<td>Petplan insurance</td>
</tr>
</tbody>
</table>

both pre and post study. Children were asked: a) if they recognised 20 different photographs of both food and non-food logos, and b) to describe the product to which the logo related. This was based on a validated food brand recognition instrument [20].

Children’s height and weight were measured on Day 1 of the study. Children’s body mass index (BMI) was calculated and these values were used to classify children into underweight, normal weight, overweight or obese categories using international standardised cut-points [21].

Children reported how hungry they felt prior to morning tea and lunch each day using a validated picture-rating scale; with the anchors “I am really hungry” and “I am not hungry at all” [22].

Procedure

Each morning children arrived fasting at the research centre at 8 am, where they were served breakfast. The dining space was set up with 40 individual trays and, each day, children were offered a selection of portioned breakfast cereals, fruit, toast or pikelets, spreads and water to drink. The children were told that they could eat as much or as little as they liked, and were given more of each food item as requested. All additional food items were offered in pre-portioned amounts that were the same size for all children. Children were allocated a unique identifying number which was placed on their meal tray at each eating occasion and used to track how much each child ate daily. After 30 min, the children left to participate in the nearby holiday camp activities. Camp leaders ensured that the physical intensity of camp activities was similar each session and day of the sports camp. Children’s breakfast intake was quantified by assessing whether children had eaten all, more than half, half, less than half or none of each food item. Visual estimation methods have been demonstrated to be a valid and highly reliable method for estimating children’s food and beverage consumption of pre-portioned food items [23]. Kilojoules (kJ) were estimated from the proportion of each standardised food item consumed, and children’s mean breakfast intakes for the three days of food and three days of non-food advertising were estimated.

At mid-morning children were directed to their intervention rooms in the research centre with each room supervised by two research assistants. The rooms were bright and colourful with a carpeted floor and a large, wall mounted TV screen. Children in both intervention rooms were asked to take a seat on the floor and to report how hungry they felt by filling out the picture rating scale [22]. Children were then told that they would be watching a cartoon and some advertisements. Once the cartoon had finished, iPads were distributed to the children in the multiple media condition and, after an explanation on how to play, they played as advergame for 5 min. In both rooms, after media exposure was complete, individual trays with six small bowls of snack foods were given out. Bowls contained 50 g of each of the following foods: high fat savoury (crinkle-cut crisps, plain potato crisps or chicken-flavoured crackers); low fat savoury (pretzels, plain crackers or rice crackers); high fat sweet (milk chocolate, chocolate-covered biscuits or sugar-coated chocolate confectionery); low fat sweet (assorted jelly lollies); fruit (green and black grapes or peeled mandarin segments); and vegetable (carrot sticks). These selections were in line with previous studies [24]. Snack items offered on Day One were matched with those offered on Day Four: Day Two with Day Five and Day Three with Day Six. None of the brands offered to children to eat were featured in any of the advertisements. Children were asked to wait until everyone had their trays before they could start eating. They were, again, told that they could eat as little or as much as they liked, and if they would like some more they should put their hand up and they would be given more of the requested food. This was the only time either food or eating was referred to by the research assistants. All additional foods were pre-weighed in advance of the morning tea period. Advertisements were not discussed with the children. Eating time was limited to 15 min after which children were instructed to leave the room. Afterwards children left to take part in further holiday camp activities and the remaining food on each child’s tray was weighed and recorded.

Lunch was served at 13.00 each day back in the research centre. Once again 40 individual trays were set up with pre-weighed food items. There was a different menu for Days One to Three which was repeated on Days Four to Six. Lunch items included fruit, vegetables, yoghurt and healthier versions of fast food, e.g. low fat...
beef burger; oven baked chicken pieces and chips. Each day prior to lunch, children completed the picture rating scale to report how hungry they felt [22]. As with the previous meal occasions, children were told that they could eat as little or as much as they liked and if they would like some more to ask and they would be given more of the requested food. Again, all additional food items were pre-weighed prior to the lunchtime period. Parents arrived to pick children up at 13:30. Once children had left, all remaining individual food items were weighed and recorded. We did not collect dietary data from children once they left camp for the day.

Children’s morning snack and lunch intakes were converted from grams amounts to kJ using FoodWorks 8 nutrient analysis software.

Children completed the online brand recognition questionnaires at home prior to the study commencing and in the week following the study’s completion and a brand recognition score was calculated. Parents reported their household weekly income via an online questionnaire at the end of the study.

Outcomes

There were two primary outcomes: firstly whether there was an increase in snack intake (kJ) after food advertising exposure compared with non-food advertising exposure and secondly, if any increased intake was compensated for at the lunchtime meal. The secondary outcome was whether there was an increased effect on energy intake (kJ) from exposure to food advertising over multiple media compared with a single media source.

Statistical analysis

The sample size, with sufficient statistical power (80%) to assess the first primary outcome, with a significance of 0.05, was estimated from published data from a similar, short-term advertising exposure feeding trial in the UK using the differences in kJ reported between conditions [25].

Each child’s mean snack and lunch intakes for the three days of food advertising exposure and three days of non-food advertising exposure were calculated. All intake data met normality assumptions. Analysis of the primary and secondary outcomes was conducted using linear mixed models, adjusting for the clustered nature of the data (i.e. camp identifier was included as a random intercept in the models). The linear mixed models were used to examine the differences in snack intake (kJ) between the two media groups and the differences in the snack and lunch intakes (kJ) between advertising conditions within each group. Any influence of the impact of age (months), gender, weight status (BMI z-score), children’s baseline brand recognition score, household weekly income or hunger on snack intake was investigated by adding these variables as covariates to the model. All analyses used a significance level of 0.05. All analyses were completed using the Statistical Package for the Social Sciences statistical software package, version 23 (SPSS Inc., Chicago, IL, USA).

Results

Of the 160 children enrolled in the study, six did not complete all six days of the camp, so their data were not included in the final analysis (Fig. 1). Table 2 depicts the completing participants’ characteristics across the two media condition groups. The proportion of children with overweight or obesity in our study (16%) was lower than the NSW state average (23%) [26]. The median household income of all families in the study was between $2000–2499 per week which was substantially higher than the NSW median household income of $800–999 per week [27].

As a whole group (n = 154), children’s estimated mean kJ intake at breakfast on the food advertising days (1356 ± 500 kJ) was similar to intakes on non-food advertising days (1300 ± 500 kJ) (p = 0.079).

A significant main effect for media condition was found. Children in the TV plus advergame group (n = 78) ate more at the snack after food advertising compared with non-food advertising than the TV only group (n = 76) (additional 182 kJ (95% CI 46 to 317)) (p = 0.009, d = 0.4) (Table 3). Consequently, data were analysed separately by media condition. Age, gender, brand recognition score at baseline and household weekly income had no significant main effect or interaction and were removed from further analyses.

Children’s reported hunger prior to advertising exposure was related to their snack intake in both the food advertising and non-food advertising conditions (p = 0.000). The difference in snack intake between food and non-food advertising exposures, however, remained significant after controlling for the difference in hunger between the advertising conditions (p = 0.006). In the TV only condition, BMI z-score was related to children’s snack intake after food advertising (p = 0.003) and non-food advertising (p = 0.038).

In the TV plus advergame group (n = 78), mean kJ intake was 201 kJ higher at the snack after food advertising exposure (2168 ± 787 kJ) compared with non-food advertising (1968 ± 698 kJ) (p < 0.0001, d = 0.3). This difference remained significant after controlling for hunger (p < 0.0001). Within this media group, children with overweight or obesity (n = 14) ate an additional 305 kJ (95% CI 73 to 538) more after food advertising exposure (p = 0.014, d = 0.3) compared with children with under–normal weight (n = 64) who ate 178 kJ (95% CI 82 to 274) more (p < 0.0001, d = 0.3). In the TV only group, children with under–normal weight (n = 65) ate comparable amounts after both food (1933 ± 619 kJ) and non-food (1929 ± 678 kJ)
advertising exposures ($p = 0.047$). Likewise, within this group, children with overweight or obesity ($n = 11$) also ate similar amounts in both the food (22.20 ± 711 kJ) and non-food advertising (2107 ± 621 kJ) conditions ($p = 0.576$).

Children in the TV plus advergame group did not compensate for their increased snack intake after food advertising at their lunchtime meal. Children in this group consumed an additional 194 kJ (95% CI 80 to 308) daily at camp (snack + lunch) ($p = 0.001$) after food advertising exposure compared with non-food advertising exposure (Fig. 2, Table 3). The effect of the food advertising appeared to be greater among children with heavier weight status. Children with overweight and obesity in the TV plus advergame group consumed an extra 398 kJ (95% CI 188 to 627) daily at camp ($p = 0.002$) compared with children with under-/normal weight who consumed an extra 156 kJ (95% CI 21 to 279) daily ($p = 0.024$) (Fig. 2). In the TV only group, children with overweight or obesity ate an extra 441 kJ (95% CI 135 to 747) at lunch on food advertising days ($p = 0.009$); this led to an additional 553 kJ (95% CI 22 to 1129) being consumed on food advertising days at camp compared with non-food advertising days ($p = 0.058$).

Table 2  Participant Characteristics by Media Condition Group

<table>
<thead>
<tr>
<th>Gender, n (%)</th>
<th>TV only (n = 76)</th>
<th>TV plus advergame (n = 78)</th>
<th>All (n = 154)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>37 (48.7)</td>
<td>40 (51.3)</td>
<td>77 (50.0)</td>
</tr>
<tr>
<td>Female</td>
<td>39 (51.3)</td>
<td>38 (48.7)</td>
<td>77 (50.0)</td>
</tr>
<tr>
<td>Age, mean ± SD (range), y</td>
<td>9.6 ± 1.3 (7.0–12.3)</td>
<td>9.1 ± 1.8 (6.5–12.9)</td>
<td>9.3 ± 1.6 (6.5–12.9)</td>
</tr>
<tr>
<td>BMI for age, ≥ % (21)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Underweight</td>
<td>4 (5.2)</td>
<td>1 (1.3)</td>
<td>5 (3.3)</td>
</tr>
<tr>
<td>Normal weight</td>
<td>61 (80.5)</td>
<td>63 (80.8)</td>
<td>124 (80.5)</td>
</tr>
<tr>
<td>Overweight</td>
<td>10 (13.2)</td>
<td>9 (11.5)</td>
<td>19 (12.3)</td>
</tr>
<tr>
<td>Obesity</td>
<td>1 (1.3)</td>
<td>5 (6.4)</td>
<td>6 (3.9)</td>
</tr>
<tr>
<td>Median household weekly income ($)</td>
<td>1500.1999*</td>
<td>2000.2499**</td>
<td>2000-2499</td>
</tr>
</tbody>
</table>

*% did not answer; **14% did not answer

Table 3  The effects of advertisement condition on thekJ intake in all children and by weight status across both media conditions

<table>
<thead>
<tr>
<th></th>
<th>Difference in means between food and non-food ads SNACK (kJ)</th>
<th>Difference in means between food and non-food ads LUNCH (kJ)</th>
<th>Additional energy intake per day at the holiday camp after food advertising SNACK PLUS LUNCH (kJ)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whole group</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All children (n = 154)</td>
<td>111 (434) p = 0.002, d = 0.2</td>
<td>41 (397) p = 0.001, d = 0.2</td>
<td>152 (559) p = 0.001, d = 0.2</td>
</tr>
<tr>
<td>Under-/normal weight</td>
<td>90 (414) p = 0.015, d = 0.1</td>
<td>1 (388) p = 0.65, d = 0.1</td>
<td>91 (241) p = 0.06, d = 0.1</td>
</tr>
<tr>
<td>Overweight/obesity</td>
<td>221 (521) p = 0.045, d = 0.3</td>
<td>246 (389) p = 0.004, d = 0.4</td>
<td>467 (631) p = 0.001, d = 0.4</td>
</tr>
<tr>
<td>TV only</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All children (n = 76)</td>
<td>19 (40) p &lt; 0.001, d = 0.3</td>
<td>69 (413) p = 0.001, d = 0.2</td>
<td>100 (603) p = 0.001, d = 0.4</td>
</tr>
<tr>
<td>Under-/normal weight</td>
<td>4 (42) p = 0.001, d = 0.3</td>
<td>29 (378) p = 0.001, d = 0.3</td>
<td>33 (222) p = 0.001, d = 0.3</td>
</tr>
<tr>
<td>Overweight/obesity</td>
<td>113 (647) p = 0.005, d = 0.3</td>
<td>441 (456) p = 0.005, d = 13</td>
<td>554 (853) p = 0.008, d = 0.6</td>
</tr>
<tr>
<td>TV plus advergame</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All children (n = 78)</td>
<td>201 (888) p &lt; 0.001, d = 0.3</td>
<td>–6 (377) p = 0.001, d = 0.2</td>
<td>194 (388) p = 0.001, d = 0.2</td>
</tr>
<tr>
<td>Under-/normal weight</td>
<td>178 (853) p &lt; 0.001, d = 0.3</td>
<td>–28 (398) p = 0.004, d = 0.2</td>
<td>150 (518) p = 0.004, d = 0.2</td>
</tr>
<tr>
<td>Overweight/obesity</td>
<td>305 (402) p = 0.014, d = 0.3</td>
<td>93 (248) p = 0.002, d = 0.3</td>
<td>398 (39) p = 0.002, d = 0.3</td>
</tr>
</tbody>
</table>

Mean (kJ: SD); All p values are two tailed; d = effect size, Cohen’s d

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Discussion

Principal findings of the study

Exposure to food advertising on TV and the advergame led to significant increases in children’s daily energy intake during their time at camp (194 kJ). This response was magnified among children with overweight and obesity (n = 14); consuming over double the additional daily kJ at the camp (398 kJ) than children with under-/normal weight (n = 64, 150 kJ). This exaggerated response was also seen among children of a heavier weight status in the TV only group, with children (n = 11) consuming an extra 353 kJ (p = 0.058) at the camp on the food advertising days. Given that cohort studies suggest that a positive energy-gap of only 200–300 kJ a day may be all that is required for the development of overweight in children [28, 29], these data raise legitimate concerns about the direct influence that food advertising over long-term exposures may exert on children’s weight.

Interpretation

Whilst not consistently seen across previous studies, children with a heavier weight status have been often shown to have heightened food intake responses to food advertising on TV [24, 30] and branded food packages [31]. In a UK study, children with overweight (n = 15) increased their intake by 1280 kJ after TV food advertising compared with control, and children with obesity (n = 11) by 1970 kJ (p < 0.001), indicating they were highly influenced by external food cues [24]. Indeed, children with overweight or obesity, when tested with a ‘stop signal’ task, have been shown to have less inhibitory control in response to food stimuli than children with normal weight [32]. The pre-frontal cortex is an area of the brain involved in cognitive control, including impulse inhibition, and making decisions in response to stimuli in the environment [33]. Neural imaging studies indicate a lack of activation of this region in children in response to food cues, in contrast to adults where activation is apparent [33]. In response to fast food logos, children with obesity have been shown to have lower activation in the pre-frontal cortex compared with children with normal weight [34]. These data suggest that a lack of impulsivity inhibition in children, in response to food cues, could make them less able to control eating impulses and, thus, more susceptible to tempting food stimuli such as those found in food marketing. Additionally, it would also appear that children with a heavier weight status have a particular vulnerability to branding and food advertising effects.

Children within the TV plus advergame group ate significantly more snack foods after food advertising (201 kJ) compared with non-food advertising, whilst children in the TV only group ate similar amounts at the snack after both the food and non-food advertisements. There was an increased effect seen among children with a heavier weight status in both media groups but at different meal occasions. In the TV plus advergame group children with overweight or obesity (n = 14) increased their snack intake by a significant 305 kJ after food advertising exposure. In the TV only group (n = 11), although no increased effect was observed at snack-time, children with overweight and obesity ate as
additional 441 kJ at lunchtime on food advertising days compared with non-food advertising days. The advertised foods were not offered to the children, indicating these effects were not brand or product specific but transferred to the foods that were on offer. Significant effects also remained after controlling for hunger. The lack of an advertisement only group meant that we were unable to isolate whether the significant main effect for media condition that we observed was due to the double exposure of TV and the advertisement or to the nature of the game itself. The effects of playing an advertisement only on snack intake have been previously demonstrated, with children (8–10 years) eating more (286 kJ, p < 0.001) after playing a five minute game promoting energy-dense foods (n = 69) compared with a non-food game (n = 65); although this study did not differentiate between children with different weight statuses [35]. Advertisements are designed to be fun and engaging, with brand immersion as the primary objective [36]. Given the consumption responses of children within this group, it would appear children have responded to the food cues prominent within the games.

Our findings suggest insights into child obesity policy at both upstream and mid-stream levels. From a primary prevention perspective, our findings clearly highlight the need for regulatory intervention to restrict children's exposure to unhealthy food promotions, on TV and across different media platforms, and particularly online media. The recent rules introduced by the UK’s media self-regulatory body, the Committee of Advertising Practice, restricting the advertising of foods high in fat, salt or sugar in children's non-broadcast media, are a step in the right direction in this regard [37]. From a weight management perspective, the increased vulnerability to food cues we observed among children with a heavier weight status supports the inclusion of interventions which aim to diminish sensitivity to these stimuli in children's weight loss education programs [7, 38, 39]. Although in their early infancy as an approach for children's weight management, Cue Exposure Treatment programs hold promise in supporting children to resist the abundance of food cues in today's environment [7, 38, 39]. The basic premise of these interventions is to present children with repeated, non-reinforced exposures to highly palatable foods with the aim of weakening the child’s conditioned response, that is, the desire to eat [38, 39].

Strengths and limitations
A key strength of this study was that we created a natural environment within which to collect the data, and in which the children were comfortable and relaxed. The recreation centre and the dining area would not be dissimilar to the facilities that children would experience when attending school camps during term time. That the children enjoyed taking part in the study and camp is strongly supported by the overwhelmingly positive feedback we received from the parents in their follow-up questionnaire and the low study attrition.

Some limitations in study design point to why significant differences in snack intake between food and non-food advertising conditions in the TV only group were not seen. Unlike previous studies, which used TV food advertisements aired within their study's countries [24, 30, 40], we elected to use unfamiliar brands. This was to isolate the effect of advertising exposure, without influence from pre-formed brand attitudes or associations. There is strong evidence that repetitive exposure to advertising enhances evaluation of that stimuli [41, 42], with maximum attitude and affect reached at approximately ten advertising exposures [43]. It is possible that exposure to novel brands and, consequently lesser opportunity to form positive affect with that brand or product, may not have cued children’s consumption responses to the extent that has previously been observed where food brands were familiar [24, 30, 40], thus resulting in a null effect. The increased effect of prior advertising exposure on children’s food intake exposure via advertisements has previously been demonstrated. In an earlier study from the USA, children who had previous food branded game play experience consumed 577 kJ more from unhealthy snack foods than children who played healthy or non-food advertisements in the study [44].

The time of day we conducted our study could also have influenced children’s consumption responses. Evidence suggests that self-regulatory capacity lessens across time as the cognitive resources needed to exert inhibition and executive control become depleted over the course of the day [45]. We measured children’s snack intake in the morning, when children’s ability to self-regulate is, arguably, at its height [45]. In contrast, previous studies, where significant effects of TV food advertising on children’s food intake were seen and which reported time of day, were conducted in the afternoon [17, 40].

A further limitation may have been that children were given a 15 min snack eating time, which was not disclosed to them. In two previous studies, where significant effects on snack food intake were seen subsequent to TV food advertising exposure, children (n = 42–59, aged 9–11 years) were given unlimited time to eat during the experimental eating period [24, 30]. In our study, a number of children had asked for more high fat sweet or low fat sweet items and had not eaten all that they had requested. We surmise that having asked for more of these food items that children had the intention of eating them and, hence, would have finished eating the sweets if they had had sufficient time. Indeed, the most proximal determinant of actual behaviour is the intention to carry out that behavior, according to the Theory of Planned Behaviour [46]. Food enjoyment is inversely correlated with satiety responsiveness and positively
correlated with food responsiveness and desire to eat [47]. The portion size of the extra food items was only 25 g so coupled with the low satiety of energy-dense, sweet and high fat foods [48, 49], and with children's predisposition for these highly palatable foods [50], this is a reasonable expectation. Analyses of mean snack food intakes allowing for children to finish the extra that they had asked for, suggests that food advertising would have had a significant increased effect on children's snack intake in the TV only condition (data not shown).

Furthermore, we were under-represented in the proportion of children with overweight or obesity in our study compared with the state population [26] and, hence, it would appear, under-powered to detect a mean difference in snack intake among this subgroup of children in the TV only group. A power calculation indicates that we would have needed a sample of 60 children with overweight or obesity to detect a mean difference of the magnitude that we observed (113 kJ), with a significance level of 0.05.

In line with previous studies [51, 52], we asked children to report how hungry they were feeling prior to the snack period, in order to control for hunger in our analyses. As such, we cannot rule out the potential of confirmation bias, in which children may have been less likely to eat as much if they had previously reported that they were not very hungry [53]. We did, however, ask children about their level of hunger prior to both the food and non-food advertising exposures, so it is likely that any effects would have been non-differential across conditions.

Children did not compensate for their increased snack intake after food advertising during their days at the camp, however if it is possible that they may have eaten less at mealtimes later in the day, or on subsequent days. Whilst we assessed children's breakfast intake and measured their daily snack and lunch intakes we did not capture children's food intake once they left the camp for the day. The limitations and challenges of collecting dietary intake data among free-living populations, particularly children, are well documented; they pose a high respondent burden, prompt an alteration of usual dietary habits and there is a poor accuracy when reporting food eaten away from home [54]. As such, we would not have been able to maintain the precision of the dietary intake data we had collected during camp hours if we had extended dietary data collection outside this controlled environment. There remain questions over whether children would have compensated for their increased energy intake at later eating occasions. As previously discussed, self-regulation tends to lessen over the course of the day [45]. Additionally, although research with young children (3 – 6 years) suggests that they adjust their daily food intake according to the energy density of their diets [55], studies with older children indicate that this ability to accurately compensate tends to decrease with age [56, 57], and is weaker in children with heavier weight status [58]. While camp leaders ensured children's camp activities were of a similar intensity and duration each day, children may have compensated for their additional energy intake after food advertising via increased energy expenditure outside the camp environment. In the absence of physical activity accelerometry data we are unable to determine this.

Conclusion

Children's exposure to unhealthy food marketing is directly associated with an imbalance in energy intake which was not compensated for during children's time at camp. While this energy imbalance may have been compensated for at a subsequent time, it is of a magnitude that, over time, could drive a positive energy gap capable of underpinning excess weight gain in children. This energy gap is higher for children with overweight and obesity, and after exposure to TV food advertising and online advertisements. These findings should inform policy specifications, including the need to focus regulatory restrictions across media platforms, and particularly online media, and that behavioural weight management interventions should address heavier children's vulnerability to food promotions.

Abbreviations

g: Grams; kJ: Kilojoules; NSW: New South Wales; TV: Television

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Availability of data and materials

Data from this study will not be openly available until planned publication outputs have been completed.

Authors' contributions

BK is the Chief investigator of the study and led the writing of the initial study protocol and successful funding application. All authors contributed to the conception and design of the study and review of the protocol following the pilot study. BK and AT M supervised JN. JN is a PhD Candidate who primarily implemented the study protocol, including recruitment, in the statistical analysis, supervised by BK and with advice from AS and LB. All authors contributed to critical revision of this manuscript and have approved the final version.
Ethics approval and consent to participate
The study was approved by the University of Wollongong Human Research Ethics Committee (H15/196).

Competing interests
All authors have completed the ICMJE uniform disclosure form at http://www.icmje.org/conflicts-of-interest/ and declare that they have no conflicts of interest.

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References


Appendix C: The published article: Children's self-regulation of eating provides no defense against television and online food marketing

Children's self-regulation of eating provides no defense against television and online food marketing

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A B S T R A C T

Exposure to unhealthy food marketing stimulates children’s food consumption. Child’s responsivity is influenced by individual factors, resulting in an increased vulnerability to advertising effects among some children. Whether these differential responses may be altered by different parental feeding behaviours is unclear. The purpose of this study was to determine the relationship between parental feeding practices and children’s food intake responses to food advertising exposure. A randomised, crossover, counterbalanced, within subject trial was conducted across four, six-day holiday camps in New South Wales, Australia between April 2016 and January 2017 with 160 children (7–12 years, n = 40/ camp). Children were randomised to either a multiple media (TV and Internet) or single media (TV) condition and exposed to food (3 days) and non-food (3 days) advertising in an online game an/or a cartoon. Children’s food consumption (kilojoules (kJ)) was measured at a snack immediately after advertising exposure and then at lunch later in the day. Parents completed the Child Feeding Questionnaire, and ‘restriction’ and ‘pressure to eat subscale scores were calculated. While food advertising affected all children in the multiple media condition, there was an increased effect on snack intake among children whose parents reported pressuring them to eat, with children consuming an additional 356 kJ after food advertising compared with non-food advertising. This was 205kJ more than children whose parents did not pressure them to eat. In the single media condition, only children whose parents reported restrictive feeding practices ate more at lunch on food advertising days than non-food advertising days (240kJ). These data highlight an increased susceptibility to food advertising among children whose parents report controlling feeding practices.

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1. Introduction

Environmental factors strongly influence the establishment of a child’s eating behaviours (Howles et al., 2015) and play a critical role in the development of childhood overweight (Swinburn et al., 2011). Food environments are increasingly dominated by cheap, ultra-processed food products, high in fat, sugar and salt; foods which are intrinsically unhealthy yet intimately palatable (Monteiro, Moubaram, Cannon, Ng, & Popkin, 2013). The widespread availability of these foods means that we are persistently faced with opportunities to overeat and, furthermore, encouraged and prompted to do so by their heavy promotion across an increasingly wide range of media and settings (Swinburn et al., 2011). As such, we are constantly challenged to self-regulate food intake (Stocek et al., 2017).

It is unsurprising that, born into this obesogenic food environment, the present generation of young people are more vulnerable to overweight than ever before (Allman-Farinelli, Chey, Bauman, Gill, & James, 2007). A sustained daily positive energy balance as small as 200–300 kilojoules (kJ) can lead to the development of overweight in children (Plachur-Danielzik et al., 2008; van den Berg,
et al., 2011). With this in mind, a plausible expectation would be that all children would develop overweight, and yet not all children do. While this individual variation can be partly explained by gene expression (epigenetics), other individual-level factors may also influence how responsive a child is to environmental influences (Gluckman & Hanson, 2008). Therefore, it is important to understand how stimuli that can prompt food intake, such as food advertising (Boylan et al., 2016), may affect some children more than others.

There is a commonly held belief that as children increase in age and attain greater cognitive maturity, they become more aware of advertising's persuasive intent and become better equipped to defend themselves against advertising's negative effects (Cabert, 2008). However, in addition to the highly emotive themes and tempting food cues present in food advertising, the subtle and embedded nature of contemporary advertising approaches blurs the distinction between media content and advertising, making critical evaluation of marketing more difficult. A prime example is online branded games (“advergames”), commonly found on food industry websites, where cues, in the form of the brand or food items, are integrated into the gameplay, and as such are less likely to be consciously processed (Trelutler & Capella, 2013). This type of advertising can influence behaviour, such as eating, without there being a deliberate or conscious processing of the information presented (Harris & Graff, 2012).

Psychosocial theoretical models propose that when children process persuasive messages with low cognitive elaboration (implies high appeal), such as the advergames, the cues are likely to have a greater effect on their eating behaviour than if they use greater cognitive elaboration (explicit processing) (Buijzen, Van Reijmersdà, & Owen, 2010; Folkvord, Anschutz, Boyland, Kelly, & Buijzen, 2016; Nairn & Fino, 2008). Intra-individual variations among children, arising from individual susceptibility factors such as attentional bias and impulsivity, lead to differential responses (Folkvord et al., 2016; Valkenburg & Peter, 2013).

Short term experimental studies, where children are exposed to food advertising, embedded in a cartoon or online game, consistently show that children have a significantly greater food intake after food advertising exposure compared with non-food advertising (Boylan et al., 2016). In addition, some children appear to respond to food advertising to a greater extent (Anschutz, Engels, & Van Strien, 2010; Folkvord, Anschutz, Nederkoorn, Westerkil, & Buijzen, 2014; Folkvord, Anschutz, Wiers, & Buijzen, 2015; Halford et al., 2008). Increased effects of food advertising on children’s food consumption have been observed among children with overweight and obesity (Halford et al., 2008; Norman et al., 2018); those whose mothers exhibit encouragement to be thin (Anschutz et al., 2010); who have high impulsivity (Folkvord et al., 2014); and who show increased attentional bias to food displayed in advertisements (Folkvord et al., 2015).

Interactions between parents and children within the family and home environment shape the development and establishment of children’s eating behaviours and dietary self-regulation (Birch, 2006). The approaches that parents use to promote healthy eating habits have been found to influence children’s food behaviours. Feeding practices, such as restricting foods deemed as unhealthy, and pressuring or coercing children to eat healthier foods such as fruit and vegetables, can be counterproductive (Gerards & Kremer, 2015); with both food restriction and pressure to eat shown to be significantly related to a child’s preference for foods high in fat and sugar (Vollmer & Baietto, 2017). Additionally, research suggests that children subject to these feeding practices are less successful in self-regulating their energy intake than children whose parents encourage them to focus on their internal satiety and hunger cues, and as a consequence these children may be more influenced by external food cues (Stocek et al., 2017). This gives rise to the question whether children who experience controlling parental feeding practices may be more responsive to unhealthy food advertising. Eating studies that explore relationships between parental feeding practices and children’s food behaviours are typically conducted in the absence of parental supervision (Lansigan, Emond, & Gilbert-Diamond, 2015). Hence, a school holiday program, which children attend without parents, presents an ideal environment in which to perform a study of this nature.

This paper reports on data collected from a randomised controlled trial (RCT) which investigated whether exposure to food advertising from a single media or a multiple media source increased children’s immediate food consumption (kcal) at a snack directly after exposure compared with non-food advertising, and whether any immediate increased energy intake was compensated for at a later lunchtime meal (Norman et al., 2018). The aim of the present study was to explore the relationships between parental feeding practices and children’s food intake responses after the different advertising exposures.

2. Methods

2.1. Study design and participants

The within-subject, crossover, counterbalanced RCT was conducted across four, six-day school holiday camps from April 2016 to January 2017 in New South Wales, Australia. Children attended the morning sessions of the holiday camp every day from 8.00 to 1.30pm. The full study protocol and main results can be found elsewhere (Norman et al., 2018). We recruited 166 children (78 female, 82 male), aged 7–12 years (9.3 ± 1.6 (mean ± SD)) via local schools, community and university networks and social media, with 46 children attending each holiday camp. Inclusion criteria included no reported food allergies or dietary restrictions, incentives for participants included payment for their holiday camp fees.

Within each holiday camp, children were allocated to one of two groups of 20, balanced by age and sex, and randomised to participate in either the single media (TV) or multiple media (TV plus Internet advergame) conditions. Within each media condition was an experimental condition (unhealthy food advertising (three days)) and a control condition (non-food advertising (three days)). Within each camp children participated in both the experimental and control conditions, with the sequence of advertising conditions counter-balanced across holiday camps.

Informed written consent was obtained for all study participants. The study was registered with the Australian New Zealand Clinical Trials Registry (ACTRN1261700123047) and approved by the University of Wollongong Human Research Ethics Committee.

2.2. Materials and measures

2.2.1. Media and advertising

TV: Six age-appropriate, ten minute cartoons were selected; one for each day of the camp. These were embedded with either ten food related TV advertisements or ten non-food related TV advertisements (approximately 30 s/advert). The ten TV advertisements were the same each day of the camp, changing only according to experimental or control condition. Pictures or references to food did not appear in any of the cartoons. Internet: an online advergame featuring either a food brand or a non-food brand (five minute game play). The advergames featured the advertised brand or product as active game components, present throughout the duration of the game. The advertised food products were categorised as unhealthy in line with the nutrient profiling criteria.
developed by Food Standards Australia New Zealand (Food Standards Australia New Zealand, 2015). In order to determine the influence of the study advertising, all branded food products in the experimental condition were for items available for purchase overseas but not in Australian supermarkets. The TV advertisements are not aired on Australian commercial TV stations and the advertisements are only available for download through international app stores.

2.2. Foods and intake measurement

Snack-time: children were offered individual trays with six small bowls of preweighed assorted snack foods. Each bowl contained 50 grams (g) of a different food option: high fat savoury, low fat savoury, high fat sweet, low fat sweet, fruit and vegetable. The snack choices were in line with previous study designs (Haldred et al., 2008), and none of the brands featured in any of the advertisements shown. Children were told that they could eat as little or as much as they would like, and were given more of any food item on request. The snack period was strictly limited to 15 min. For each child the leftovers of the individual foods were weighed (g).

Lunch-time: children were presented with a tray of prepared, pre-weighed standardised food items. There were three different lunch menus: items included fruit, vegetables, yoghurt and healthier types of fast food eg cheese and tomato pizza, oven baked chips and chicken pieces. Menus on Days One to Three were repeated on Days Four to Six of the camp. As with snack-time, extra food items were available on request and there was a thirty minute time limit. All leftovers were individually weighed (g).

Gram amounts were converted to kj using FoodWorks nutrient analysis software (Version 8, Xyris Pty Ltd, Australia). Each child’s mean snack and lunch intakes for the three days of food advertising exposure and three days of non-food advertising exposure were calculated.

2.2.3. Children’s hunger

Children reported how hungry they felt before snack-time and lunch each day using a validated 5-point picture-rating scale; with the anchors ‘I am really hungry’ (1) and ‘I am not hungry at all’ (5) (Bennett & Bissett, 2014). Mean hunger scores were calculated for snack and lunch for the two advertising conditions.

2.2.4. Children’s weight and height

Children’s weight and height were measured on Day 1 of the camp. Children’s body mass index (BMI; weight/height$^2$) and BMI z-scores (World Health Organization, 2007) were calculated. The BMI for age was used to classify weight status into underweight, normal weight, overweight or obesity categories using international standardised cut-points (Cole & Lobstein, 2012).

2.2.5. Daily procedure

At mid-morning on each day of the holiday camp children were shown to either the single media or multiple media intervention room, according to randomisation. Each day children in both rooms watched the same cartoons with the same TV advertisements embedded. The children in the multiple media condition then played an Internet advertisement for five minutes. Snack-time immediately followed children’s advertising exposure. Lunch was served in the main camp dining room at 1 pm, after which children went home for the day. Camp leaders ensured that the duration and intensity of children’s camp activities, which were conducted between meal periods, were similar each day.

2.2.6. Parental feeding practices

Parental feeding practices were self-reported online by parents at baseline using the Child Feeding Questionnaire (CFQ) (Birch et al., 2001). The controlling feeding practices ‘restriction’ and ‘pressure to eat’ are two of the most commonly researched subscales of the CFQ and were the two that were used in this analysis. There are eight questions relating to the restriction subscale (e.g. “If I did not guide or regulate my child’s eating he/she would eat too much of their favourite foods”) and four questions relating to the pressure to eat subscale (e.g. “My child should always eat all of the food on his/her plate”). Response options were rated as 1 = disagree, 2 = slightly disagree, 3 = neither disagree nor agree, 4 = slightly agree, and 5 = agree. The internal consistency of items within these subscales has been confirmed in earlier research (pressure to eat: $\alpha = 0.70$; restriction: $\alpha = 0.73$ (Cronbach’s alphas)) (Birch et al., 2001). Mean scores for each subscale were calculated. Subsequently, the subscale mean feeding scores were dichotomised into ‘no’ for scores of 3 or lower for each child and ‘yes’ for greater than 3, with ‘yes’ indicating that parents exerted a higher level of parental control on their children’s eating behaviours, either by restricting or pressuring food intake. A similar approach to dichotomising responses to the CFQ has been used in earlier studies (Park, Li, & Birch, 2015).

2.2.7. Outcome variables

The main outcomes were children’s mean snack intake (kJ) after food advertising exposure (3 days) and non-food advertising exposure (3 days), their mean lunch intake (kJ) on food advertising and non-food advertising days, and combined mean snack and lunch intakes (kJ) on food advertising and non-food advertising days.

3. Statistical analysis

Data were analysed separately by media condition Linear mixed models with repeated measures were used to examine relationships between children’s consumption responses (kJ) at the different eating occasions and dichotomised feeding practice scores. The three different primary outcomes were kJ consumed at the snack, lunch and snack and lunch combined repeated across the two advertising conditions. The fixed-factor effects used in all models were advertising condition (food or non-food advertising) and feeding practice scores. The interaction between advertising condition and feeding practice scores was tested for significance in all models. Camp identifier was included as a random intercept in the models in order to adjust for the clustered nature of the data. Any influence of the impact of age, sex, weight status (BMI z-scores), or hunger on snack and lunch intake were investigated by adding these variables as covariates to the models.

Descriptive statistics are reported as means (±SDs) for continuous variables or as percentages for categorical variables. Results from the linear mixed models analyses are presented as means (95% CIs) unless otherwise indicated. Reported p values are two-sided, and p < 0.05 was considered significant in all tests. Analyses were completed using SPSS Statistics version 23.0 for Windows (SPSS Inc., Chicago, IL, USA).

4. Results

Six children did not complete all six days of the camp, leaving 154 children in the final analysis (78 female, 76 male, 9.3 ± 1.6 years (mean ± SD)). Participant characteristics and parental feeding practice scores are shown in Table 1. There were no significant differences between the descriptive statistics for the two media condition groups.

As previously reported, the increase in snack intake after food advertising (compared with non-food advertising) was significantly greater in the multiple media condition than the single
media condition (p < 0.01) [Norman et al., 2018]; hence data were analysed separately by media condition. Age and sex had no significant main effect or interaction on food consumption and were removed from further analyses. In the single media condition BMI z-score was positively related to the difference in mean lunch food intake (p < 0.05) and mean snack plus lunch intake (p < 0.01) between food advertising and non-food advertising days. There were no associations between parental feeding practice scores, either restriction or pressure to eat, and BMI z-score, nor were restriction and pressure to eat scores related.

In the single media condition all children ate similar amounts at the snack after food advertising and non-food advertising, with no differential effect among different feeding practice sub-groups (Table 2).

However there was a positive significant association between restrictive parental feeding practices and increased lunch intake (p < 0.01) and snack plus lunch intake (p < 0.05) on the food advertising days compared with non-food advertising days. Children whose parents were restrictive ate 240 kJ more at lunch on food advertising days versus non-food advertising days (p < 0.01), remaining significant after controlling for hunger and BMI z-score (p < 0.01). The children whose parents were non-restrictors did not consume any additional kJ at lunch in response to the food advertising, with a difference observed between the two groups (restrictors vs. non-restrictors) of 287 kJ (p < 0.01). Children with restrictive parents in this media condition ate an additional 288 kJ overall (snack plus lunch) (p < 0.05) on food advertising days compared with non-food advertising days. This was an additional 334 kJ more than the children with non-restrictive parents, who did not consume any additional kJ overall in response to the food advertising (p < 0.05). Pressure to eat did not have a differential effect on children’s lunch consumption in the single media condition.

As reported elsewhere, all children in the multiple media condition ate more at the snack after food advertising than after non-food advertising (201 kJ, p < 0.0001) [Norman et al., 2018]. This was not compensated for at lunch which led to an additional daily food intake of 194 kJ (p < 0.0001) (snack plus lunch) on food advertising days.

Table 2
The effects of advertisement condition on the kJ intake in all children and by feeding practices across media conditions (means (95% CIs)).

<table>
<thead>
<tr>
<th></th>
<th>Difference in mean kJ intake between food and non-food advertisements SNACK</th>
<th>Difference in mean kJ intake between food and non-food advertisements LUNCH</th>
<th>Daily additional kJ consumed at the holiday camp after food advertising</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Single media</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All children</td>
<td>19 (-85 to 125)</td>
<td>89 (-5 to 183)</td>
<td>108 (-30 to 246)</td>
</tr>
<tr>
<td>(n = 767)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No restriction</td>
<td>-7 (-161 to -47)</td>
<td>-47 (-161 to -47)</td>
<td>54 (-315 to 108)</td>
</tr>
<tr>
<td>(n = 40)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Restriction (n = 36)</td>
<td>48 (-101 to -19)</td>
<td>240** (-96 to -384)</td>
<td>288* (-65 to -111)</td>
</tr>
<tr>
<td>No pressure to eat</td>
<td>50 (-70 to 160)</td>
<td>66 (-35 to -166)</td>
<td>115 (-36 to 266)</td>
</tr>
<tr>
<td>(n = 57)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pressure to eat</td>
<td>-71 (-300 to -166)</td>
<td>150 (-45 to -93)</td>
<td>80 (-431 to 256)</td>
</tr>
<tr>
<td>(n = 19)</td>
<td></td>
<td></td>
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<tr>
<td><strong>Multiple media</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All children</td>
<td>201*** (-113 to 288)</td>
<td>-6 (-91 to 79)</td>
<td>194*** (80 to 308)</td>
</tr>
<tr>
<td>(n = 78)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No restriction</td>
<td>237*** (-114 to -299)</td>
<td>36 (-79 to 151)</td>
<td>313*** (-140 to 480)</td>
</tr>
<tr>
<td>(n = 33)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Restriction (n = 45)</td>
<td>160** (-46 to -174)</td>
<td>-52 (-163 to -59)</td>
<td>108 (-263 to 48)</td>
</tr>
<tr>
<td>No pressure to eat</td>
<td>147** (-44 to -251)</td>
<td>-4 (-101 to -93)</td>
<td>143* (7 to 280)</td>
</tr>
<tr>
<td>(n = 58)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pressure to eat</td>
<td>356*** (-19 to -515)</td>
<td>-14 (-205 to -177)</td>
<td>342** (-135 to -548)</td>
</tr>
<tr>
<td>(n = 20)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*p < 0.05, **p < 0.01, ***p < 0.001, ****p < 0.0001.

Significant differences between b and c (p < 0.002); d and c (p = 0.013); f and e (p = 0.038).

Results published in [Norman et al., 2018].
days for children within this media condition. There was an increased effect seen among children whose parents reported high pressure to eat feeding practices. These children ate an additional 356 kJ (p < 0.0001) at the snack after food advertising exposure compared with non-food advertising exposure, remaining significant after controlling for hunger and BMI z-score (p < 0.0001); an extra 209 kJ (p < 0.05) more than children whose parents did not pressure them to eat. This led to a total additional daily food intake of 342 kJ (p < 0.01) on food advertising days among children whose parents pressured them to eat. Children in both the restrictive and non-restrictive groups ate more at a snack after food advertising compared with non-food advertising, with no significant difference in snack intake between these two groups. Children consumed similar amounts at lunch on food and non-food advertising days in the multiple media condition, with no differential effect among the feeding practice sub-groups.

5. Discussion

This study identifies that children who experience parental feeding practices that impede their self-regulation of eating have an increased vulnerability to the effects of unhealthy food advertising; with these children consuming more in response to food advertising exposure over a sustained period, compared with non-food advertising. In the multiple media condition, parental pressure to eat did heighten the effect of advertising, however all children had increased snack intakes after food advertising exposure, compared with non-food advertising, which was not compensated for at a later meal. This suggests that marketing effects override children’s learned self-regulatory responses to eating, especially when this is sustained and repeated across multiple media platforms. It also highlights that none of the parental feeding practices children experienced, whether controlling or non-controlling, were sufficient to negate the impact of food advertising on their eating behaviours. As this multiple media advertising condition is closer to children’s real world exposures (Boyland & Whalen, 2015), this is a particularly important finding. The differential susceptibility was most pronounced in the single media group and resulted in children who experienced restrictive parental feeding practices eating more at a lunchtime meal following food advertising exposure.

Previous studies have identified other groups of children who also have increased vulnerability to the effects of food advertising, including those with heavier weight status (Hafford et al., 2008; Norman et al., 2018) and those whose mothers exhibit encouragement to be thin (Janschutz et al., 2010). BMI z-score was not associated with parents’ restriction or pressure to eat in our study, and so was not a confounder in the relationship between controlling feeding practices and children’s responses to marketing. We have separately found weight status to influence the magnitude of children’s responses to food advertising (Norman et al., 2018). This study finds a separate group of vulnerable children whose responses to marketing occur independently of weight status.

Psychosocial processing models propose that unhealthy food advertising prompts cravings for food and induces subsequent food intake via previously conditioned responses, with the level of processing of the embedded food cues influencing the magnitude of the effect of the food advertising (Buijzen, Reimersdal, & Owen, 2010; Folkevold et al., 2016; Nairn & Fine, 2008). This may explain the different intake responses at the snack after advertising exposure across the two media conditions and why all children were affected by the food advertising in the multiple media condition. The integrated nature of the food advertising within the adgame may have had a greater effect on children’s food intake as the promotional content involved low levels of elaborative processing, initiating physiological responses which motivated food consumption without children being aware that they were being cued to eat (Buijzen et al., 2010; Folkvord et al., 2016). Of course, children in the multiple media condition also received double the dose of advertising exposure compared with the single media condition, so it may be that volume of exposure, as well as the different media platforms, is also important in influencing the magnitude of responses. Empirical data on sustained exposures to food advertising are scarce, however, an early study found that repetitive exposures to an ice cream TV advertisement embedded within a cartoon did not increase children’s subsequent food consumption compared with single exposure (Gom & Goldberg, 1980). The authors report that this could have been a factor of study design, with children appearing irritated by the repetitive nature of the advertisement and that this may have directly affected children’s eating behaviours. More recent research suggests that when online and offline media marketing communications are used in tandem, their interaction can enhance consumer behavioural responses through synergistic cross-effects (Batra & Kellar, 2016).

Indeed, an aim of integrated multimedia campaigns is to increase consumer effects in such a way that the coordinated effect is greater than if the individual marketing platforms were experienced independently of each other (Kellar, 2016). The lack of an ‘advergame-only’ single media condition means that we were unable to confirm this effect.

Identifying increased vulnerability to food advertising among children who experience controlling parental feeding practices is a novel finding. Not only does it highlight a group of children with differential susceptibility to the negative effects of food advertising but it emphasises the importance of promoting feeding practices that help support a child’s self-regulatory development in regards to their eating. It has been suggested that responsive, structure-based feeding practices, where parents offer guidance, provide routines, set boundaries and take into account the child’s perspective, can be helpful in promoting self-regulation (Frankel, Powell, & Janzen, 2017; Rollins, Savage, Fisher, & Birch, 2018). It is questionable, however, given the immersive nature of the promotional messages within contemporary food advertising, and in light of our findings for multiple media exposures particularly, whether the results of any parenting practices could be effective in protecting children from advertising’s negative influences.

The sustained energy imbalances observed in this study after food advertising exposure are of a magnitude that could contribute to the development of overweight (Plachta-Danielzik et al., 2008; van den Berg et al., 2011). Our findings dearly highlight the requirement for more stringent regulatory policy to restrict children’s exposure to unhealthy food marketing across offline and, particularly, online media. Despite restriction of food marketing to children being identified at the highest levels of international policy—making (United Nations General Assembly, 2011; World Health Organization, 2010), few territories have enforced statutory restrictions, with most countries relying on industry-led codes for responsible marketing (Galbraith-Emami & Lobstein, 2013). Evidence indicates that industry self-regulation has not been effective in protecting children from food advertising exposures (Galbraith-Emami & Lobstein, 2013), with children continuing to be exposed to high levels of food marketing across a wide range of media platforms (Boyland & Whalen, 2015; Vandevijvere, Soupen, & Swinburn, 2017).

There were different responses to food advertising on snack and then on meal consumption across the single and multiple media groups. While the multiple media group ate more snack food in the food advertising condition, the single media group ate more at the next meal and not at the snack. In these children it is possible that the activation of prior advertising-based memory structures could have been triggered in the presence of palatable lunch foods,
promoting a greater intake of foods (Büttrich, Florack, & Serfas, 2014). Both restrictive and pressure to eat feeding practices were associated with greater intakes at the lunchtime meal for children in the single-media condition, however this was only significant for children who experienced restrictive practices. Posteriori calculations estimate that a sample of 80 children in the pressure to eat subgroup would be needed to detect this effect on lunch consumption.

As reported elsewhere, a study limitation may have been the time-limited, undisclosed snack eating period of 15 min. which may have accounted for the lack of effect on children’s snack intake in the single media condition (Norman et al., 2018). Previous studies, where significant consumption responses after TV food advertising exposure were observed had unlimited snack eating times (Halford, Gillespie, Brown, Pontin, & Dovey, 2004; Halford et al., 2008). As children within the single media condition ate similar amounts at the snack after both snack and non-food advertising (Norrman et al., 2018), it is unsurprising that no interactions with advertising condition or feeding practices were found here.

A possible limitation in using the CFQ was the reliance on parental report which may have been subject to social desirability bias. A former study which utilised a child version of the CFQ, in addition to the parents’ version of the CFQ, found a lack of agreement between parental and child reports and perceptions of restrictive eating habits (Carpenter, Orlet Fisher, & Birch, 2000); though this may have simply related to subjective differences between the two groups.

In conclusion, this study indicates that children who experience controlling parental feeding practices may be less able to self-regulate their food intake after exposure to food advertising than children who experience less controlling feeding practices. However, our findings show that all children within the multiple media condition, regardless of their parents’ feeding practices, ate more at a snack after food advertising, which was not compensated for at the next meal. The ubiquitous nature of contemporary food marketing means that children are frequently faced with unhealthy food cues in their daily lives. While structure-related parental feeding practices hold promise in supporting a child’s self-regulatory development (Fraske et al., 2017), if children respond to real world marketing stimuli in the same way they did to the food advertising in our study, then their responses could, indeed, lead to weight gain. These data clearly suggest that policy interventions that focus singularly on improving the at-home (eating) environment will be ineffective in the absence of broader regulatory controls on food marketing. A more practicable solution is for policy makers to enforce stronger regulations on children’s food advertising exposure across all media platforms, particularly online media.

Contributors

BK is the Chief Investigator of the study and led the writing of the initial study protocol and successful funding application. All authors contributed to the conception and design of the study. BK and A-T supervised JN. JN is a PhD Candidate who primarily implemented the study protocol, including recruitment. JN led the statistical analysis, supervised by BK and with advice from AB and JB. All authors contributed to critical revision of this manuscript and have approved the final version.

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This research has been conducted with the support of the Australian Government Research Training Program Scholarship. The Australian Research Council played no part in the study design, collection, analysis and interpretation of data; or the writing of the report; or the decision to submit the paper for publication. The corresponding author has full access to all the data in the study and had final responsibility for the decision to submit for publication. Two researchers from Cancer Council NSW (KC and CH) were study collaborators.

Competing interests

All authors have completed the ICMJE uniform disclosure form at http://www.icmje.org/conflicts-of-interest/ (available on request from the corresponding author). JN, BK, EB, IB, AB, KC, I.K, and CH all declare that they have no conflicts of interest.

A-T M reports grants from Australian Meals on Wheels Association, personal fees from Port CRC, personal fees from Proportion Foods, personal fees from YLM Corp, personal fees from PhD examinations, personal fees from Flagstaff Fine Foods personal fees from IRT, grants from University of Wollongong grant funds; outside the submitted work.

Acknowledgements

We wish to acknowledge Lee Murray and his team at the University of Wollongong Sports Holiday Camp for their flexibility and willingness to partner with us to bring this study to fruition. We thank the operations team at Early Start and all our research assistants for their support and hard work throughout the study. Finally, we wish to acknowledge all our study participants, without whom the successful completion of this study would not have been possible.

Appendix A. Supplementary data

Supplementary data related to this article can be found at https://doi.org/10.1016/j.appet.2018.02.026.

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Appendix D: Abstract of paper presented at the University of Wollongong Social Sciences Higher Degree Research Conference 2017

Oral Presentation Submission: Jennifer Norman, Early Start, School of Health and Society

The sustained impact of unhealthy food advertising on children’s dietary intake: a within-subject, randomised, crossover, counter-balanced trial

Jennifer Norman¹, Bridget Kelly¹, Anne-T McMahon¹, Emma Boyland², Louise Baur³, Adrian Bauman³, Lesley King², Kathy Chapman¹, Clare Hughes⁴
¹University of Wollongong, Australia; ²University of Liverpool, UK; ³University of Sydney, Australia; ⁴Cancer Council NSW, Australia

Abstract

Background

Food advertising exposure increases children’s immediate food consumption, but whether this increased intake is compensated for at later eating occasions is not known; consequently the sustained effect on diets, and resultant link to children’s weight, remains unclear.

Methods

Across four, six-day holiday camps between April 2016 and January 2017, children (aged 7-12 years, n=160; 40/camp) were exposed to food and non-food advertising in an online game and/or a television cartoon in a randomised within-subject, cross-over, counter-balanced design. Children’s food intake (kilojoules) was measured at a snack immediately after exposure and then at lunch later in the day. Linear mixed models analyses were conducted to examine relationships between exposure and dietary intake, taking into account gender, age and weight status.

Results

All children in the multi-media condition ate more at a snack after exposure to food advertising compared with non-food advertising; this was not compensated for at lunch, leading to additional daily food intake of 194kJ (p=0.001). Exposure to multi-media food advertising compared with a single-media source increased the effect on snack intake by a difference of 182kJ (p= 0.009). Food advertising had an increased effect among children with heavier weight status in both media groups.

Conclusion

The lack of compensation for children’s increased snack intake suggests that unhealthy food advertising does play a role in contributing to a positive energy-gap, which can lead to overweight. These results are an important addition to the evidence needed to continue to advocate for regulation to limit food marketing to children.
Appendix E: Abstract of paper presented at International Society of Behavioral Nutrition and Physical Activity Conference 2017

THE SUSTAINED IMPACT OF UNHEALTHY FOOD ADVERTISING ON CHILDREN’S DIETARY INTAKE: RESULTS FROM AN EXPERIMENTAL STUDY

1University of Wollongong, NSW; 2University of Liverpool, Liverpool; 3University of Sydney, NSW; 4Cancer Council NSW, NSW.

Purpose Children continue to be exposed to significant levels of unhealthy food marketing. A key issue impeding policy change is the shortage of evidence showing direct and ongoing links between food marketing and children’s energy intake and weight. Acute exposure to food advertising on TV or online has an immediate direct effect on children’s food consumption, increasing their intake of snack foods. This study investigates children’s food consumption over an extended period following exposure to food advertising from one or more media sources. The study aims to explore whether short-term increases in snack intake following food advertising exposure are compensated for at a subsequent meal; and hence identify if food advertising contributes to a positive energy balance likely to contribute to childhood overweight. Methods Across a series of six-day holiday camps, children (aged 7-12 years, n=40/camp; final camp January 2017) were exposed to food and non-food advertising in an online game and/or a television cartoon in a randomised within-subject, cross-over design. Children’s food consumption (kilojoules) was measured at a snack immediately after exposure and then at lunch later in the day. Linear mixed models analyses and t-tests were conducted to examine relationships between exposure and dietary intake, taking into account sex, age and weight status. Results Higher snack intake after watching food advertising was not compensated for at lunch in any condition or group (n=115). Exposure to multi-media food advertising compared with a single-media source increased the effect on snack intake (340kJ, p = 0.01). All children (irrespective of sex, age or weight status) in the multi-media condition ate more at a snack after food advertising compared with non-food advertising (182kJ, p=0.002). In the single-media condition, weight status was a moderator of the relationship between exposure to food ads and snack intake. Conclusions The lack of compensation for children's increased snack intake suggests that unhealthy food advertising does play a role in contributing to a positive energy-gap, which can lead to overweight. These results are an important addition to the evidence needed to continue to advocate for regulation to limit food marketing to children.
WHO European Action Network on Reducing Marketing Pressure on Children

Report of 12th meeting in Dublin, Ireland, 10-11 May 2017
ABSTRACT

In April 2017, the 12th meeting of the WHO European Action Network on Reducing Marketing Pressure on Children took place in Dublin, Ireland. The Network facilitates cooperation and knowledge sharing between European Member States on reducing marketing of foods high in fat, sugar or salt (HFSS) to children as part of broader efforts to tackle increasing levels of childhood obesity and the high burden of noncommunicable diseases.

Meeting participants—including representatives of 15 Network countries—exchanged information on national efforts to reduce marketing pressure on children. New national developments to extend the scope of marketing restrictions beyond broadcast marketing were reported in several Member States, to improve compliance through monitoring arrangements, to adopt the WHO nutrient profile model to define HFSS foods, and to implement evidence-informed policy.

New research of relevance was presented, including the findings that children who eat more HFSS foods following exposure to HFSS marketing do not compensate by eating less at the next mealtime, and that inclusion of a ‘protective’ message does not reduce the impact of advertisements promoting unhealthy foods to children. The Network meeting explored the wider challenges of food marketing—including digital marketing, advertisements and supermarket packaging of foods targeted at children—and identified the definition, measurement and monitoring of digital HFSS marketing to children as key areas for future collaboration. The meeting also considered how to address inappropriate promotion of foods for infants and young children and agreed to extend the remit of the Network beyond the issue of ‘marketing to children’ to include ‘promotion of foods for infants and young children’.

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Session 3: Update on new research in the area of marketing to children

Is overconsumption in response to food marketing later compensated for?

Jenny Norman and Bridget Kelly, University of Wollongong, Australia, presented (via a remote link) results of a study on sustained impact of energy-dense food advertising on children’s dietary intake.

It has been shown that food marketing influences children’s attitudes, preferences and consumption. While it has been shown that acute exposure to food advertising on television or online directly increases intake afterwards, however, there is a lack of evidence showing a direct and ongoing link between food marketing and children’s energy intake and weight.

A research study was conducted, therefore, to fill some of these gaps. The study aimed to investigate the effect of unhealthy food marketing on children’s immediate and later food consumption, from single and multiple media platforms over a period of six days. More specifically it aimed to monitor if increased energy consumed as a result of food advertising is compensated for at a later eating occasion.

The with-in-subject, randomised, crossover, counter-balanced trial was conducted at four University of Wollongong school holiday camps among children aged 7 to 12 years. There were two advertising conditions: experimental (food advertising) and control (non-food advertising).

Children arriving at the camp were served breakfast and their intake recorded. At mid-morning they were exposed to the advertising through single or multiple media. All children were shown a television cartoon and those with multi-media exposure also played an advergame. Food and non-food adverts were embedded. Each child was exposed to three days of food advertising and three days of non-food advertising. After the advertising exposure, children were served morning tea and snacks. Children were given 15 minutes’ eating time, and were given more food if they asked for it. At lunchtime, children could again eat as much or as little as they liked in the 30 minutes eating time. All food items were weighed pre and post eating.

The study found that a significant increase in snack intake (in kJ) was associated with exposure to the food advertising. There was an increased effect seen among children exposed to the multi-media condition and among children with overweight and obesity. The increased intake at snack time was not compensated for at lunch thus leading to a positive daily energy-gap on days children were exposed to food advertising.

Limitations of the study include the relatively short 15-minute period for snack time; sometimes children had asked for extra snacks but had not finished them by the end of the period. The study was also underpowered in the proportion of overweight and obese children. Strengths of the study include the natural setting and that dietary data collection was over a six day period.

This lack of compensation at lunch for children’s increased snack intake suggests that unhealthy food advertising does increase children’s daily energy intake, which, cumulatively over time could lead to the development of overweight. This is a significant contribution to the evidence base, and adds to the case for further restrictions on food advertising to children.
Discussion

The researchers were congratulated on this important contribution to the overall debate on food advertising to children.

There was clarification that there was no attempt to get the parents to assess or measure food intakes later in the day. It was felt that the burden on participants was already considerable and that measuring intakes at home would probably be too prone to error for this specific purpose. Additionally, it was clarified that camp organisers tried to maintain the intensity of physical activities during the camp consistent over the six days.

Children were able to choose between high fat savoury and high fat sweet snacks. To date, the analysis has been on results pooled from all data, and no specific analysis by type of food has been done. This may be a subject for further analyses.

None of the brands promoted in the advertising were offered as snacks. In this way, care was taken to ensure that the study looked beyond the brand effect of advertising.

It seems likely that the children would have consumed more snacks if the time available had been longer and this would have had implications for the results. Other studies, which did not impose a time limit, saw significant results for television advertising alone. An analysis of data on children who had asked for extra snacks but not finished them lead the authors to believe that the ‘television only’ results would have been statistically significant if the children had been given more eating time.

To offset any ethical concerns, the study also included a summary sheet for parents offering advice on how to discuss advertising with children. In addition, it was explained that children would not be exposed to more advertising than they would be in one hour of television viewing.

In relation to socioeconomic characteristics of the sample, some data on household income were collected and this was somewhat higher than the state average.

The research team does not currently have plans to repeat the study, but the study methodology could be repeated—and built on—in other countries. A change that the research team would recommend for any future studies would be to over sample overweight and obese children.

Available: https://www.isbnpa.org/files/annual_meetings/2016/08/31/19/attachments/57c72823e3fda.pdf
viewed 1 August 2018

P1.050
The sustained impact of energy-dense food advertising on children's dietary intake: results from a pilot study

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SIG: Children and families

Awards: Yes, for the Student Competition*

Purpose
An important reason for the failure to restrict children's exposure to energy-dense food marketing is the lack of evidence directly linking marketing to children's weight and energy intake. Short term studies designed to assess the effect of food advertising (in a cartoon or game) on children's subsequent food intake show there is an immediate direct effect from advertisement exposure (children consume more snack foods). This study will explore the effect of repeated exposure to food advertising (over several days) via multiple media (TV and online) on children's immediate snack intake and later meal consumption. This study's main contribution will be to investigate if food advertising contributes to positive energy balance through a lack of compensation for snack intake at later eating occasions, which would, therefore, suggest a role for food marketing in childhood weight gain.

Methods
At a series of six-day holiday camps, children (aged 7-12 years, $n = \text{approx. 120}$) will be exposed to food and non-food advertising in a cartoon and/or an online game in a randomised within-subject, cross-over design. Children's food consumption (grams and kilojoules) will be measured at a snack immediately after exposure and then at lunch later in the day. Linear mixed models analyses will be conducted to examine relationships between exposure and dietary intake: covariates will include age, sex and BMI.

Results
This paper presents pilot outcomes for the first 30 subjects, reporting on the impact of sustained exposure to food advertising on both immediate and later food choice and consumption, both within and between single media and multiple media platforms, compared with the control condition (non-food ad exposure). We will report within-subject differences between exposure to three days of food advertising and three days of non-food advertising for snack and lunch time dietary intake and whether increased energy intake from snack foods was compensated for at the later meal.

Conclusions
This study will contribute to understanding the effects of food advertising on children's dietary intake and its potential influence on children's weight. It will add to the evidence needed to continue to advocate for regulation to limit energy-dense food marketing to children.
Appendix H: Three minute thesis presentation 2018
Title: ‘Sustained impact of energy-dense food marketing on children’s dietary intake’.

Included on this page is a copy of the Peoples’ Choice Winner Certificate, a video link to the presentation and a copy of the speech.

This presentation included a ‘call to action’ to join the Cancer Council NSW CanAct advocacy campaign that was running at the time of the presentations.

Presentation available at https://youtu.be/GSAkzvupw0

Imagine if you will, mouth-watering adverts of smooth, rich, velvety chocolate. Not directed at children, mind you, but of course, children were wanting to share the joy and just wishing their worlds were made of Cadbury.

Junk food advertising. It was just about everywhere.

“We can keep our own house in order”, the food industry said. Voluntary regulation it was called. “We don’t want a nanny state, it’s up to parents to control what their children are seeing and eating.” Really? How were parents meant to push back against the millions of dollars that were spent on food advertising every year?

Buses, bus stops, train stations, TV, all over the internet. Even whilst we were waiting for the video umpire to make his decision on the cricket and the footy? Yep, we sat looking at a bargain bucket full of deep-fried chicken.

So even though there was evidence from all round the world that food advertising negatively affected children’s food behaviours, research from longer term studies was needed to look at the effect of food advertising on children’s dietary intake.

So, we recruited 160 children aged between 7 and 12 years and children attended one of four, six day school holiday camps here at the University of Wollongong. Children saw three days of food advertising and three days of non food advertising in a cartoon and an online game. When we measured what children had to eat at a snack afterwards we found that children ate more after food advertising. Now you would have thought that children would have eaten less at lunch later in the day to make up for this, but they didn’t. And children left camp on the food advertising days having eaten almost 50 calories more.

“50 calories”, people said, “so what, that’s not much”. But it was actually. An energy imbalance of only 50 calories is all that’s needed for the development of unhealthy weight gain in children over time.

This got everyone’s interest. This was the first study in the world to show a direct link between food advertising exposure and the likelihood of overweight in children.

Our National TV talked about our study, the NSW parliament and even the UK parliament have talked about our study.

But despite all this evidence restricting junk food advertising to children isn’t even on the Government’s agenda here in Australia.

But as researchers, health organisations and mums and dads everywhere have had ENOUGH.

We want children to grow up without the influence of junk food advertising.

So what can you do? Have you ENOUGH?

Then join me and Cancer Council’s CanAct’er advocacy campaign and together we CAN ACT.

Let’s ask the government to put our kids before corporates. Because we need them to stand up to the mighty multinational media machine of Maccas and their mates. Because quite frankly, Maccas, we ain’t loving it.
Children’s self-regulation of eating overpowered by junk food marketing

STUDY STRENGTHENS CASE FOR GREATER REGULATION OF FOOD INDUSTRY MARKETING TO CHILDREN

All children are susceptible to junk food advertising, regardless of how parents try to influence their eating habits. This key finding is from a study led by researchers from the University of Wollongong (UOW) published in the journal *Appetite*.

The study, of 160 children aged between seven and 12, measured their food consumption after exposure to television and online advertising.

Food consumption of all children increased after they were exposed to promotions for unhealthy food and drinks. However, the increase was greatest among those whose parents reported that they used controlling feeding practices in the home.

These practices, which have been shown to impede a child’s ability to self-regulate their own food intake, include pressuring children to eat everything on their plate and restricting the types of food that children are allowed to eat, such as not allowing them any access to unhealthy foods.

Children who self-regulated their eating had a smaller increase in food consumption than the children who were less able to self-regulate. But even these children who had better self-regulation were still overwhelmed by the food marketing and ate significantly more in after food marketing exposure.

Associate Professor Bridget Kelly, from UOW’s Early Start and School of Health and Society, said the study looked at how exposure to food marketing affected children’s food intake in the longer term.

‘This is the first study that has looked at the impact of junk food marketing on overall diet by estimating how much extra kids eat after exposure to food marketing, and the influence on subsequent meals,’ Professor Kelly said.

‘We exposed the kids to either food or non-food advertising over a six-day period and looked to see how much they ate at snack time just after that advertising, and then also at a later meal to see whether they compensated for any increase that they had at the snack.’

The research paper’s lead author, PhD student Jenny Norman, said the researchers also wanted to see whether parents’ feeding practices had an influence on children's ability to guard against the negative effects of food advertising on their eating behaviours.

‘First of all, no parenting practices protected children from food advertising affects, but more so, both restrictive eating practices and pressure to eat actually increased children's responsiveness,’ Ms Norman said.

‘Essentially, what the study indicates is that as a parent you are damned if you do, damned if you don't. Your child appears to be at the mercy of whatever food industry messages they are seeing.'
‘Basically, the effects of advertising overrode any child’s ability to regulate themselves’

In the study, groups of children were exposed to either television advertising only, or to both television and online advertising. Professor Kelly said children exposed to advertising from multiple sources were particularly susceptible to overeating afterwards.

‘When kids see advertisements from multiple media sources it really is overwhelming and their defences are really down,’ she said.

‘There’s emerging evidence to suggest that children don’t see online advertising merely as marketing and so their scepticism is reduced.

‘When they’re immersed in the game they don’t necessarily recall seeing the advertising, let alone thinking critically about it. So it’s just another food cue they see and process – potentially unconsciously – and then they go and eat more when the opportunity arises.’

The study strengthens the case for greater regulation of food industry marketing to children.

‘The message from this paper is that yes, parents are largely responsible for children's diets, but we also need governments to step in to create supportive environments for children in terms of the advertising they see,’ Professor Kelly said.

‘The argument that parents should be the sole gatekeepers of children's diets, that we don’t need so-called ‘nanny state’ government control over what advertising children see, is a furphy.

‘Children aren't able to defend themselves against this marketing. It's more than just getting parents to be gatekeepers; this research shows that governments need to step in and regulate.’

‘Children's self-regulation of eating provides no defense against television and online food marketing’, by Jennifer Norman, Bridget Kelly, Anne-T. McMahon, Emma Boyland, Louise A. Baur, Kathy Chapman, Lesley King, Clare Hughes, and Adrian Bauman, is published in the journal Appetite.

This research was funded by an Australian Research Council Linkage Grant with contributed funding from Cancer Council NSW as the Linkage Partner organisation.

Media resources:

Professor Kelly is available for interview via the contact details below or through the UOW Media Office. High-resolution photographs of Professor Kelly are available for download from Dropbox.

Television interview opportunities are available on request. UOW has a Globelyn live TV interview studio facility. To arrange an interview, contact the UOW Media Office and book via the Globelyn online booking system.

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JUNK FOOD

A child's ability to control over-eating is too often overpowered by junk food marketing regardless of what a parent might attempt to do to encourage healthy eating, a study has found.

Australian researchers at the University of Wollongong say the study, published in journal Appetite, strengthens the case for greater regulation of food industry marketing to children.

The study, of 160 children aged between seven and 12, measured their food consumption after exposure to television and online advertising for six straight days.

Food consumption of all children increased after they were exposed to promotions for unhealthy food and drinks.

Interestingly, the increase was greatest among those whose parents reported that they used controlling feeding practices in the home.

These practices include pressuring children to eat everything on their plate and restricting the types of food that children are allowed to eat, such as not allowing them any access to unhealthy foods.

Children who self-regulated their eating had a smaller increase in food consumption than the children who were less able to self-regulate.

But even these children who had better self-regulation were still overwhelmed by the food marketing and ate significantly more in after food marketing exposure.

The research paper's lead author, PhD student Jenny Norman says the effects of advertising overrode any child's ability to regulate themselves.

‘Essentially, what the study indicates is that as a parent you are damned if you do, damned if you don't. Your child appears to be at the mercy of whatever food industry messages they are seeing,’ said Ms Norman.
This article was published on the following Australian online news pages on 16 March 2018:

**Online Article:** ‘Junk food’. *SBS News Australia* 16 March 2018, viewed 23 July 2018:

**Online Article:** ‘Junk food’. *Daily Mail Australia* 16 March 2018, viewed 23 July 2018:

**Online Article:** ‘Junk food’. *The Australian* 16 March 2018

**Online Article:** ‘Junk food’. *The Daily Telegraph* 16 March 2018

**Online Article:** ‘Junk food’. *The Brisbane Courier-Mail* 16 March 2018

**Online Article:** ‘Junk food’. *The Adelaide Advertiser* 16 March 2018
Appendix K: Online news article: ‘UOW professor wants greater regulation of junk food marketing to children’. Illawarra Mercury March 16 2018, viewed 23 July 2018:

UOW professor wants greater regulation of junk food marketing to children

Agron Latifi MARCH 16 2018 – 12.10PM

Associate Professor Bridget Kelly wants governments to step in and regulate what advertising children

Illawarra parents take note – being overly controlling with your kids’ diets is no match for junk food marketing.

In fact a key finding of a study led by University of Wollongong researchers found food consumption of all children increased after they were exposed to promotions for unhealthy food and drinks.

Furthermore, the increase was greatest among those whose parents reported that they used controlling feeding practices, such as not allowing their children access to unhealthy foods in the home.

The study, of 160 children aged between seven and 12, measured their food consumption after exposure to television and online advertising.

The study published in the journal Appetite, found all children were susceptible to junk food advertising, regardless of how parents try to influence their eating habits.

The research paper’s lead author, PhD student Jenny Norman said ‘what the study indicates is that as a parent you are damned if you do, damned if you don’t’.
‘Your child appears to be at the mercy of whatever food industry messages they are seeing,’ Ms Norman said.

‘Basically, the effects of advertising overrode any child’s ability to regulate themselves.’

Associate Professor Bridget Kelly, from UOW’s Early Start and School of Health and Society, said children exposed to advertising from multiple sources were particularly susceptible to overeating afterwards.

‘When kids see advertisements from multiple media sources it really is overwhelming and their defences are really down,’ Prof Kelly said.

‘There’s emerging evidence to suggest that children don’t see online advertising merely as marketing and so their scepticism is reduced.’

She said the study strengthens the case for greater regulation of food industry marketing to children.

‘The message from this paper is that yes, parents are largely responsible for children's diets, but we also need governments to step in to create supportive environments for children in terms of the advertising they see,’ Prof Kelly said.

‘The argument that parents should be the sole gatekeepers of children's diets, that we don't need so-called ‘nanny state’ government control over what advertising children see, is a furphy.

‘Children aren't able to defend themselves against this marketing. It's more than just getting parents to be gatekeepers; this research shows that governments need to step in and regulate.’

‘Children's self-regulation of eating provides no defense against television and online food marketing’ was funded by an Australian Research Council Linkage Grant.

The above article by Agron Latifi was published online on the following 44 Australian regional news pages on 16 March 2018:


The website links for the following articles are no longer valid:

5. ‘UOW professor wants greater regulation of junk food marketing to children’. Moree Champion 16 March 2018
6. ‘UOW professor wants greater regulation of junk food marketing to children’. Daily Liberal 16 March 2018
7. ‘UOW professor wants greater regulation of junk food marketing to children’. Port Macquarie News 16 March 2018
8. ‘UOW professor wants greater regulation of junk food marketing to children’. Maitland Mercury 16 March 2018
9. ‘UOW professor wants greater regulation of junk food marketing to children’. Newcastle Herald 16 March 2018
10. ‘UOW professor wants greater regulation of junk food marketing to children’. Ararat Advertiser 16 March 2018
11. ‘UOW professor wants greater regulation of junk food marketing to children’. Barossa Herald 16 March 2018
12. ‘UOW professor wants greater regulation of junk food marketing to children’. Eyre Peninsula Tribune 16 March 2018
13. ‘UOW professor wants greater regulation of junk food marketing to children’. The Courier 16 March 2018
14. ‘UOW professor wants greater regulation of junk food marketing to children’. The Armidale Express 16 March 2018
15. UOW professor wants greater regulation of junk food marketing to children’. Bunbury Mail 16 March 2018
16. ‘UOW professor wants greater regulation of junk food marketing to children’. The Standard 16 March 2018
17. ‘UOW professor wants greater regulation of junk food marketing to children’. Port Stephens Examiner 16 March 2018
18. ‘UOW professor wants greater regulation of junk food marketing to children’. Cowra Guardian 16 March 2018
19. ‘UOW professor wants greater regulation of junk food marketing to children’. The Advocate 16 March 2018
20. ‘UOW professor wants greater regulation of junk food marketing to children’. The North West Star 16 March 2018
21. ‘UOW professor wants greater regulation of junk food marketing to children’. Blayney Chronicle 16 March 2018
22. ‘UOW professor wants greater regulation of junk food marketing to children’. Wimmera Mail Times 16 March 2018
23. ‘UOW professor wants greater regulation of junk food marketing to children’. Wollondilly Advertiser 16 March 2018
24. ‘UOW professor wants greater regulation of junk food marketing to children’. The Advocate Hepburn 16 March 2018
25. ‘UOW professor wants greater regulation of junk food marketing to children’. _The Northern Daily Leader_ 16 March 2018
26. ‘UOW professor wants greater regulation of junk food marketing to children’. _The Irrigator_ 16 March 2018
27. ‘UOW professor wants greater regulation of junk food marketing to children’. _Central Western Daily_ 16 March 2018
28. ‘UOW professor wants greater regulation of junk food marketing to children’. _The Rural_ 16 March 2018
29. ‘UOW professor wants greater regulation of junk food marketing to children’. _Wellington Times_ 16 March 2018
30. ‘UOW professor wants greater regulation of junk food marketing to children’. _Port Lincoln Times_ 16 March 2018
31. ‘UOW professor wants greater regulation of junk food marketing to children’. _The Port Pirie Recorder_ 16 March 2018
32. ‘UOW professor wants greater regulation of junk food marketing to children’. _Inverell Times_ 16 March 2018
33. ‘UOW professor wants greater regulation of junk food marketing to children’. _Narooma News_ 16 March 2018
34. ‘UOW professor wants greater regulation of junk food marketing to children’. _The Young Witness_ 16 March 2018
35. ‘UOW professor wants greater regulation of junk food marketing to children’. _Newcastle and Lake Macquarie Star_ 16 March 2018
36. ‘UOW professor wants greater regulation of junk food marketing to children’. _Mudgee Guardian_ 16 March 2018
37. ‘UOW professor wants greater regulation of junk food marketing to children’. _Parkes Champion Post_ 16 March 2018
38. ‘UOW professor wants greater regulation of junk food marketing to children’. _Collie Mail_ 16 March 2018
39. ‘UOW professor wants greater regulation of junk food marketing to children’. _The Examiner_ 16 March 2018
40. ‘UOW professor wants greater regulation of junk food marketing to children’. _Bendigo Advertiser_ 16 March 2018
41. ‘UOW professor wants greater regulation of junk food marketing to children’. _Southern Highland News_ 16 March 2018
42. ‘UOW professor wants greater regulation of junk food marketing to children’. _Western Advocate_ 16 March 2018
43. ‘UOW professor wants greater regulation of junk food marketing to children’. _The Avon Valley and Wheatbelt Advocate_ 16 March 2018
44. ‘UOW professor wants greater regulation of junk food marketing to children’. _Augusta-Margaret River Mail_ 16 March 2018
Appendix L: Printed Newspaper Article: ‘UOW study finds children ‘overpowered’ by junk food marketing’. Illawarra Mercury 19 March 2018

Illawarra parents take note – being overly controlling with your kids’ diets is no match for junk food marketing.

In fact, a key finding of a study led by University of Wollongong researchers found food consumption of all children increased after they were exposed to promotions for unhealthy food and drinks.

Furthermore, the increase was greatest among those whose parents reported that they used controlling feeding practices, such as not allowing their children access to unhealthy foods in the home.

The study, of 160 children aged between seven and 12, measured their food consumption after exposure to television and online advertising.

The study published in the journal Appetite, found all children were susceptible to junk food advertising, regardless of how parents try to influence their eating habits.

The research paper’s lead author, PhD student Jenny Norman said “what the study indicates is that as a parent you are damned if you do, damned if you don’t.”

“Your child appears to be at the mercy of whatever food industry messages they are seeing,” Ms Norman said.

“Basically, the effects of advertising override any child’s ability to regulate themselves.”

Associate Professor Bridget Kelly, from UOW’s Early Start and School of Health and Society, said children exposed to advertising from multiple sources were particularly susceptible to overeating afterwards.

“When kids see advertisements from multiple media sources it really is overwhelming and their defences are really down,” Prof Kelly said.

“There’s emerging evidence to suggest that children don’t see online advertising merely as marketing and so their scepticism is reduced.”

She said the study strengthens the case for greater regulation of food industry marketing to children.

“The message from this paper is that yes, parents are largely responsible for children’s diets, but we also need governments to step in to create supportive environments for children in terms of the advertising they see,” Prof Kelly said.

“The argument that parents should be the sole gatekeepers of children’s diets, that we don’t need so-called ‘nanny state’ government control over what advertising children see, is a farce.

“Children aren’t able to defend themselves against this marketing. It’s more than just getting parents to be gatekeepers; this research shows that governments need to step in and regulate.”

“Children’s self-regulation of eating provides no defense against television and online food marketing” was funded by an Australian Research Council Linkage Grant.
Appendix M: Media release -Junk food ads lead to overeating capable of driving unhealthy weight gain in children, new study finds.

**Media Release**

23 APRIL 2018

**Junk food ads lead to overeating capable of driving unhealthy weight gain in children, new study finds**

**FINDINGS show need for greater regulation says researcher**

Children’s food consumption increases after exposure to unhealthy food advertising and this increase is not compensated for by eating less at subsequent meals, a world-first study by University of Wollongong (UOW) researchers has found.

On average, the daily food intake of children in the study increased by almost 50 calories after watching food advertising; an amount that over time would lead them to becoming overweight.

The study is published in the *International Journal of Behavioural Nutrition and Physical Activity*.

Lead author Ms Jenny Norman, a PhD student at UOW’s Early Start and School of Health and Society, said previous studies have shown that food advertising increases children’s immediate food consumption, but this was the first to show that this could lead to calorie imbalance.

“This study shows food marketing can directly influence calorie imbalances capable of driving excess weight gain in children,” Ms Norman said.

“We know when children watch food advertising they eat more at a snack afterwards. What hasn’t been shown before is whether that short-term increase is compensated for at later meals, and that’s what we measured in our study.”

The study involved 160 children between the ages of seven and 12, and took place over six days at a school holiday camp. On three of the days, the children watched food advertising—a television cartoon and, for some children, also an online game—and on the other three days they watched non-food advertising. The researchers measured the children’s food intake at a snack soon after watching advertising as well as at a later meal.

On food advertising days the children left camp with an average positive energy imbalance of almost 50 calories. Previous studies have shown that an energy imbalance of between 50 and 70 calories is enough to drive unhealthy weight gain in children.

Exposure to both online and television advertising exerted a stronger influence than exposure to television advertising alone, the researchers found.

“Exposure to food advertising from multiple media is part of children’s daily life. Children are avid users of modern technology and it is not unusual for children to be watching TV while playing online,” Ms Norman said.

“We captured our results in an experimental setting where children were exposed to a limited and controlled amount of advertising. In the real-world they are exposed to many more unhealthy food messages over the course of the day, and could be stimulated to eat unhealthy foods much more than we saw in our study.”
The study also found that overweight children were even more receptive to food advertising than their normal weight peers were.

‘Children with overweight and obesity had an increased susceptibility to the food marketing and had a calorie imbalance that was double that of other children,’ Ms Norman said. ‘Given that one in four children in New South Wales has overweight, this is quite a concern.’

Ms Norman said the study showed the need for increased regulation of food marketing to children.

‘Previous studies have shown that restricting food marketing to children is one of the best, most cost-effective ways to reduce the incidence of childhood obesity,’ she said.

‘Sustained impact of energy-dense TV and online food advertising on children’s dietary intake: a within-subject, randomised, crossover, counter-balanced trial’ by Jennifer Norman, Bridget Kelly, Anne-T McMahon, Emma Boyland, Louise A. Baur, Kathy Chapman, Lesley King, Clare Hughes and Adrian Bauman is published in the International Journal of Behavioral Nutrition and Physical Activity.

The study received funding from an Australian Research Council Linkage Grant and from Cancer Council NSW (the Linkage Partner organisation).

MEDIA NOTES:

Jenny Norman is available for interview via the contact details below or through the UOW Media Office. B-roll footage and high-resolution photographs of Ms Norman are available for download from Dropbox.

Television interview opportunities are available on request. UOW has a Globelynx live TV interview studio facility. To arrange an interview, contact the UOW Media Office and book via the Globelynx online booking system.

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Appendix N: TV program appearances

1. *WIN News Illawarra*, 2018, TV program, Channel Nine Entertainment Company, Australia, 23 April

2. ‘Junk Food’. *The Today Show* 2018, TV program, Channel Nine Entertainment Company, Australia, 24 April. The Today Show Panel discussion on interview available at:

   https://www.facebook.com/iwakeupwithtoday/videos/1987182297983092/


   https://www.facebook.com/tennews/videos/1927923067277991/?t=0


Junk food ads driving weight-gain in children – study

In 2016, two UN human rights experts called upon schools to ban advertising, promotion and sponsorship of unhealthy foods in schools, which they said was contributing towards the obesity of young people.

Such commercial messages, they said, have the potential to shape children’s long-term consumer and financial behaviour – and what’s more, they are growing in number and reach.

Now, a world-first study has found that junk food ads lead to overeating capable of driving unhealthy weight gain in children.

The study, published in the International Journal of Behavioural Nutrition and Physical Activity, shows that children eat more food after watching unhealthy food advertising and don’t compensate by eating less at later meals.

On average, the daily food intake of children in the study increased by almost 50 calories after watching food advertising; an amount that over time would lead them to becoming overweight.

Lead author Jenny Norman, a PhD student at the University of Wollongong’s (UOW) Early Start and School of Health and Society, said previous studies have shown that food advertising increases children’s immediate food consumption, but this was the first to show that this could lead to calorie imbalance.

‘This study shows food marketing can directly influence calorie imbalances capable of driving excess weight gain in children,’ Norman said.

‘We know when children watch food advertising they eat more at a snack afterwards. What hasn’t been shown before is whether that short-term increase is compensated for at later meals, and that’s what we measured in our study.’

The study involved 160 children between the ages of seven and 12, and took place over six days at a school holiday camp. On three of the days the children watched food advertising – a television cartoon and, for some children, an online game as well. On the other three days, they watched non-food advertising.

The researchers measured the children’s food intake at a snack soon after watching advertising as well as at a later meal. On food advertising days the children left camp with an average positive energy imbalance of almost 50 calories.
Previous studies have shown that an energy imbalance of between 50 and 70 calories is enough to drive unhealthy weight gain in children.

Exposure to both online and television advertising exerted a stronger influence than exposure to television advertising alone, the researchers found.

‘Exposure to food advertising from multiple media is part of children's daily life. Children are avid users of modern technology and it is not unusual for children to be watching TV while playing online,’ Norman said.

‘We captured our results in an experimental setting where children were exposed to a limited and controlled amount of advertising. In the real-world they are exposed to many more unhealthy food messages over the course of the day, and could be stimulated to eat unhealthy foods much more than we saw in our study.’
Kids chew on junk food ads
BRIGID O’CONNELL
317 words
24 April 2018
Herald Sun
HERALDSUN
Herald Sun
13

CHILDREN eat more after watching junk food ads, but they also don’t compensate by eating less later in the day, a world-first study has found.

This is the first time researchers have measured whether the influence of food advertising is balanced out over subsequent meals, with population health experts saying the results provide strong evidence to tighten restrictions on unhealthy food advertising to children.

The University of Wollongong team measured the food consumption of 160 children aged 7-12 years over six days across four school holiday camps in New South Wales.

On three days, they were shown unhealthy food advertising on TV, and in some kids through video games, and on the other days the ads were non-food-related.

On the days they watched junk food ads, children consumed almost an extra 210 kilojoules through snacks and lunch, an energy imbalance that would lead them to excess weight gain over time.

Overweight children were more influenced by the cues. They ate 126 kilojoules more than healthy weight children when they saw ads on TV, and consumed an additional 250 kilojoules when exposed to unhealthy food ads on both TV and in games.

The findings were published in the International Journal of Behavioral Nutrition and Physical Activity. It follows research released last week from the University of Adelaide and the Heart Foundation that found children are exposed to 800 junk food ads each year if they watch 80 minutes of TV a day.

Lead UOW researcher Jenny Norman said that a key barrier to policy change surrounding unhealthy food marketing to children had been a lack of evidence.

“Economic modeling suggests that limiting food marketing to children would be one of the most cost-effective population-based strategies to reduce the prevalence of childhood obesity,” Ms Norman
wrote.brigid.oconnell@news.com.au
UOW study reveals parents steamrolled by junk food industry

April 24 2018 – 1.00PM
Agron Latifi

Study lead author Jenny Norman, a PhD student at UOW’s Early Start and School of Health and Society, wants increased regulation of food marketing to children.

Jenny Norman has had enough of her kids being force-fed junk food ads while watching television or playing on their iPads.

That’s why the lead author of a ‘world-first’ University of Wollongong study is leading calls for tougher regulations of food marketing to children.

On average, the daily food intake of children in the study increased by almost 50 calories after watching food advertising; an amount that over time would lead them to becoming overweight.

Ms Norman, a PhD student at UOW’s Early Start and School of Health and Society, said action was needed to stop children from continually being exposed to high levels of junk food advertising.

‘This [study] is all about creating supportive environments for parents so they can bring their children up to be as healthy as they can,’ she said.

‘The Cancer Council are actually running a campaign at the moment called Our Kids, Our Call where parents can join the campaign and be a collective voice for their children.

‘There has also been a lot of media this last week with Jamie Oliver promoting the We’ve #AdEnough of junk food marketing campaign in England.

‘I think globally there is a strong call for increased regulation. Parents have had enough of their children being exposed to lots of unhealthy food advertising.’

Parents, she said, were also sick of the uneven playing field.

‘On the one hand you have the food industry spending millions of dollars a year creating really clever, enticing adverts and as parents we are all trying to do our best but I guess those efforts get steamrolled by what’s being promoted,’ Ms Norman said.

‘We do know that food advertising creates social norms around what's acceptable to eat and it effects children's attitudes, preferences and so forth.

‘As a parent, I’ve had enough. I think we’ve all had enough.’
Ms Norman recognises policing online advertising would be challenging, but felt the Australian government could follow the lead of the UK and introduce ‘some internet regulations’.

‘The online space is currently very unregulated and we are really calling for the government to look into that and on TV also, especially between 7-9pm,’ she said.

‘It’s during that family viewing time, like when you’ve got The Voice on, as well as other popular shows, that children continue to be exposed to high levels of junk food advertising.’

Ms Norman added that while previous studies have shown that food advertising increases children’s immediate food consumption, the latest UOW research was the first to show that this could lead to calorie imbalance.

The study involved 160 children between the ages of seven and 12, and took place over six days at a school holiday camp.

The study is published in the International Journal of Behavioural Nutrition and Physical Activity

The above article by Agron Latifi was published online on the following 80 Australian regional news pages on 25 April 2018:

1. ‘UOW study reveals parents steamrolled by junk food industry’. The Courier 25 April 2018, viewed 23 July 2018:

2. ‘UOW study reveals parents steamrolled by junk food industry’. The Stawell Times 25 April 2018, viewed 23 July 2018:

3. ‘UOW study reveals parents steamrolled by junk food industry’. The Gurya Argus 25 April 2018, viewed 23 July 2018:

4. ‘UOW study reveals parents steamrolled by junk food industry’. The Collie Mail 25 April 2018, viewed 23 July 2018:


6. ‘UOW study reveals parents steamrolled by junk food industry’. The Cowra Guardian 25 April 2018, viewed 23 July 2018:

7. ‘UOW study reveals parents steamrolled by junk food industry’. Lakes Mail 25 April 2018, viewed 23 July 2018:

8. ‘UOW study reveals parents steamrolled by junk food industry’. Manning River Times 25 April 2018, viewed 23 July 2018:


Merryn Porter
May 24 2018 at 9.26AM

**Proof that junk food advertising makes children overeat**

Children are more likely to overeat after being exposed to ads for junk food, according to a ground-breaking new study likely to reignite the debate about advertising aimed at children.

The study, led by researchers from the University of Wollongong and published in the journal Appetite, measured the food consumption of 160 children aged seven to 12 after exposure to advertising on the television and internet.

The children were exposed to either food or non-food advertising over a six-day period. Researchers then looked at how much they ate for a snack straight afterwards and a meal later that day.

The study found children ate more after they were exposed to promotions for unhealthy food and drink.

Associate Professor Bridget Kelly, from the university's Early Start program and The School of Health and Society, said the study was the first to look at the impact of junk food marketing on overall diet. She said children exposed to advertising from multiple sources were particularly susceptible to overeating.

‘When kids see advertisements from multiple media sources it really is overwhelming and their defences are really down,’ she said.

‘There's emerging evidence to suggest that children don't see online advertising merely as marketing.

‘They don't necessarily recall seeing the advertising, let alone thinking critically about it. So it's just another food cue they see and process – potentially unconsciously – and then they go and eat more when the opportunity arises.’

Lead author, PhD student Jenny Norman, said researchers also examined whether parental practices when it came to food had an influence on children's ability to stop themselves from overeating.

Practices, such as pressuring children to eat everything on their plate and restricting the types of food that children are allowed to eat, has been shown to impede a child's ability to self-regulate their own food intake, said the researchers.

The researchers found that the children who self-regulated ate less after viewing the material than the children whose parents were more involved in what they ate.

Ms Norman said the study overwhelmingly showed children were at the mercy of food advertisers.

‘Basically, the effects of advertising overrode any child's ability to regulate themselves,’ she said.

‘Your child appears to be at the mercy of whatever food industry messages they are seeing.’

The researchers said the study strengthened the case for greater regulation of food industry marketing to children.

‘The argument that parents should be the sole gatekeepers of children's diets, that we don't need so-called 'nanny state' government control over what advertising children see, is a furphy,’ Professor Kelly said.

‘Children aren't able to defend themselves against this marketing. It's more than just getting parents to be gatekeepers; this research shows that governments need to step in and regulate.’
The study comes just days after a leading obesity expert renewed calls for cartoon characters to be banned from food packaging aimed at children.

Associate Professor Gary Sacks of Deakin University told the Herald-Sun that colourful advertising on sugary junk foods in particular made them more appealing to children.

He said cartoon characters that appear on items like Paddle Pops, Froot Loops, Frosties and Coco Pops encouraged children to eat unhealthy foods.

He wants marketing restrictions placed on foods that would cover images used and the time of day they can be advertised.

The Obesity Policy Coalition supports this stance. Its own research has found that more than half of supermarket products marketed at kids are unhealthy.

A survey last year of 186 packaged foods with cartoons or character promotions designed to attract children found 52 per cent were classified as unhealthy by the Food Standards Australia New Zealand Nutrient Profiling Scoring Criterion calculator.

Kids' ice-creams and ice block were the worst offenders, with 88 per cent deemed unhealthy, followed by snack bars (87 per cent), cheese snacks (61 per cent), breakfast cereals (32 per cent) and dairy snacks (19 per cent).

The coalition's executive manager Jane Martin said it was shocking that manufacturers were getting away with directly targeting children with ads for unhealthy food.

'It's extremely frustrating to see cartoons and animations being used to lure children and create pester power to push parents into buying unhealthy products for kids,’ Ms Martin said.

‘Children are naturally drawn to fun, colourful characters on foods in the supermarket and food companies are fully aware of this. They know that children have an incredible amount of power over what their parents buy.'

Ms Martin said countries such as Chile had restricted the use of cartoons on unhealthy food packaging.

'In Australia, the use of cartoons and characters on food and drink packaging is allowed, even under weak self-regulation, providing an unfettered marketing tool for food advertisers to target children,’ Ms Martin said.

'We want food manufacturers to stop using animations to promote junk food in any way to kids and for the federal government to extend and strengthen existing junk food marketing regulations.

'Peak health bodies, such as the World Health Organization, recognise that restricting junk food marketing to children is a vital step in improving children's diets and slowing our serious obesity problem.

'Urgent action is required to protect our children from the plethora of junk food promotion that surrounds them.'
Appendix S: Webpage articles and references


Webpage reference:

World Health Organization 2018, ‘Reducing the impact of marketing of foods and non-alcoholic beverages on children. Evidence and clinical trials, viewed 23 July 2018:

http://apps.who.int/trialsearch/nutrition.aspx?Title=marketing%20and%20obesity%20
Appendix T: New South Wales Parliament Food Marketing Submission

Junk Food Marketing and Childhood Obesity: The Evidence and Action Needed

Over one in five children in NSW are classified as overweight or obese, putting them at risk of life-threatening disease in the future [1]. Reducing childhood overweight and obesity by 5% over 10 years is one of the NSW Premier’s Priorities [2]. The current NSW Health Healthy Living and Active Living Strategy recognises the importance of supportive food and physical activity environments to achieve this goal [3]. As acknowledged by the NSW Office for Preventive Health itself, there is still much to do if the target to reduce childhood overweight and obesity is to be reached [4]. Pioneering government policy is needed to disrupt the status quo.

Restricting children’s junk food marketing exposure has been identified as an international policy priority to reduce childhood obesity [5, 6] and has been highlighted as one of the most cost-effective population-based strategies to reduce the prevalence of childhood obesity, resulting in children’s health gains and health-service savings [7].

The Obesity Policy Coalition, an Australian alliance of 25 leading community, health and academic groups, has called for stronger restrictions to protect children from junk food marketing to help reduce child obesity [8].

This document sets out a summary of the key evidence to date and discusses the extent to which the evidence supports a causal link between junk food marketing exposure and children’s unhealthy weight gain. We conclude with opportunities for action at the State level.

How does junk food marketing affect children’s health?

The pathway linking exposure to junk food marketing to children’s unhealthy weight gain is complex, but is likely to involve a number of impacts (consolidated and accumulating over time) as outlined in the diagram below from Kelly et al., 2015 [9].
What is the evidence that junk food marketing is a problem?

There is a substantial body of evidence to demonstrate that junk food marketing negatively affects children’s eating behaviours and dietary health.

Research has shown that, in children, junk food marketing is associated with:

- The ‘normalisation’ of junk food consumption [10]
- Increased preference for junkfood [11]
- Greater taste preferences towards advertised products [12-14]
- Greater pesterings of parents to buy junk food [15]
- Immediate snack food consumption [14]
- Greater intake of junk food and lower intake of healthy food overall [17]
- Increased calorie intake that is not compensated for by eating less at later eating occasions, or an amount that could lead to the development of overweight in children [18, 19]
- Greater body weight [20]

Does junk food marketing contribute to childhood obesity?

Demonstrating a direct link between marketing exposure and obesity is challenging because:

- Obesity is a driven by a number of factors
- Weight gain typically occurs gradually
- Long-term trials that alter children’s exposure to food marketing are extremely challenging and expensive as all children in Australia and most Western cultures are exposed to a similarly large volume of marketing through a number of avenues

However, a recent Australian randomised crossover trial, where 160 children aged 7-12 years attended a 6 day holiday camp, showed that children ate an additional 94 kJ more at camp on the days they saw food advertising compared with non-food advertising. This energy imbalance is of a magnitude that over time could lead to unhealthy weight gain in children [18].

Taking the body of evidence in this field as a whole, there is sufficient evidence to surmise a cause and effect relationship. The internationally-recognised and widely-used standard for determining causality is the Bradford Hill framework [21].

A 2016 study by Norman et al [12] categorised the evidence for food marketing’s relationship with childhood obesity against this framework. The results are as follows:

- **Strength of association**: evidence shows that junk food marketing exposure is strongly associated with poor dietary choices and overconsumption of junk food
- **Experimental evidence**: across various study designs using a range of media, experimental evidence shows that junk food marketing strongly influences the food children prefer, the food they choose, and the food they actually eat
- **Dose-response**: evidence demonstrates that as the level of junk food marketing exposure increases so does the impact of that marketing
- **Consistency of evidence**: various study designs using a range of media, wide range of countries and ethnicities, evidence consistently shows negative impact on children’s food behaviours
- **Temporality**: evidence demonstrates significant effects on children’s food behaviours after exposure to junk food marketing
- **Plausibility and coherence**: psychosocial theories and biological underpinnings of children’s food preference development support the impact of junk food marketing on food behaviours

**Conclusion:** the current evidence satisfies all the key criteria and provides compelling evidence that junk food marketing and obesity are causally related.
What action is needed?
The Australian Government has overarching responsibility for the regulation on junk food marketing, but to date has not acted in the areas available to it to address concerns or strengthen regulations. There are, however, several opportunities for action at a state level.

1. Outdoor advertising.
Outdoor advertising continues to be a major promotional medium for advertisers. In the words of the industry, outdoor advertising is perceived as ‘a channel that is not able to be turned off or blocked, out-of-home advertising is unrivalled as the ultimate broadcaster’ [23]. In fact, out-of-home advertising reaches 12.4 million people daily across Australia with food listed as sixth and non-alcoholic beverages as tenth in the top 20 advertising categories [23]. The annual spend in Australia in the out-of-home food advertising category was $39 million, 22% from McDonalds Family Restaurants ($8.7 million)[23].

Children are exposed to junk food advertising in outdoor advertisements near schools [24], at bus shelters [25] and on the Sydney metropolitan train network [26]. For example: Red Rock Dell at Town Hall Station [27]; Streets Ice Cream at Bus Stops [28]; KFC at Bus Stops [29]; Coca Cola at Buses [30]; Fanta in city High Streets [31].

The fifth objective of the NSW State Environment Planning Policy No 64, Advertising and Signage (2013) states that ‘This Policy aims to ensure that public benefits may be derived from advertising in and adjacent to transport corridors’ [32]. We argue that given the proven negative effects of junk food marketing on children’s food behaviours, outdoor advertising of junk food does not confer benefit to the public but is, in fact, a public health threat.

Recommendation
We recommend that junk food advertising be removed from publicly owned assets where children and young people are likely to be exposed, including train stations, buses and bus shelters (though we acknowledge the latter are under local government jurisdiction).

**Hungry Jacks**

**Campaign:** Premium Choices  
**Agency:** Maxus  
**Year:** 2012  
**Source:** APN Outdoor  
**Objective:** To measure the awareness and brand impact of the ‘Premium Choices’ outdoor campaign and compare it to the same campaign on FTA  
**Audience:** People 18-54  
**Strategy:** Outdoor - Large Format & Transit and FTA TV  
**Results:**  
Outdoor in comparison to the FTA component, saw significant positive impact across all brand metrics.  
- Prompted Brand Awareness +58%  
- Outdoor added 17% Unique Awareness  
- 61% purchase intention of ‘Premium Choices Range’

2. Sponsorship of sporting, music and cultural events

Junk food companies sponsor sporting events (from local teams through to major national codes), community, music and cultural activities and events popular with children and young people [33]. Sponsorship is a powerful form of junk food promotion; it is a way of raising brand awareness, creating positive brand attitudes, and building emotional connections with consumers [34] [35]. It has been suggested that sponsorship has the potential to reach audiences through less regulated ways than traditional advertising [36].

There are many examples: McDonald’s supports Camp Quality’s Puppet Primary School Education Program in NSW Primary Schools, Little Athletics NSW [37] and Clean Up Australia Day (‘co-branding on essential materials that youth groups and schools receive.’[38]); KFC sponsors the Australian Cricket Big Bash League [39]; Coca Cola Amatil sponsor the Powerade Sports Loyalty Program for sports clubs [40] and the list goes on.


Recommendation

We recommend junk food sponsorship and advertising be phased out from sporting, cultural and music events in NSW. Appropriate funding opportunities should be made available to support the transition of sport, music and other events and activities away from junk food sponsorship.

3. Advocating at a national level for stronger regulation

The NSW Government can play an important role in encouraging the Australian Government to introduce strong, independent, legislation controls on all forms of junk food marketing. If state governments are taking steps towards reducing children’s exposure to junk food marketing, it’s vital that the Australian Government also takes action to maximise the impact and act in areas not available to state and territory governments.

Recommendation

We recommend the NSW Government advocate at a national level for effective, Government-led regulation of junk food marketing efforts could focus on encouraging the Australian Government to extend the restrictions on free-to-air TV junk food advertising to 5pm; to include all forms of digital marketing communication directed to children; to remove junk food sponsorship from sport and close the loophole in the Commercial Television Industry Code of Practice that allows junk food advertisements during sports programs, to complement action at a state level.

We draw your attention to the Bill ‘Protecting Children from junk food Advertising (Broadcasting and Telecommunications Amendment) Act 2011’ tabled in Federal Parliament by Senators Bob Brown and Richard Di Natale in 2011 [41]. We also commend Richard Di Natale for instigating a parliamentary inquiry into Australia’s obesity epidemic, particularly how it affects children, and the food industry’s role.

Contact details:
Associate Professor Bridget Kelly Email: bkelly@uow.edu.au Phone: +61 2 4221 3893
Mrs Jenny Norman Email: jn20@uowmail.edu.au Phone: +61 0407598874 Twitter: @jen_2517

Junk Food Marketing Brief May 2018, Bridget Kelly & Jenny Norman UOW
Key Papers


References

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32. nsw government: state environmental planning policy no 64—advertising and signage. in.; 2018.


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40. coca cola amati: powerade sports partnership program [https://test.mycams.com.au/~/media/MyCam/Partner%20Pages/partners/sport%20partnerships.html?en]

Appndix U: New South Wales Parliament Adjournment Speech

Walker D., 2018 ‘Childhood Obesity’ adjournment speech presented to the New South Wales Parliament, Legislative Council 23 May, viewed 23 July 2018:

Legislative Council Hansard – 23 May 2018 – Proof

CHILDHOOD OBESITY

Ms DAWN WALKER (02:44): Obesity is one of the most important public health challenges facing us today. Recently ABC’s Four Corners investigated the obesity and diabetes epidemic that we are facing in Australia. It was an eye-opening program but there was one fact that stuck with me. The youngest person with type 2 diabetes in Australia is just five years old. Type 2 diabetes used to be considered a disease of age, which was only seen in the elderly. That does not seem to be the case anymore. Type 2 diabetes is characterised by someone’s body losing its ability to respond to insulin. When a person’s pancreas cannot make enough insulin, the body loses its ability to properly regulate blood sugar levels— a symptom of diabetes. So how is it that a disease that has previously been slow and progressive has managed to affect someone as young as five years old?

Last week I spoke to two experts from the University of Wollongong about childhood obesity to try to get my head around what is happening when it comes to our kids’ health. They recently published a paper on junk food marketing and childhood obesity, and I was shocked to see the results. Exposure to junk food advertising has been clearly demonstrated to be linked to childhood obesity. Every parent in this room knows the difficulty of getting their kids to eat well. It is made even harder in the face of what feels like relentless junk food advertising. Pester power is a very real thing, but even if parents are able to resist the relentless pleas of their kids for junk food there is a substantial body of evidence to demonstrate that simply being exposed to junk food advertising negatively affects children’s eating behaviours and dietary health.

Advertising to children at all is widely regarded as ethically dubious. Young children cannot distinguish between advertisements and regular content, and older children, even if they understand the purpose and role of an advertisement, are still often emotionally and unconsciously influenced. This is particularly troubling when it comes to junk food advertising, which is linked to higher levels of weight and obesity in children. Shockingly, studies have shown that children as young as three recognise many more unhealthy food brands than healthy ones. We have regulations in place in Australia to limit junk food advertising but we need to do more. One in five children in New South Wales is classed as obese or overweight, which can lead to lifelong health problems. We have a responsibility to do all we can to ensure the best outcomes for children.

Much of this kind of regulation falls within the power of the Federal Government, but there are steps we can take at a State level. One area we could vastly improve is the outdoor advertising of junk foods. Children are exposed to this kind of advertising on billboards near their schools, at bus stops and on the Sydney metropolitan train system. We could easily address this by regulating the kind of advertising allowed on public transport routes that are frequently used by schoolchildren. We could ensure that when we encourage families to take public transport we are not exposing their children to harmful advertising. We have a chance to step in and make sure that the next generation of Australian children grows up happy and healthy. We need to act now to ensure that the current obesity and diabetes epidemic does not capture the next generation. We need to regulate junk food advertising to protect the health and wellbeing of our children.
Appendix V: Senate Select Committee into the Obesity Epidemic in Australia Submission

Kelly B. and Norman J., on behalf of the Food and Movement Research Theme, Early Start, University of Wollongong, 2018, ‘Submission to the Select Committee into the Obesity Epidemic in Australia’ (submission number 69), viewed 23 July 2018: https://www.aph.gov.au/Parliamentary_Business/Committees/Senate/Obesity_epidemic_in_Australia/Submissions

[Image of submission document]

PO Box 6100, Parliament House, Canberra ACT 2600
Tel: (02) 6277 3128 | Email: senate.committee.stn@aph.gov.au
Website: http://www.aph.gov.au/Parliamentary_Business/Committees/Senate/Obesity_epidemic_in_Australia

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Appendix W: Invitation to give evidence at the Senate Select Committee public hearing into the Obesity Epidemic in Australia

Following the above submission, the Early Start Food and Movement Research Theme were invited to give evidence at the Senate Committee public hearing into the Obesity Epidemic. Professor Heather Yeatman, Associate Professor Bridget Kelly and Jennifer Norman gave evidence on behalf of the Theme on Tuesday 4 September 2018. The Hansard transcript of the public hearing will be available at: https://www.aph.gov.au/Parliamentary_Business/Committees/Senate/Obesity_epidemic_in_Australia/Obesity/Public_Hearings

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18 August 2018

Ms Jenny Norman
Food and Movement Research Team at Early Start, University of Wollongong
By email: jenN@uowmail.edu.au

Dear Ms Norman,

Invitation to give evidence at a public hearing

The Senate Select Committee into the Obesity Epidemic in Australia will be holding a public hearing in Melbourne on Tuesday, 4 September 2018. The hearing is scheduled as follows:

Date: Tuesday, 4 September 2018
Time: 9.00am – 1.30pm
Location: Thornbury Room, Stamford Plaza, Melbourne

Your organisation is scheduled to appear from 2.30 pm – 3.00 pm. A copy of the program is attached; please note it is subject to change. At the commencement of the hearing, witnesses will be given an opportunity to make a short opening statement, preferably of no more than two minutes, after which the committee members will move to questioning.

Information on the role of the committee and its membership can be found here: https://www.aph.gov.au/Parliamentary_Business/Committees/Senate/Obesity_epidemic_in_Australia

Guidelines for witnesses appearing before Parliamentary Committees, and procedures to be observed by Senate Committees for the protection of witnesses can be found on the Senate’s website: http://www.aph.gov.au/Parliamentary_Business/Committees/Senate. If you require any special assistance including an Auslan interpreter, please advise the secretariat as soon as possible.

Could you please confirm your availability to give evidence at the public hearing and return a Hansard witness form (attached) for each person giving evidence by close of business Wednesday, 29 August 2018. Please note that the hearing will be broadcast on the committee’s website: https://www.aph.gov.au/News_and_Events/Webcast.ParlHearings

If you have any questions about the inquiry process or the public hearing, please feel free to contact the secretariat on (02) 6277 3228.

Yours sincerely,

Ms Gerry McLachlan
Committee Secretariat

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# The Senate Select Committee into the Obesity Epidemic in Australia

### Public Hearing Order of Proceedings

**SELECT COMMITTEE INTO THE OBESITY EPIDEMIC IN AUSTRALIA**

**Obesity Epidemic in Australia**  
**PUBLIC HEARING**  
**Tuesday 4 September 2018**  
**Melbourne**

<table>
<thead>
<tr>
<th>Time</th>
<th>Witness</th>
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<tbody>
<tr>
<td>9.00 am</td>
<td>The National Health and Medical Research Council <em>(Submission 116)</em></td>
</tr>
<tr>
<td></td>
<td>Australian Institute of Health and Welfare <em>(Submission 51)</em></td>
</tr>
<tr>
<td>9.45 am</td>
<td>National Centre for Epidemiology and Population Health, The Research School of Population Health, at The Australian National University <em>(Submission 29)</em></td>
</tr>
<tr>
<td></td>
<td>Dietitians Association of Australia <em>(Submission 107)</em></td>
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<tr>
<td>10.30 am</td>
<td>Break</td>
</tr>
<tr>
<td>10.45 am</td>
<td>Public Health Association of Australia <em>(Submission 73)</em></td>
</tr>
<tr>
<td></td>
<td>Australian Healthcare and Hospitals Association <em>(Submission 101)</em></td>
</tr>
<tr>
<td>11.30 am</td>
<td>Obesity Policy Coalition <em>(Submission 135)</em></td>
</tr>
<tr>
<td>12.00 pm</td>
<td>National Aboriginal Community Controlled Health Organisation <em>(Submission 136)</em></td>
</tr>
<tr>
<td>12.45 pm</td>
<td>Lunch</td>
</tr>
<tr>
<td>1.45 pm</td>
<td>National Rural Health Alliance Ltd <em>(Submission 138)</em></td>
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<tr>
<td></td>
<td>Australian Medical Association <em>(Submission 126)</em></td>
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<tr>
<td>2.30 pm</td>
<td>Food and Movement Research Team at Early Start, University of Wollongong <em>(Submission 69)</em></td>
</tr>
<tr>
<td>3.00 pm</td>
<td>Break</td>
</tr>
<tr>
<td>3.15 pm</td>
<td>Australian Industry Group <em>(Submission 117)</em></td>
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<tr>
<td></td>
<td>Australian Sugar Alliance <em>(Submission 71)</em></td>
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<tr>
<td></td>
<td>Australian Taxpayers’ Alliance <em>(Submission 123)</em></td>
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</tbody>
</table>

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Committee Chair: Senator Richard Di Natale  
Committee Secretary: Gerry McInally  
PO Box 6100, Parliament House Canberra ACT 2600  
Tel: +61 2 6277 3228 Fax: +61 2 6277 5829  
Email: obesitycommittee@aph.gov.au Internet:  
www.aph.gov.au/Parliamentary_Business/Committees/Senate/Obesity_Epidemic_in_Australia
Appendix X: Recruitment email cover letter for schools and sports clubs

Subject: Research study investigating the effects of media on children’s eating behaviours

Dear <<principal / sports club president >>,

We are conducting a research project on the effects of media on children’s eating behaviours. We are writing to request your assistance in recruiting participants for this research study. If you agree to provide assistance, we would ask for you to display posters and distribute flyers to families from your <<school/sports club>>. The study flyer is attached to this email. Once the participants are recruited to the study, no further involvement is required from your <<school/sports club>>.

What children eat is influenced by a wide range of factors. Childhood is an important time for the development of healthy eating habits and this project will explore how different media may impact on children’s eating behaviours.

To be eligible, children must be 7-12 years old and be able to attend a half-day session (8am – 1.30pm) of the University of Wollongong Sports Holiday Camp every day for six days on <<insert days>> during the upcoming <<insert>> school holidays.

As a thank you for participating, children’s camp fees for the mornings that they participate in the study will be fully paid. Fees are $27 per morning session: 6 days = $162. All meals will be provided during the study.

Parents and children must also be willing to complete some online questionnaires: two before the study starts and two a week after. Questionnaires will include questions about children’s media habits and knowledge and eating behaviours. Each pair of questionnaires will take approximately 40 – 50 minutes.

In appreciation for participating, parents will have the opportunity to go in to a draw to win an iPad Air 2 at the end of the final questionnaire.

Again, your assistance is only requested in the initial stage of distributing flyers to parents to inform them about the study. Thank you for considering our request.

Kind regards,

Jenny Norman
PhD Candidate | Public Health
Early Start, School of Health and Society
University of Wollongong NSW 2522 Australia
Children’s Eating Habits & Media Research Study

Is your child aged between 7 & 12 years?

Would they like to come along to the University of Wollongong Sports Holiday Camp in the XXX school holidays to take part in camp activities & some eating habits & media research?

Can they come every day from 8am to 1.30pm for 6 days: <<insert dates>>?

NO COST: CAMP FEES FULLY PAID

PLUS enter a draw to WIN an iPad Air 2

Please contact Jenny on <insert email> or <insert phone> for more information
Appendix Z: Recruitment email for email networks

Subject: Research study investigating the effects of media on children’s eating behaviours

Do you have a child aged 7-12 years?

Childhood is an important time for the development of healthy eating habits and what children eat is influenced by a wide range of factors. A research study is being conducted which will explore how different media may impact on children’s eating behaviours.

We are seeking volunteers to participate in a research trial being conducted through the University of Wollongong Early Start Research Institute.

To be eligible, children must be 7-12 years old and be able to attend a half-day session (8am – 1.30pm) of the University of Wollongong Sports Holiday Camp every day for six days from <<insert dates>> during the upcoming school holidays.

Parents and children must also be willing to complete some online questionnaires: two before the study starts and two a week after. Questionnaires will include questions about children’s media and eating habits and knowledge about brands and logos. Each pair of questionnaires will take approximately 40 – 50 minutes.

As a thank you for participating, children’s camp fees for the half-days that they participate in the study will be fully paid. Fees are $27 per morning session: 6 days = $162. All meals will be provided during the study and you will also have the opportunity to go in to a go in to a draw to win an iPad Air 2 at the end of the study.

For further information, please contact Jenny Norman on mobile XXX OR email XXX
Appendix AA: Eligibility screening script

INTERVIEWER’S NAME: ___________________________ DATE ______________

Thank you for your interest in your child participating in our research study which will be looking at different media and its potential effects on children’s eating behaviours.

My name is Jenny Norman, one of the researchers involved in the study. Could I take your name please?

RESPONDENT’S NAME: ___________________________

PHONE NUMBER: ________________________________

Where did you hear about the research study? ___________________________

Before I tell you more about the study we need to check that your child is eligible to participate so I need to ask you a series of questions. This will take about 10-15 minutes. Do you have time to talk now?

---

If Yes

Thinking about your child who is going to participate in this study:

What is their date of birth (day/month/year)? ___/___/_____

So, their age at their next birthday will be ________

*Check child is between 7 and 12 when they will be participating in the study if yes, continue with questions

If yes, continue with questions

---

If no...when would be a convenient time? ___________________________

Could I please take your phone number and call you back? ___________________________

---

The study will be held at the University of Wollongong in conjunction with their Sports Holiday Camp over a 6 day period from <<insert dates>> from 8.00am until 1.30pm. The study requires that your child needs to come along every morning for the six days. Will your child be available to attend each of those days? Yes/No.

---

If yes, 6 days, continue with Behavioural/Learning Questions below

---

If no, can’t attend those 6 days... We plan to run the study again during the school holidays later in the year. Is it likely that you might like your child to participate then? Yes/No if Yes, continue with questions and waitlist if eligible. If No, go to 2 below
During the study, we will be asking both you and your child to complete some questionnaires online; do you have access to the Internet and a computer or a tablet where you will be able to complete these?

If no, go to 6 below  
If yes, continue

During the study your child be required to complete tasks independently. There will include some reading and writing; the ability to listen and follow instructions; and the ability to sit still and quietly and focus on a task for 15 – 20 minutes each day of the study. Will your child be able to do all of these things independently? YES/NO

(If no, don't pressure the parent to disclose information)

If no, go to 3 below  
If yes, okay, I just have a few food related questions to ask you

Food Questions

Again, thinking about your child who is going to participate in this study:

Do they have any food allergies? (eg nuts, egg, dairy) Yes/No. If yes, please give details______________________________

If any of these are representative of any of the study foods go to 5 below....

If no to all of the above
Thank you. That is all the questions that we need to ask to make sure your child is eligible to participate in the study.

Your child is eligible to take part.

Have you got any questions about anything I've asked you so far? (Answer any questions)

I'll take more details from you shortly so we can send you out an information pack which includes a participant information sheet and consent forms but first I will briefly outline what the study will involve. This will take about 5 minutes. Are you happy to continue? If yes, continue. If no, when would be a convenient time to call back? (Make note on page 4)

The overall aim of the study is to explore the effect of different media on children's eating behaviours. The study has two main parts - the first is your child's participation during the University's school holiday camp and the second involves some online questionnaires with yourself and your child, two before the study starts and two one week after. Each pair of questionnaires will take about 50 minutes to complete. The parent questionnaires will ask you about your child's media and eating habits, some questions about your perceptions of both your child's weight and your own weight, some questions about family eating habits and finally some general information about your family. The children's questionnaires will ask them a series of questions about different brands and logos. Once you have completed the follow up questionnaires you will have the opportunity to go in to a draw to win an iPad Air 2.

I'll give you a brief overview of what your child's participation in the camp will entail. Everything will be clearly outlined in the information pack we will be sending out to you. Over the six day period of the holiday camp we will ask that you bring your child in to the University of Wollongong to the Early Start Research Institute at 8am and either pick them up at 1.30pm or, if they are booked in to the holiday camp for a full day, they will continue there for the afternoon. During the morning period we will be giving your child breakfast, morning tea and lunch and they will take part in camp activities for three hours. Mid-morning, depending on which group they are allocated to, they will either watch a short age-appropriate cartoon or play an online age-appropriate game for 5 minutes. During this time we will also show your child some advertisements that are typically shown during family peak viewing times. The advertisements are for a wide range of products including cars, sports equipment, food, whitegoods and department stores. All the products are international brands. There will be 30-40 other children involved in the study. They will eat breakfast and lunch all together and split into groups of 15-20 to have morning tea. As a thank you for participating in the study, your child's camp fees, for the mornings that they participate in the study will be fully paid. Morning session fees are $27 so for the 6 days that is $162.

That's just a brief overview. As I mentioned the information pack will have more detailed information. Please make sure you read it thoroughly, and you will have opportunity to ask questions before you give consent for your child to take part. Do you have any general questions now? (Answer any questions)
1. Unfortunately your child is out of the required age range of our study and isn’t eligible to participate. Thank you for your interest and taking the time to speak with me. Your child is still welcome to join in the UOW Holiday Camp – you can register your child online through the University of Wollongong.

2. Unfortunately we need your child to be able to attend for all the six days of the camp to be eligible to participate in the study. Thank you for your interest and taking the time to speak with me. Your child is still welcome to join in the UOW Holiday Camp – you can register your child online through the University of Wollongong.

3. We need your child to be able complete tasks independently/read independently/write independently/be able to listen and follow instructions/be able to sit still and quietly and focus on a task for 15 – 20 minutes each day of the study (refer to point which is applicable) so, unfortunately, they won’t be eligible to participate in the study. Thank you for your interest and taking the time to speak with me. Your child is still welcome to join in the UOW Holiday Camp – you can register your child online through the University of Wollongong.

4. Unfortunately because your child has food allergies/food intolerances/ a medical condition which effects what they can eat they won’t be eligible to participate in the study. Thank you for your interest and taking the time to speak with me. Your child is still welcome to join in the UOW Holiday Camp – you can register your child online through the University of Wollongong.

5. Unfortunately because your child has some strong dislikes/dietary restrictions to some of the foods we will be using in the study they won’t be eligible to participate. Thank you for your interest and taking the time to speak with me. Your child is still welcome to join in the UOW Holiday Camp – you can register your child online through the University of Wollongong.

6. Unfortunately you do need to have access to the Internet in order to complete the study questionnaires – because you don’t have access you won’t be able to complete them and, I’m sorry, this makes you ineligible to participate.
Waitlist

Child’s name__________________________________________

Preferred school holiday camp (circle): April July September January 2017

We will call you at least 2 weeks before the camp is due to start to let you know if there is a space for your child to take part in the study.

Notes
PARTICIPANT INFORMATION STATEMENT: RESEARCH PROJECT

Title: Investigating the Effect of Media on Children’s Eating Behaviours

What is the study about?
Childhood is an important time for the development of healthy eating habits and what children eat is influenced by a wide range of factors. This research study will explore how different media may impact on children’s eating behaviours.

Who is carrying out the study?
The study is being undertaken as part of a PhD at the University of Wollongong Early Start Research Institute by student Jenny Norman, and will be supervised by Drs Bridget Kelly and Anne McMahon. We are also partnering with the University of Wollongong Sports Holiday Camp for the study.

What does the study involve? The study has TWO parts:

PART ONE involves your child’s participation at the University’s Sports Holiday Camp EVERYDAY FOR SIX DAYS from 8.00am until 1.30pm on <insert dates> and <insert dates> (inclusive) during the school holidays. This will involve both camp and research activities: the daily schedule is outlined in Table 1 below.

Table 1: Study Days Daily Schedule

<table>
<thead>
<tr>
<th>Time</th>
<th>Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>08.00 am</td>
<td>- Park at one of the options listed on page 2</td>
</tr>
<tr>
<td></td>
<td>- Bring your child to Room 111A, Early Start Research Institute (Building 21) before they have anything to eat</td>
</tr>
<tr>
<td></td>
<td>- Register your child for the day, parent leaves</td>
</tr>
<tr>
<td></td>
<td>- Children eat breakfast</td>
</tr>
<tr>
<td></td>
<td>- Day one: children’s height and weight measured</td>
</tr>
<tr>
<td>08.30 - 10.00 am</td>
<td>Children escorted to Sports Hub for camp activities</td>
</tr>
<tr>
<td>10.00 - 10.45 am</td>
<td>Children escorted back to Early Start Building</td>
</tr>
<tr>
<td></td>
<td>- Watch age-appropriate cartoon for 10 minutes, play age-appropriate online game for 5 minutes</td>
</tr>
<tr>
<td></td>
<td>- Children eat morning tea</td>
</tr>
<tr>
<td>10.45am - 1.00pm</td>
<td>Children escorted back to Sports Hub for camp activities</td>
</tr>
<tr>
<td>1.00 - 1.30pm</td>
<td>Children escorted back to Early Start Building</td>
</tr>
<tr>
<td></td>
<td>- Children eat lunch</td>
</tr>
<tr>
<td>1.30pm</td>
<td>- If your child is staying at the Sports Holiday Camp for the afternoon, they will be escorted back to the Sports Hub. You will pick your child up from the Sports Hub at the end of the afternoon.</td>
</tr>
<tr>
<td></td>
<td>- If you are picking your child up at 1.30pm, come to the Early Start Building, where you dropped your child off in the morning.</td>
</tr>
<tr>
<td></td>
<td>- Park at one of the options listed on page 2</td>
</tr>
</tbody>
</table>

As a thank you for participating, children’s camp fees for the mornings that they participate in the study will be fully paid. Fees are $27 per morning session: 6 days = $162.
When will the study take place?
The dates for the XX school holidays are <<insert dates>> AND <<insert dates>> (inclusive). Your child will need to attend every day for six days from 8am – 1.30pm. If you wish for your child to participate in the full day sports holiday camp, you will need to enrol your child directly with the camp (we can assist you with this).

What happens if my child misses a day?
Due to the nature and design of the study, if your child is unable to attend on a particular study day, they will be unable to continue in the research aspect of the study. They are welcome to continue to participate in the Sports Holiday Camp but this will be at parents own expense and costs will not be covered by the research study.

Where will the study take place?
The study will take place at the University of Wollongong at the Early Start Research Institute, Building 21 and the Sports Hub, Building 9 (See map).

Where can you park for free?
**Dropping off:**
You have 4 options:
1. **P6**, Western Carpark (free parking if you leave before 8.30am) OR
2. **P4**, the Multi Storey Carpark (free parking for ½ hour) OR
3. **P6**, under the Sports Hub (free parking for ½ hour) OR
4. If you have more than three in your car you can park for free in the **P4** carpooling area

**Picking up:**
You have 3 options:
1. **P3**, the Multi Storey Carpark (free parking for ½ hour) OR
2. **P6**, under the Sports Hub (free parking for ½ hour) OR
3. If you have more than three in your car you can park for free in the **P4** carpooling area

Where do you drop off your child each morning and at what time?
You need to bring your child to the Early Start Research Institute, Building 21 at the University of Wollongong at 8am each day. The location within Building 21 will be signposted. We ask that you bring your child before they have anything to eat each morning.

Where do you pick up your child each day and at what time?
If your child is only participating in the half-day session of the camp, you need to pick up your child at 1.30pm at the Early Start Research Institute (where you dropped them off).

If your child is attending the Sports Holiday Camp for the afternoon session as well, you will need to pick them up from the Sports Hub when your child is due to finish for the day (either 3pm or 5pm, whichever option you register for).

What will your child be eating during the study?
We will be offering your child breakfast, morning tea and lunch during the study, serving foods that are freely available for sale in Australian supermarkets and commonly eaten by children of this age group. All meals will be prepared onsite in the Early Start Research Institute kitchen by trained researchers following NSW food hygiene requirements. Breakfast and lunch menus are in line with the Australian Dietary Guidelines. Morning tea will offer a range of choices including low and high fat savoury (e.g. rice crackers/popcorn and potato chips); low and high fat sweet (e.g. jelly snakes and...
chocolate buttons); fruit (eg grapes/mandarin/strawberries); and vegetable (eg carrot/celery/capsicum). Children will be told that they can eat as little or as much as they would like, and, if they finish a particular food that they will be provided with more if they wish. Morning tea will last no longer than 15 minutes.

**Where will my child be weighed and measured?**
Your child will be weighed and measured in private and we will not show the measurements to either your child or any other children. If your child is reluctant to be weighed or measured, they will not be pressured to do so and will be invited to continue taking part in the study regardless.

**Who will be looking after my child each morning?**
During the study your child will be supervised either by trained research assistants or Sports Holiday Camp leaders. All researchers and leaders will hold a valid NSW Working with Children Check.

**What does my child need to bring each day?**
For camp activities your child needs to bring a water bottle, spare change of clothes, hat, wet weather gear and a towel and swimming costume. All meals are provided during the morning session (breakfast, morning tea and lunch). If your child is attending the afternoon camp session they will need to bring an afternoon snack.

**Who can participate?**
Children aged 7 to 12 years, who met the inclusion criteria outlined during the screening interview, are eligible to participate, as long as their parents have provided written consent (please see enclosed consent form) and the child themselves provide verbal consent at the time of the study.

**PART TWO** involves some online questionnaires for both your child and one parent, **two need to be completed before the study starts and two the week after the study finishes**. The parental questionnaires will ask you about your child’s media and eating habits, some questions about your perceptions of both your child’s weight and your own weight, some questions about family eating habits and finally some general information about your family. The children’s questionnaires will ask them a series of questions about different brands and logos and may require some parental guidance. All questionnaires are to be filled out online. The links to the first questionnaires will be sent to you once we receive your consent forms and the links to the follow-up questionnaires once the study has finished.

**How much time will the online surveys and questionnaires take?**
The first parental questionnaire will take 15-20 minutes and the first children’s questionnaire about 30 minutes to complete. The second parent questionnaire will take 10-15 minutes and the second children’s questionnaire about 30 minutes to complete. At the completion of both the second questionnaires you will have the opportunity to go in to a **draw to win an iPad Air 2 (Value $750)**.

**Can I withdraw from the study?**
Being in this study is completely voluntary – you are not under any obligation to participate and - if you do participate – you can withdraw at any time without affecting your relationship, or your child’s relationship, with the University of Wollongong. Your child may choose to stop participating in the study at any time if they do not wish to continue. If you have dropped them off to the study and your child asks to go home, we will contact you directly by phone to pick them up. In either case any information or data collected will not be included in the study. If you or your child decides to withdraw from the study please phone Bridget Kelly to let us know. Due to budgetary constraints, the study can only cover camp fees for the mornings that your child participates in both research and
camp activities. If you decide to withdraw from the study, we will not cover fees for subsequent camp days.

Photographs
We shall be seeking permission to take photographs of your child/ren during the research study. The details of this will be discussed with you, and your consent sort, on Day One of the study (names of children will not be published at any time). We understand that, for many reasons parents may not wish for their children to be photographed, if you don’t want to give consent to your child being photographed it will not affect their participation in the study or sports camp in any way.

Will anyone else know the results?
All aspects of the study, including the results, will be strictly confidential and only the researchers will have access to information on participants. A report of the study may be submitted for publication or presentation at a conference, but individual participants will not be identifiable by name. In accordance with University procedure, the survey data will be securely kept for 5 years before being destroyed.

What are the benefits of the study?
This study will contribute new information about the possible effects of different media on children’s eating behaviours. Understanding these effects is important to designing solutions to improve children’s dietary intake and nutrition-related health outcomes.

What are the potential risks?
This study poses no physical or emotional harm to children. Information from children will be de-identified following the interview. We will be showing children a range of advertisements whilst they are watching the cartoon or playing the online game. The advertisements are for a wide range of international branded products including cars, sports equipment, food, travel, whitegoods, phone providers, insurance and department stores.

What if I require further information?
If you would like to know more at any stage, please feel free to contact:

Dr Bridget Kelly (Senior Lecturer)  Mrs Jenny Norman (PhD Candidate)
Phone: xxx  Phone: xxx
Email: xxx  Email: xxx

What if I have a complaint or concerns?
Any person with concerns or complaints about the conduct of this research study can contact the Ethics Officer, Research Services Office, University of Wollongong, NSW on xxx (telephone) or xxx(email).
DROPPING OFF: PARK AT P2 Western Carpark (free parking if you leave before 8.30am OR if you have 3 or more in your car) OR IN the Multi Storey Carpark OR P5 (both free parking for ½ hour)

BRING YOUR CHILD to the EARLY START RESEARCH INSTITUTE, Building 21 at 8am

PICKING UP: Park at P1 OR P6 (both free parking for ½ hour) OR P2 (if you have 3 or more in your car)

**for 3pm or 5pm camp pick up park at P1**

EARLY START RESEARCH INSTITUTE, Building 21
8am drop off
1.30pm pick up

3pm or 5pm sports camp pick up
Appendix CC: Consent Form

PARENT CONSENT FORM

For children aged 7-12 years (parents please sign)

I, ...........................................................................................(PRINT NAME), agree to permit my child
...........................................................................................(PRINT CHILD’S NAME), who is aged ................... years, to be a
participant in the research project:

Title: Investigating the effect of media on children’s eating behaviours.

In giving my consent I acknowledge that:

1. I have read the Participant Information Statement, which explains the aims and the nature of the
   study and the possible risks, and the statement has been explained to me to my satisfaction.

2. I understand that my child’s participation in this study will include attending the half-day session of
   the University of Wollongong’s Sports Holiday Camp each day from <<insert dates>> AND <<insert
   dates>> (inclusive) from 8am – 1.30pm (6 days).

3. I understand that I need to bring my child to the study each morning before they have anything to
   eat.

4. I understand that during this time my child will be provided with breakfast, morning tea and lunch;
   will watch either an age-appropriate cartoon (10 minutes) and/or play an age-appropriate online
   game (5 minutes) during which they will also see a range of different advertising (international
   brands); will participate in Sports Holiday Camp activities; and on the first day of the study will have
   their height and weight recorded.

5. I understand that my child’s camp fees will be paid only for mornings that they attend the research
   study.

6. I understand that if my child misses a day of the research study they will be unable to continue to
   participate in the research aspect but can continue to participate at the Sports Camp at my own
   expense.

7. I understand that if my child is unable to attend a particular day that I will call Jenny Norman
   (Researcher) on XXX to let her know.

8. I understand my participation in the study will include two online questionnaires for myself and two
   online questionnaires for my child. I understand two need to be completed before the study starts
   and two after the study has finished. During these I will be asked about my child’s media and eating
   habits, my perceptions of both my child’s weight and my own weight, family eating habits and some

Page 1 of 2
general information about my family. My child will be asked questions a series of questions about
brands and logos and may require some guidance from me.

9. Before signing this Consent Form, I have been given the opportunity of asking any questions
relating to any possible physical and mental harm my child might suffer as a result of participation
and I have received satisfactory answers.

10. I understand that on Day One of the study I will be asked to give consent for my child/ren to be
photographed during the research study. I understand that I will not be pressured to give consent
and if I choose not to it will not affect my child’s participation in the study or sports camp in any
way. I understand that names of children will not be published at any time.

11. I understand that I can withdraw my child from the study at any time without prejudice to me or my
child’s relationship to the University of Wollongong, Early Start Research Institute or the University
of Wollongong Sports Holiday Camp.

12. I agree that research data gathered from the results of the study may be published in a journal or
report or presented at a conference provided that my child and I cannot be identified by name.

13. I understand that if I have any questions relating to my child’s participation in this research, I may
contact Bridget Kelly (Chief Researcher) by telephone on XXX.

14. I understand that if I wish to withdraw any information provided by myself or my child at a later
date, I may contact Bridget Kelly.

15. I understand that if I have any complaints or concerns surrounding the conduct of the research I
can contact the Ethics Officer, Research Services Office at the University of Wollongong via
telephone on XXX or email via XXXX.

16. I acknowledge receipt of a copy of this Consent Form and the Participant Information Sheet.

Signed: ................................................................. Date: ...........................................

Name: .................................................................
Appendix DD: Email cover letter for Participant Information Sheet and Consent Form

Dear <parent/caregiver>,

Thank you again for your interest in our research study and sports camp.

Please find attached a copy of the Participant Information Sheet and Consent Form for you to print: please read both the Consent Form and the Participant Information Sheet thoroughly. If you have any questions you wish to ask before signing the Parent Consent Forms, please contact Bridget Kelly on XX or myself on XX.

Once you are satisfied and are happy to give consent for <<child name>> to participate, please sign the Parent Consent Form, scan both sides and email them back to me. I will then enrol <<child name>> in the research study and camp.

Please keep the Consent form for your records with your Participant Information Sheet.

Once we have received signed copies of your Consent Form we will email you out the web page links for the online questionnaires that need to be completed before the study starts. One questionnaire is for you, the parent, to fill out and for child name>> to fill out themselves.

Please do not hesitate to contact us should you have any questions at all.

Kind regards,

Jenny Norman
PhD Candidate Public Health
Early Start, School of Health and Society
University of Wollongong NSW 2522 Australia
Appendix EE: Breakfast menu and set-up procedure

Procedure

Day before

1. Set up 40 breakfast trays in dining room at end of each day with bowl, cup, jug, knife and teaspoon. Place jam/vegemite portion control on each plate.
2. Put one banana/fruit pot on each tray.
3. Arrange cereals in baskets in kitchen ready to offer to children in the morning.

7.15am
1. Fill cups on trays with water

7.45am
1. Fill up jugs with 250ml milk. Drop down so eye level is at level of jug to ensure accurate reading.
2. If it is Day 2, 3, 5 or 6 put a portion control margarine on each plate
3. Place 2 pikelets on each plate OR offer child a piece of toast when they arrive

When child sits down put ID number on their tray.
Appendix FF: Snack foods for morning tea

<table>
<thead>
<tr>
<th>Days One/Four</th>
<th>BLUE</th>
<th>ORANGE</th>
<th>GREEN</th>
<th>PINK</th>
<th>PURPLE</th>
<th>YELLOW</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cadbury's Dairy milk chocolate</td>
<td>Woolworths Select Raspberry lollies</td>
<td>Shapes: Chicken Crimpies</td>
<td>Peckish Rice crackers</td>
<td>Fruit: grapes or mandarin segments</td>
<td>Carrot sticks</td>
</tr>
<tr>
<td>Day Two/Five</td>
<td>Chocolate coated Tiny Teddy biscuits</td>
<td>Woolworths Select Gummy bears</td>
<td>Pringles (plain – Woolworths brand)</td>
<td>Jatz crackers (97% fat free)</td>
<td>Fruit: grapes or mandarin segments</td>
<td>Carrot sticks</td>
</tr>
<tr>
<td>Day Three/Six</td>
<td>Nestle Smarties</td>
<td>Woolworths Select Strawberries and cream</td>
<td>Woolworths Crinkle Cut Potato chips</td>
<td>Parkers Mini pretzels</td>
<td>Fruit: grapes or mandarin segments</td>
<td>Carrot sticks</td>
</tr>
</tbody>
</table>
Appendix GG: Lunch menus and daily procedures

Lunch Days One and Four

- McCain’s Margherita Pizza 125g
- Woolworths portion control diced fruit salad (variable weight)
- Cherry tomatoes 50g
- Capsicum 30g
- Ski D’Lite Yoghurt (variable weight)

Procedure

- Lay out trays on tables with teaspoon and cup on each. Fill cups with water.

Tomatoes

- Collect 40 small bowls
- Wash and dry tomatoes
- Weigh tomatoes in to 50g amounts and put into small bowl

Capsicum:

- Wash capsicum and dry with kitchen towel.
- Slice capsicum thinly on chopping board.
- Weigh capsicum slices into 30g amounts and put in with tomatoes.

Fruit salad and yoghurt

- Weigh portion control fruit salad (g) and write weight on underside of container in permanent pen.
- Place fruit salad on tray
- Weigh yoghurt (g) and record weight on base with permanent pen. Put in fridge.
Prepare 10 extra bowls of salad. Weigh extra fruit salads and yoghurts. Store yoghurts in fridge.

**Pizza**

12.15

- Turn on four ovens to 220 degrees Celsius. Put baking paper on 12 trays. Put pizzas on to trays.

12.25

- Cook pizzas (approx 20 mins)
- Take 56 small paper plates, put small piece of greaseproof paper on each and set adjacent to ovens
- Take 56 plastic plates and put small sticker on each

12.45 - 13.00

- All research assistants (work in twos). Turn ovens down to 100 degrees Celsius.
- Take out each pizza one at a time, cut into quarters on chopping board.
- Weigh each piece, record weight on paper plate. Return pizza to oven to keep warm.
- Once 40 pieces have been portioned, cut remaining pizza into eighths and weigh for extras
- When children arrive, one research assistant supervises children to fill out hunger scale
- Other research assistants transfer pizza to plates, recording weight of each on to sticker
- Put child’s ID number on tray
- Put plates on trays in dining space
- Put yoghurts on trays
- If children ask for more of any food, record on child’s record sheet (in kitchen out of children’s view)

13.30

- Parents arrive and children leave dining space
- Take trays out to kitchen for weighing
Lunch Days Two and Five

Procedure

- Lay out trays on tables with teaspoon and cup on each. Fill up cups with water. Put portion control tomato sauce on each tray.

Lettuce

- Collect 40 small bowls.
- Peel off outer leaves and discard. Wash and dry lettuce. Roughly shred lettuce on chopping board with chef's knife.
- Weigh lettuce into 15g amounts and put into small bowl.

Carrot

- Peel carrots and grate.
- Weigh carrot into 30g amounts and put on top of lettuce.
Apple and Yoghurt

- Weigh apple (g), record weight in grams on sticker (e.g. A=120g). Put sticker on tray and put apple on top of sticker.
- Weigh yoghurt (g) and record weight on base with permanent pen. Put in fridge

Prepare 10 extra bowls of salad. Weigh extra apples and yoghurts. Store in fridge.

Rolls

- Collect 40 plates. Put two small stickers on each plate. Cut rolls in half. Weigh rolls (g) and record weight on one of the stickers (e.g. R=40g). Put roll on plate and put adjacent to grills.

12.15

- Turn on 3 x grills – high heat.
- Line 3 baking trays with aluminium foil. Place burgers on to foil and place under grill.

12.30 - 13.00

- Cook burgers (approx 20 mins) until cooked through.
- Turn off grill. Weigh each burger (g) – record on sticker on plate (e.g. B=60g)
- Put burgers into rolls as children arrive
- Children arrive, fill out hunger scale
- Put child’s ID number on tray
- Put plates on trays in dining space
- Put yoghurts on trays
- If children ask for more of any food, record on child’s record sheet (in kitchen out of children’s view)

13.30 Parents arrive and children leave dining space

Take trays cut to kitchen for weighing
Lunch Days Three and Six

**Procedure**

- Lay out 40 trays in dining room with teaspoon and cup on each. Fill cups with water. Put portion control tomato sauce on each tray.

**Lettuce**

- Collect 40 small bowls.
- Peel off outer leaves and discard. Wash and dry lettuce. Roughly shred lettuce on chopping board with chef’s knife.
- Weigh lettuce into 15g amounts and put into small bowl.

**Cucumber**

- Wash cucumber and dry with kitchen towel.
- Slice capsicum thinly on chopping board.
- Weigh cucumber slices into 50g amounts and put on top of lettuce.

- Chicken (100g) and chips (100g)
- Tomato sauce (14g)
- Cucumber (50g)
- Lettuce (15g)
- Portion controlled peaches (variable weight)
- Yogurt (variable weight)
Peaches and Yoghurt

- Weigh portion control peaches (g), record weight on underside of container in permanent pen. Place fruit salad on tray in dining room
- Weigh yoghurt (g) and record weight on base with permanent pen.

Chicken and chips

12.10

- Turn on eight ovens to 220 degrees. Put baking paper on 24 trays.

12.25

- Put chicken on to trays and chips on to trays. Cook (approx 20 mins)
- Take 100 paper bowls and set aside adjacent to ovens

12.45 – 13.00

- All research assistants (work in twos). Turn ovens down to 100 degrees.
- Weigh out 100g chips and chicken on to paper plates: return to oven to keep warm.
- When children arrive, one research assistant supervises children to fill out hunger scale
- Other research assistants transfer chicken and chips onto plates
- Put child’s ID number on tray
- Put plates on trays in dining space
- Put yoghurts on trays
- If children ask for more of any food, record on child’s record sheet (in kitchen out of children’s view)

13.30

- Parents arrive and children leave dining space
- Take trays out to kitchen for weighing
Appendix HH: Children’s daily record sheet example

**BREAKFAST**

<table>
<thead>
<tr>
<th>Amount eaten</th>
<th>None</th>
<th>Less than half</th>
<th>Half</th>
<th>More than half</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milk in jug (250ml)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cereal in bowl Type: Extra cereal:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Banana</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pikelets (2) Extra pikelet (how many):</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jam</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**NAME**

**ID NUMBER**

**SNACKS**

Record weight of **REMAINING** food

**RECORD ANY EXTRAS**

<table>
<thead>
<tr>
<th>SNACK (50g)</th>
<th>WEIGHT REMAINING (g)</th>
<th>WEIGHT EATEN (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chicken Crimpies (50g)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rice crackers (50g)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lollies (50g)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chocolate (50g)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carrots (50g)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grapes (50g)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Extras (type and number):</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

NB: Extras Fruit & Veg = 50g. All others = 25g

**LUNCH**

<table>
<thead>
<tr>
<th>FOOD</th>
<th>WEIGHT BEFORE</th>
<th>WEIGHT REMAINING</th>
<th>WEIGHT EATEN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pizza (variable)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Capsicum</td>
<td>30g</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cherry tomatoes</td>
<td>50g</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fruit Salad (variable) (with pot and lid)</td>
<td>(with pot and lid)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yoghurt (variable) (with pot and lid)</td>
<td>(with pot and lid)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**NAME**

**ID NUMBER**
## Appendix II: Breakfast estimation weight chart

<table>
<thead>
<tr>
<th>Food</th>
<th>Amount Eaten</th>
<th>None</th>
<th>Less than half</th>
<th>Half</th>
<th>More than half</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lite white milk</td>
<td>0</td>
<td>62.5 ml</td>
<td>125 ml</td>
<td>187.5 ml</td>
<td>250 ml</td>
<td></td>
</tr>
<tr>
<td>Kellogg’s Rice Bubbles</td>
<td>0</td>
<td>6.25 g</td>
<td>12.5 g</td>
<td>18.75 g</td>
<td>25 g</td>
<td></td>
</tr>
<tr>
<td>Sanitarium Weetbix</td>
<td>0</td>
<td>7.5 g</td>
<td>15 g</td>
<td>22.5 g</td>
<td>30 g</td>
<td></td>
</tr>
<tr>
<td>Kellogg’s Just Right</td>
<td>0</td>
<td>10 g</td>
<td>20 g</td>
<td>30 g</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>SPC Pear in Juice</td>
<td>0</td>
<td>30 g</td>
<td>60 g</td>
<td>90 g</td>
<td>120 g</td>
<td></td>
</tr>
<tr>
<td>Woolworths Two fruit</td>
<td>0</td>
<td>31.25 g</td>
<td>62.5 g</td>
<td>93.75 g</td>
<td>125 g</td>
<td></td>
</tr>
<tr>
<td>Banana</td>
<td>0</td>
<td>0.25 (24.5 g)</td>
<td>0.5 (49 g)</td>
<td>0.75 (73.5 g)</td>
<td>1 medium size (98 g)</td>
<td></td>
</tr>
<tr>
<td>Woolworths pikelets (listed in Foodworks)</td>
<td>0</td>
<td>0.75</td>
<td>1</td>
<td>1.5</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Toast (slice of Wonderwhite toast)</td>
<td>0</td>
<td>0.25</td>
<td>0.5</td>
<td>0.75</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Kraft jam portion</td>
<td>0</td>
<td>3.25 g</td>
<td>6.5 g</td>
<td>9.75 g</td>
<td>13 g</td>
<td></td>
</tr>
<tr>
<td>Kraft Vegemite portion</td>
<td>0</td>
<td>1.2 g</td>
<td>2.4 g</td>
<td>3.6 g</td>
<td>4.8 g</td>
<td></td>
</tr>
<tr>
<td>Meadowlea canola margarine portion</td>
<td>0</td>
<td>2.5 g</td>
<td>5 g</td>
<td>7.5 g</td>
<td>10 g</td>
<td></td>
</tr>
</tbody>
</table>
Hello there,

Thank you for taking part in our research study.

How do you complete this survey...?

If you require assistance, please ask your parent to guide you.

To answer a question...
Some questions have round buttons to click or check boxes to tick. Click on your selection - this will mark it with a black dot to answer the question. Other questions will need you to type your answers in the spaces provided.

To change an answer...
Just click on a different button.

To go to the next question...
Once you have completed all questions on the page you will need to click the ‘Next’ button at the bottom of the screen. Sometimes you will need to scroll down the page to see the ‘Next’ button.

We hope you enjoy the survey!

Click next to continue....
Thank you for taking part in our Research Study: this survey is for **your child** to respond to and should take about 30-40 minutes. If you have more than one child participating, each child will need to fill out their own survey (we will email you separate web pages links for each child).

Your child may need some assistance in completing this survey but **please don't answer for them**, we are really interested in hearing their responses. It may be helpful to sit with your child whilst they complete the survey.

As with the parent survey, there are no right or wrong answers.

All answers will be strictly confidential, kept in a secure place and only researchers listed on the ethics application will have access to the information. A report from the study may be submitted for publication or presentation at a conference, but individual participants will not be identifiable.

Your child's participation in the questionnaire is voluntary and they can withdraw from it at any time you choose. You can also ask for any data they have already provided to be withdrawn from the study. Withdrawing data or withdrawing from the study will not affect any relationship with the University of Wollongong or the University of Wollongong Sports Holiday Camp.

This study has been reviewed by the Human Research Ethics Committee of the University of Wollongong.

Please enter the name of your child who will be participating in this study (FIRST and LAST name). If you have more than one child participating please fill out separate surveys (you will be sent separate web page links for your other children).

Please bring your child that you just named, to the computer, if you haven’t already done so, then press Next to continue.
We are interested in finding out about what you know about different brands of products that are sold in shops.

In case you don't know, a brand is a particular name or label of a product.

An example is a name like 'Nike' which is a brand of running shoe.

This is a picture of their logo which represents their brand and can be found on their different products:

![Nike Logo]

If you are still a little unsure what a brand is, perhaps a parent can explain it to you.

The following five questions will ask you to name three brands for lots of different products.

Just write down what comes in to your head - don't worry if you can't think of any just move on to the next question.

2. Still thinking about running shoes, can you name three other brands of running shoes? (if you can, type them in the boxes below).

Running shoe brand: 

Running shoe brand: 

Running shoe brand: 

3. Now let’s think about cars. Can you name three different brands of cars?

   Car brand: 
   Car brand: 
   Car brand: 

Okay, the next three questions are going to ask you to think about some different food brands.

4. Can you name three different brands of breakfast cereal? (Again, if you can think of some answers, fill out the boxes below).

   Breakfast cereal brand: 
   Breakfast cereal brand: 
   Breakfast cereal brand: 

5. Can you name three different brands of chocolate or lollies?

   Chocolate or lolly brand: 
   Chocolate or lolly brand: 
   Chocolate or lolly brand: 

6. Can you name three different brands of chips or snacks?

   Chips or snack brand: 
   Chips or snack brand: 
   Chips or snack brand: 

We now have twenty different pictures of logos for you to look at.
Remember, a logo is a symbol or a picture that is often used to represent a brand or product.
We would like you to look at each logo and tell us if you have seen it before. Just answer yes or no.

If you answer yes, that you have seen the logo before, we would like you to describe the product that the logo relates to.
For some of the logos if you click yes, that you have seen them before, you will be asked some extra questions about what you think about the brand and product that the logo represents....

7.

Have you seen this logo before?

☐ NO

☐ YES. If YES, please describe the product the logo relates to:

8.

Have you seen this logo before?

☐ NO

☐ YES. If YES, please describe the product the logo relates to:
9.

Have you seen this logo before?
- NO
- YES  If YES, please describe the product the logo relates to:

10.

Have you seen this logo before?
- NO
- YES  If YES, please describe the product the logo relates to:

11.

Have you seen this logo before?
- NO
- YES  If YES, please describe the product the logo relates to:
12.

Have you seen this logo before?

☐ NO

☐ YES  If YES, please describe the product the logo relates to:


13.

Have you seen this logo before?

☐ NO

☐ YES  If YES, please describe the product the logo relates to:


14.

Have you seen this logo before?

☐ NO

☐ YES  If YES, please describe the product the logo relates to:


306
15. 

Have you seen this logo before?
☐ NO 
☐ YES  If YES, please describe the product the logo relates to:

16. 

Have you seen this logo before?
☐ NO 
☐ YES  If YES, please describe the product the logo relates to:

17. 

Have you seen this logo before?
☐ NO 
☐ YES  If YES, please describe the product the logo relates to:
You are doing really well...almost half way through!

18.

Hershey's

Have you seen this logo before?

☐ NO

☐ YES  If YES, please describe the product the logo relates to:

19.

BN

Have you seen this logo before?

☐ NO

☐ YES  If YES, please describe the product the logo relates to:

You are doing really well, just eight more to go...

20.

Adidas

Have you seen this logo before?

☐ NO

☐ YES  If YES, please describe the product the logo relates to:
21.

Have you seen this logo before?
☐ NO
☐ YES If YES, please describe the product the logo relates to:

22.

Have you seen this logo before?
☐ NO
☐ YES If YES, please describe the product the logo relates to:

23.

Have you seen this logo before?
☐ NO
☐ YES If YES, please describe the product the logo relates to:
Almost finished... just three to go!

24.

![Hula Hoops Logo]

Have you seen this logo before?

☐ NO

☐ YES  If YES, please describe the product the logo relates to:

Last two coming up!

25.

![Apple Logo]

Have you seen this logo before?

☐ NO

☐ YES  If YES, please describe the product the logo relates to:

26.

![Maynards Discovery Patch Logo]

Have you seen this logo before?

☐ NO

☐ YES  If YES, please describe the product the logo relates to:
For all the food logos (and the Apple logo), if the participant answers ‘yes’ they know the brand, they will be asked the following questions:

(The online questionnaire is set up to skip these pages if the participant answers “NO”, they haven’t seen the brand before).

For example:

We would like to know what you think about this brand.

Mark one box on each row which best describes what you think about this brand.

Q1 I think this brand is
- Very cool
- A little cool
- In between
- A little uncool
- Very uncool

Q2 I think this brand is
- Very exciting
- A little exciting
- In between
- A little unexciting
- Very unexciting

Q3 I think this brand is
- Very fun
- A little fun
- In between
- A little boring
- Very boring

Q4 What type of person do you think would eat this product?
- Very popular
- A little popular
- In between
- A little unpopular
- Very unpopular

Q5 What type of person do you think would eat this product?
- Very sporty
- A little sporty
- In between
- A little unfit
- Very unfit

Q6 What type of person do you think would eat this product?
- Very cool
- A little cool
- In between
- A little uncool
- Very uncool

Q7 I would like to eat this product sometime soon
- YES
- NO
Appendix KK: Hunger and satiety rating scale

Hunger and Satiety Rating Scale: Teddy the Bear*  How hungry do you feel?

Name____________________________  ID Number________________________  Date_______________  Meal __________

Appendix LL: Parent baseline questionnaire

This questionnaire is for you, the parent, to respond to and should take 15-20 minutes. You can complete this paper version of the questionnaire OR complete it online at <<insert link>>.

If you fill out this paper version please bring it with you on the first day of the study, <insert date>.

There are no right or wrong answers. Please answer as honestly as you can. You are not being judged on any of your responses.

All answers will be strictly confidential, kept in a secure place and only researchers listed on the ethics application will have access to the information. A report of the study may be submitted for publication or presentation at a conference, but individual participants will not be identifiable.

Your participation in both this questionnaire and the study is voluntary and you can ask any data you have provided to be withdrawn from the study at any time you choose. Withdrawing data or withdrawing from the study will not affect any relationship with the University of Wollongong or the University of Wollongong Sports Holiday Camp.

This study has been reviewed by the Human Research Ethics Committee of the University of Wollongong.

This question is about media devices in your home. Which of these do you have in your home, does your child who will be participating in this study use it? Yes/No in boxes below

Again, thinking about your child in the study, does your child own any of these devices themselves? Do they use them in their bedrooms?

<table>
<thead>
<tr>
<th>Media Device</th>
<th>In home Yes/No</th>
<th>Used by child Yes/No</th>
<th>Owned by child Yes/No</th>
<th>In bedroom Yes/No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Television</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Computer or laptop</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Smartphone</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Games console that works with the television such as Xbox or PlayStation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tablet such as an iPad or Samsung</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The following questions are about your child’s television viewing.

1. On a usual school day, how many hours would your child spend watching commercial television? (eg Channel 7, Channel 9, Channel 10, Gem, One, Foxtel, Pay TV channels etc) (prompt: think about before and after school)

<table>
<thead>
<tr>
<th>0</th>
<th>0.5</th>
<th>1</th>
<th>1.5</th>
<th>2</th>
<th>2.5</th>
<th>3</th>
<th>3.5</th>
<th>4</th>
<th>4.5</th>
<th>5</th>
<th>5.5</th>
<th>6</th>
<th>6.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>HOURS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. On a usual school day, how many hours would your child spend watching non-commercial television? (eg ABC, ABC Kids) (prompt: think about before and after school)

<table>
<thead>
<tr>
<th>0</th>
<th>0.5</th>
<th>1</th>
<th>1.5</th>
<th>2</th>
<th>2.5</th>
<th>3</th>
<th>3.5</th>
<th>4</th>
<th>4.5</th>
<th>5</th>
<th>5.5</th>
<th>6</th>
<th>6.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>HOURS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3. On a usual weekend day or day in the holidays, how many hours would your child spend watching commercial television? (eg Channel 7, Channel 9, Channel 10, Gem, One etc)

<table>
<thead>
<tr>
<th>0</th>
<th>0.5</th>
<th>1</th>
<th>1.5</th>
<th>2</th>
<th>2.5</th>
<th>3</th>
<th>3.5</th>
<th>4</th>
<th>4.5</th>
<th>5</th>
<th>5.5</th>
<th>6</th>
<th>6.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>HOURS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4. On a usual weekend day or day in the holiday, how many hours would your child spend watching non-commercial television? (eg ABC, ABC Kids)

<table>
<thead>
<tr>
<th>0</th>
<th>0.5</th>
<th>1</th>
<th>1.5</th>
<th>2</th>
<th>2.5</th>
<th>3</th>
<th>3.5</th>
<th>4</th>
<th>4.5</th>
<th>5</th>
<th>5.5</th>
<th>6</th>
<th>6.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>HOURS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The following questions are about your child’s internet use

5. How often would your child access the internet? (prompt: think about computer, tablet, smart phone; think about weekdays and weekends incl school time and holidays)
   - Once a month or less
   - Once a week
   - Several times a week
   - Once a day
   - Several times a day

   [Go to question 6]

   [Go to question 7 & 8]
6. **How many hours per week would your child spend online?** (prompt: again think about weekdays and weekends inc school time and holidays) *Go to question 9*

![0 0.5 1 1.5 2 2.5 3 3.5 4 4.5 5 5.5 6 6.5 HOURS]

7. **On a usual school day how many hours per day would your child spend online?** (prompt: think about computer, tablet, smart phone)

![0 0.5 1 1.5 2 2.5 3 3.5 4 4.5 5 5.5 6 6.5 HOURS]

8. **On a usual weekend day how many hours per day would your child spend online?** (prompt: think about computer, tablet, smart phone)

![0 0.5 1 1.5 2 2.5 3 3.5 4 4.5 5 5.5 6 6.5 HOURS]

9. **When your child accesses the internet, which of the following would they usually do? (tick all that apply)**
   - [ ] use the internet for school
   - [ ] play computer games
   - [ ] play apps
   - [ ] Facebook
   - [ ] other social media
   - [ ] YouTube
   - [ ] other (eg streaming music, videos, shopping)

*If yes to computer games or apps, please list what games or apps they play or use*

---

315
The next six questions ask you about what your child usually eats:

9a. How many serves of vegetables does your child usually eat each day? (please select one answer only)

(a serve = 1/2 cup cooked vegetables or 1 cup of salad vegetables: includes fresh, dried, frozen and tinned vegetables)

- ☐ My child doesn’t eat vegetables
- ☐ Less than one serve
- ☐ 1 serve
- ☐ 2 serves
- ☐ 3 serves
- ☐ 4 serves
- ☐ 5 serves
- ☐ 6 or more serves

9b. How many serves of fruit does your child usually eat each day? (please select one answer only)

(a serve = 1 medium piece or two small pieces of fruit or 1 cup of diced pieces: includes fresh, dried, frozen and tinned fruits)

- ☐ My child doesn’t eat fruit
- ☐ Less than one serve
- ☐ 1 serve
- ☐ 2 serves
- ☐ 3 serves
- ☐ 4 serves
- ☐ 5 serves
- ☐ 6 or more serves

9c. Please indicate how often your child usually eats the following foods? (please select only one answer for each question)

<table>
<thead>
<tr>
<th>Food Description</th>
<th>Never or rarely</th>
<th>1-2 times per WEEK</th>
<th>3-4 times per WEEK</th>
<th>5-6 times per WEEK</th>
<th>1 time per DAY</th>
<th>2 or more times per DAY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meat products such as sausages, frankfurters, devon, ham, hamburgers or chicken nuggets?</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Hot chips, French fries, wedges or fried potatoes?</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Potato crisps or other salty snacks (such as Twisties or corn chips)?</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Snack foods, such as sweet or savoury biscuits, cakes, donuts or muesli bars?</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Confectionery, such as lollies and chocolate?</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Ice cream or ice blocks?</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>
9d. How often does your child have takeaway meals or snacks from places like McDonalds, Hungry Jacks, Pizza Hut, KFC, Red Rooster or local takeaway places? (please select one answer only)

- Never or rarely
- Less than once a week
- About 1-2 times a week
- About 3-4 times a week
- About 5-6 times a week
- Everyday

9e. How often does your child usually have something for breakfast? (please select one answer only)

- Never or rarely
- Less than once a week
- About 1-2 times a week
- About 3-4 times a week
- About 5-6 times a week
- Everyday

9f. Please indicate how many cups of the following drinks your child usually consumes?

(please select only one answer for each question)

<table>
<thead>
<tr>
<th></th>
<th>1 cup or less per WEEK</th>
<th>2-4 cups per WEEK</th>
<th>5-6 cups per WEEK</th>
<th>1 cup per DAY</th>
<th>2 or cups per DAY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fruit Juice (1 cup = 250ml, a household tea cup or 1 large popper)</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Water (tap or bottled) (1 cup = 250ml, a household tea cup or 1 average bottle of water = 2 ½ cups)</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Soft drink, cordials, or sports drink (such as cola, lemonade, Powerade) (1 cup = 250ml; 1 can of soft drink = 1 ½ cups)</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>'Diet' soft drink or diet cordial (such as Diet Coke or Sprite or Pepsi Max) (1 cup = 250ml; 1 can of soft drink = 1 ½ cups)</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
</tbody>
</table>
The following questions are about your child's eating and habits, some questions about your perceptions about your child's weight, your own weight and general eating habits within the home. Please circle one answer per question. Remember there are no right or wrong answers. Thinking about your child who is going to participate in the study...

<table>
<thead>
<tr>
<th>Question</th>
<th>Never₁</th>
<th>Seldom₂</th>
<th>Half the time₃</th>
<th>Most of the time₄</th>
<th>Always₅</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 When your child is at home, how often are you responsible for providing meals and snacks for him/her?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11 How often are you responsible for deciding what your child's portions are?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 How often are you responsible for deciding if your child has eaten the right kinds of food?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13 How concerned are you about your child eating too much when you are not around him/her?</td>
<td>Unconcerned₀</td>
<td>Slightly unconcerned₁</td>
<td>Neutral₂</td>
<td>Slightly concerned₃</td>
<td>Concerned₄</td>
</tr>
<tr>
<td>14 How concerned are you about your child having a diet to maintain a desirable weight?</td>
<td>Unconcerned₀</td>
<td>Slightly unconcerned₁</td>
<td>Neutral₂</td>
<td>Slightly concerned₃</td>
<td>Concerned₄</td>
</tr>
<tr>
<td>15 How concerned are you about your child becoming overweight?</td>
<td>Unconcerned₀</td>
<td>Slightly unconcerned₁</td>
<td>Neutral₂</td>
<td>Slightly concerned₃</td>
<td>Concerned₄</td>
</tr>
<tr>
<td>16 How would you classify your child's weight during the first year of life?</td>
<td>Markedly Underweight₁</td>
<td>Underweight₂</td>
<td>Average₃</td>
<td>Overweight₄</td>
<td>Markedly Overweight₅</td>
</tr>
<tr>
<td>17 How would you classify your child's weight as a toddler? (aged 1-3 years)</td>
<td>Markedly Underweight₁</td>
<td>Underweight₂</td>
<td>Average₃</td>
<td>Overweight₄</td>
<td>Markedly Overweight₅</td>
</tr>
<tr>
<td>18 How would you classify your child's weight as a pre-schooler? (aged 4-5 years)</td>
<td>Markedly Underweight₁</td>
<td>Underweight₂</td>
<td>Average₃</td>
<td>Overweight₄</td>
<td>Markedly Overweight₅</td>
</tr>
<tr>
<td>19 How would you classify your child's weight from kindergarten to Year 2?</td>
<td>Markedly Underweight₁</td>
<td>Underweight₂</td>
<td>Average₃</td>
<td>Overweight₄</td>
<td>Markedly Overweight₅</td>
</tr>
<tr>
<td>20 How would you classify your child's weight now?</td>
<td>Markedly Underweight₁</td>
<td>Underweight₂</td>
<td>Average₃</td>
<td>Overweight₄</td>
<td>Markedly Overweight₅</td>
</tr>
<tr>
<td>21 I have to be sure that my child doesn't eat too many sweet foods (eg lollies, chocolates, ice cream, cake, sweet biscuits)</td>
<td>Disagree₁</td>
<td>Slightly Disagree₂</td>
<td>Neutral₃</td>
<td>Slightly Agree₄</td>
<td>Agree₅</td>
</tr>
<tr>
<td>22 I have to be sure that my child doesn't eat too many high fat foods (eg fried foods, hot chips, chips, butter)</td>
<td>Disagree₁</td>
<td>Slightly Disagree₂</td>
<td>Neutral₃</td>
<td>Slightly Agree₄</td>
<td>Agree₅</td>
</tr>
<tr>
<td>23 I have to be sure that my child doesn't eat too many of his/her favourite foods?</td>
<td>Disagree₁</td>
<td>Slightly Disagree₂</td>
<td>Neutral₃</td>
<td>Slightly Agree₄</td>
<td>Agree₅</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>24</td>
<td>I intentionally keep some foods out of my child’s reach</td>
<td>Disagree</td>
<td>Slightly Disagree</td>
<td>Neutral 3</td>
<td>Slightly Agree 4</td>
</tr>
<tr>
<td>25</td>
<td>I offer sweets (e.g. lollies, chocolate, ice cream, sweet biscuits) to my child as a reward for good behaviour.</td>
<td>Disagree</td>
<td>Slightly Disagree</td>
<td>Neutral 3</td>
<td>Slightly Agree 4</td>
</tr>
<tr>
<td>26</td>
<td>I offer my child his/her favourite foods in exchange for good behaviour.</td>
<td>Disagree</td>
<td>Slightly Disagree</td>
<td>Neutral 3</td>
<td>Slightly Agree 4</td>
</tr>
<tr>
<td>27</td>
<td>If I did not guide or regulate my child’s eating he/she would eat too many junk foods.</td>
<td>Disagree</td>
<td>Slightly Disagree</td>
<td>Neutral 3</td>
<td>Slightly Agree 4</td>
</tr>
<tr>
<td>28</td>
<td>If I did not guide or regulate my child’s eating he/she would eat too much of their favourite foods.</td>
<td>Disagree</td>
<td>Slightly Disagree</td>
<td>Neutral 3</td>
<td>Slightly Agree 4</td>
</tr>
<tr>
<td>29</td>
<td>My child can help themselves to any foods when they say they are hungry.</td>
<td>Disagree</td>
<td>Slightly Disagree</td>
<td>Neutral 3</td>
<td>Slightly Agree 4</td>
</tr>
<tr>
<td>30</td>
<td>My child should always eat all of the food on his/her plate.</td>
<td>Disagree</td>
<td>Slightly Disagree</td>
<td>Neutral 3</td>
<td>Slightly Agree 4</td>
</tr>
<tr>
<td>31</td>
<td>I have to be especially careful to make sure my child eats enough.</td>
<td>Disagree</td>
<td>Slightly Disagree</td>
<td>Neutral 3</td>
<td>Slightly Agree 4</td>
</tr>
<tr>
<td>32</td>
<td>If I did not guide or regulate my child’s eating he/she would eat much less than he/she should.</td>
<td>Disagree</td>
<td>Slightly Disagree</td>
<td>Neutral 3</td>
<td>Slightly Agree 4</td>
</tr>
<tr>
<td>33</td>
<td>How much do you keep track of the sweet foods (e.g. lollies, chocolate, ice cream, cake, sweet biscuits) that your child eats?</td>
<td>Never 1</td>
<td>Rarely 2</td>
<td>Sometimes 3</td>
<td>Mostly 4</td>
</tr>
<tr>
<td>34</td>
<td>How much do you keep track of the snack food (e.g. potato chips, corn chips) that your child eats?</td>
<td>Never 1</td>
<td>Rarely 2</td>
<td>Sometimes 3</td>
<td>Mostly 4</td>
</tr>
<tr>
<td>35</td>
<td>How much do you keep track of the high fat foods (e.g. hot chips, sausage rolls, pies) that your child eats?</td>
<td>Never 1</td>
<td>Rarely 2</td>
<td>Sometimes 3</td>
<td>Mostly 4</td>
</tr>
<tr>
<td>36</td>
<td>How would you classify your own weight in childhood (5 to 10 years)?</td>
<td>Markedly Underweight 1</td>
<td>Underweight 2</td>
<td>Average 3</td>
<td>Overweight 4</td>
</tr>
</tbody>
</table>
In many houses families eat in different areas of the house.

- **B2**: How frequently does your child eat breakfast in front of the television?
  - Never₁
  - Rarely₂
  - Sometimes₃
  - Frequently₄
  - Always₅

- **B3**: How frequently does your child eat lunch in front of the television?
  - Never₁
  - Rarely₂
  - Sometimes₃
  - Frequently₄
  - Always₅

- **B4**: How frequently does your child eat dinner in front of the television?
  - Never₁
  - Rarely₂
  - Sometimes₃
  - Frequently₄
  - Always₅

Thank you, that completes all the questions in the questionnaire.
Appendix MM: Parent post-study questionnaire

Thank you for participating in the Media and Eating Habits Research Study.

This questionnaire is for you, the parent, to respond to and should take 15-20 minutes. There are no right or wrong answers. Please answer as honestly as you can. You will not be judged on any of your responses.

All answers will be strictly confidential, kept in a secure place and only researchers listed on the ethics application will have access to the information. A report from the study may be submitted for publication or presentation at a conference, but individual participants will not be identifiable.

Your participation in the questionnaire is voluntary and you can withdraw from it at any time you choose. You can also ask for any data you have already provided to be withdrawn from the study. Withdrawing data or withdrawing from the study will not affect any relationship with the University of Wollongong or the University of Wollongong Sports Holiday Camp.

This study has been reviewed by the Human Research Ethics Committee of the University of Wollongong.

Please enter the name of your child who will be participating in this study (first and last name). If you have more than one child participating please fill out separate surveys (you will be sent separate web page links for your other children).

Name: ____________________________
During the study your child saw some advertisements for different products and I would like to ask you a few questions about these.

2. Did they make any comments or talk about any of the advertisements? 1. Yes  2. No (please mark response)

If yes, what did they talk about? (please jot down any details, however small)

3. Did your child ask you to buy any of the items that they said they had seen advertised?

1. Yes  2. No (please mark response) (if no they skip forward to C1 for the demographic questions)

4. If yes, what products did they ask for? (you can mark more than one if necessary)

- Hoola Hoops
- Maynards Discovery Patch
- McVitie's BN
- Taco Bell
- McVitie's Delichoc
- McCoys Chips
- Hersheys Chocolate Spread
- Walkers Crisps
- Nestle KokoKunch
- Any other requests (please give product details)
5. How many times did they ask for each one? (please make a mark next to the relevant product)

<table>
<thead>
<tr>
<th></th>
<th>1 time</th>
<th>2 times</th>
<th>3 times</th>
<th>4 times</th>
<th>5 times</th>
<th>More than 5 times</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hoola Hoops</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Maynards</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Discovery Patch</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>McVities BN</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Taco Bell</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>McVities Delichoc</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>McCoys Chips</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Hersheys</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Chocolate Spread</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Burger King</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Walkers Crisps</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Nestle KokoKrush</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Other products</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>
The next section asks some general questions about you and your family. This will be used to give us some background information about the children and families that have taken part in the study. This helps us understand if our sample of children is representative of the average Australian family. Remember any information you give me is confidential and will be coded so that no one will be identifiable.

The first few questions are about your family unit.

6. Could you please tell me what your marital status is? (circle)

7. Thinking about your child who took part in the study, do they have any siblings? (circle)
   1. Yes 2. No If yes...

8. How many older brothers and sisters do they have living in your house? __________

9. How many younger brothers and sisters do they have living in your house? __________

These next few questions are about language, your ancestry and education.

10. Which language do you mainly speak in the home? (circle)

The next two questions are about where you and your partner (if applicable) were born.

11. Where were you born? (circle)

12. Where was your partner born? (if applicable) (circle)

The next few questions are about you and your partner’s (if indicated in C1) education

13. What is the highest year of primary or secondary school that you have completed? (circle)
    1. Year 12 or equivalent 2. Year 11 or equivalent 3. Year 10 or equivalent 4. Year 9 or equivalent
    5. Year 8 or below 6. Never attended school
14. What is the highest year of primary or secondary school that your partner has completed? (if applicable) *(circle)*

1. Year 12 or equivalent  
2. Year 11 or equivalent  
3. Year 10 or equivalent  
4. Year 9 or equivalent  
5. Year 8 or below  
6. Never attended school

15. Have you completed a trade certificate, diploma, degree or any other educational qualification? *(circle)*

1. Yes  
2. No  
If Yes, enter qualification level

16. Has your partner completed a trade certificate, diploma, degree or any other educational qualification? (if applicable) *(circle)*

1. Yes  
2. No  
If Yes, enter qualification level

The final question is about your household income.

17. What is your approximate **weekly** household income before tax?

- □ Less than $599 per week ($31,199 per year)
- □ $600 - $799 per week ($31,200 - $41,599 per year)
- □ $800 - $999 per week ($41,600 - $51,999 per year)
- □ $1,000 - $1,249 per week ($52,000 - $64,999 per year)
- □ $1,250 - $1,499 per week ($65,000 - $77,999 per year)
- □ $1,500 - $1,999 per week ($78,000 - $103,999 per year)
- □ $2,000 - $2,249 per week ($104,000 - $116,948 per year)
- □ $2,250 - $2,499 per week ($117,000 - $129,948 per year)
- □ $2,500 - $2,999 per week ($130,000 - $155,948 per year)
- □ $3,000 - $3,249 per week ($156,000 - $168,948 per year)
- □ $3,250 or more per week ($169,000 or more per year)
- □ Don’t know
- □ Don’t want to answer
We have a factsheet which contains different links to healthy eating and physical activity websites and some information about advertising and online gaming which we can email to you if you like?

Yes/No (Circle)

Finally, is there any feedback you would like to give us about the study?

______________________________________________________________________________________________

______________________________________________________________________________________________

______________________________________________________________________________________________

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______________________________________________________________________________________________

______________________________________________________________________________________________

Thank you so much for participating.

Press 'done' to submit survey.
Appendix NN: Photographic release form

PHOTOGRAPH RELEASE FORM

Consent

This form is my consent and acknowledgement that I, ________________________________

(insert full name, address)

__________________________

hereby consent for my child/ren ________________________________

(insert full name/s)

__________________________

to be photographed by the University of Wollongong (UOW), Early Start Research Institute (ESRI) on the following terms:

1. UOW will own any and all rights in the photography.

2. I hereby consent for UOW and/or its representatives, agents and related entities to Use any photographs of my child/ren’s (as named above) Appearance for promotional, commercial, and marketing purposes, whether or not accompanied by any narration or dialogue, by any present or future media or means known or unknown.

3. I consent to the Use of any printed material in conjunction with the abovementioned Use.

4. I hereby waive all personal rights and objections to, including the right to inspect, any Use which will be made of my child/ren’s (as named above) Appearance by UOW.

5. I hereby waive, release and forever discharge the UOW and all persons acting under its permission or authority from all claims, actions and liability relating to use of the said photographs.

6. I understand that I will not receive any compensation or payment or any form of remuneration now or in the future in consideration for the above consent.

7. I acknowledge that images of my child/ren’s Appearance may be transferred outside Australia and stored and processed overseas.

Definitions

a. Appearance means my child/ren’s image and physical likeness only. I understand that their name or any personal details (apart from their image and physical likeness) will not be disclosed.

b. UOW means the University of Wollongong, and any successors, assigns or licensees including the accommodation services and campuses:

c. Use means lawful use and includes the exclusive and perpetual right of UOW in any jurisdiction worldwide to:-

Photograph Release Form_Appendix R9 V1 9_3_2016
(i) use, copy, adapt and/or exploit;
(ii) mix, edit, duplicate, or re-use, or create derivative works;
(iii) assign, license or sub-license;
(iv) publicise and/or market; and
(v) exhibit and/or perform and/or distribute by any present or future media, for profit or otherwise.

Legal guardian: (print name) __________________________________________

Legal guardian signature ____________________________________________

Dated: ___________________________ __________________________________

Witnessed: _________________________________________________________

{name and signature}
Appendix OO: The research study ethical approval

2 November 2015

Dr Bridget Kelly
School of Health and Society
Building 15
University of Wollongong

Dear Dr Kelly

Thank you for your letter responding to the HREC review letter. I am pleased to advise that the Human Research Ethics application referred to below has been approved.

Ethics Number: HE15/396

Project Title: Investigation into the sustained impact of food advertising on children’s dietary intake and its potential to influence children’s weight

Researchers: Dr Bridget Kelly, Dr Anne McMahon, Professor Adrian Bauman, Mrs Jennifer Norman, Professor Louise Baur, A/Professor Lesley King, Dr Emma Boyland, Ms Kathy Chapman, Ms Clare Hughes

Documents Approved: Initial Ethics Application
Recruitment Email Cover Letter for schools, sports clubs, after school care services and Early Start Engagement centres V1 - 12/09/2015
Recruitment Email for Email Networks V1 - 12/09/2015
Parent Consent Form V1 - 15/09/2015
Cover Letter for Parent Information Pack V1 - 16/09/2015
Child Verbal Assent Form V1 - 15/09/2015
Promotional Flyer V2 - 27/10/15
Interest in Participating in Study and Screening Questionnaire V2 - 27/10/2015
Participant Information Statement: Research project V2 - 27/10/2015
Parking Map V1 - 27/10/2015
Baseline Questionnaire V2 - 27/10/2015
Follow up Questionnaire V2 - 27/10/2015
Supporting documentation from UOW Sports Camp Organiser
Supporting documentation from Early Start Research Institute
24 hour food recall template V1 - 12/09/2015
Parent sign in sheet V1 - 12/09/2015
Parent sign out sheet V1 - 12/09/2015
Brand Recall and Recognition Task V1 - 16/09/2015
Healthy Eating and Physical Activity Information, Advertising Information, Classification System Information and Online Safety Tips V1 - 12/09/2015
Hunger and Safety Rating Scale V1 - 12/09/2015

Ethics Unit, Research Services Office
University of Wollongong NSW 2522 Australia
Telephone (02) 4221 3388 Facsimile (02) 4221 4338
Email: rso-ethics@uow.edu.au Web: www.uow.edu.au
Approval Date: 30 October 2015
Study Expiry Date: 29 October 2016

The University of Wollongong/Illawarra Shoalhaven Local Health District Social Sciences HREC is constituted and functions in accordance with the NHMRC National Statement on Ethical Conduct in Human Research. The HREC has reviewed the research proposal for compliance with the National Statement and approval of this project is conditional upon your continuing compliance with this document.

A condition of approval by the HREC is the submission of a progress report annually and a final report on completion of your project. The progress report template is available at http://www.uow.edu.au/research/roo/ethics/UOW009385.html. This report must be completed, signed by the appropriate Head of School, and returned to the Research Services Office prior to the expiry date.

As evidence of continuing compliance, the Human Research Ethics Committee also requires that researchers immediately report:

- proposed changes to the protocol including changes to investigators involved
- serious or unexpected adverse effects on participants
- unforeseen events that might affect continued ethical acceptability of the project.

Please note that approvals are granted for a twelve month period. Further extension will be considered on receipt of a progress report prior to expiry date.

If you have any queries regarding the HREC review process, please contact the Ethics Unit on phone 4221 3386 or email iso-ethics@uow.edu.au.

Yours sincerely

Associate Professor Melanie Randle
Chair, Social Sciences
Human Research Ethics Committee

Ethics Unit, Research Services Office
University of Wollongong NSW 2522 Australia
Telephone (02) 4221 3386 Facsimile (02) 4221 4338
Email: iso-ethics@uow.edu.au Web: www.uow.edu.au
Appendix PP: The research study ethical amendment approval

AMENDMENT APPROVAL LETTER
In reply please quote: HE15/396
Further Information Phone: 4221 3386

20 November 2015

Dear Dr Kelly,

I am pleased to advise that the amendments dated 18 November 2015 to the following Human Research Ethics application have been approved.

Ethics Number: HE15/396

Project Title: Investigation into the sustained impact of food advertising on children’s dietary intake and its potential to influence children’s weight

Researchers: Dr Bridget Kelly, Dr Anne McMahon, Professor Adrian Bauman, Mrs Jennifer Norman, Professor Louise Baur, A/Professor Lesley King, Dr Emma Boyland, Ms Kathy Chapman, Ms Clare Hughes

Amendments Approved: Addition of an Online and Paper Questionnaire
Inclusion of further exclusion criteria
Appendix R4 – Interest in Participating in Study Screening Questionnaire – V3 -17/11/15
Appendix R5 – Participant Information Sheet – V3 -17/11/15
Appendix R7 – Cover letter Parent Info pack – V2 -17/11/15
Appendix S3 – Baseline Questionnaire – V3 -17/11/15
Baseline Questionnaire for mail Out – V1 -17/11/15

Amendment Approval Date: 20 November 2015
Expiry Date: 29 October 2016

Please remember that in addition to reporting proposed changes to your research protocol the HREC requires that researchers immediately report:

- serious or unexpected adverse effects on participants immediately
- unforeseen events that might affect continued ethical acceptability of the project.

A condition of approval by the HREC is the submission of a progress report annually and a final report on completion of your project. The progress report template is available at http://www.uow.edu.au/research/ethics/UOW099385.html. This report must be completed, signed by the appropriate Head of School and returned to the Research Services Office prior to the expiry date.

If you have any queries regarding the HREC review process, please contact the Ethics Unit on phone 4221 3386 or email rso-ethics@uow.edu.au
Yours sincerely,

Associate Professor Melanie Randie
Chair, UOW & ISLHD Social Sciences
Human Research Ethics Committee

The University of Wollongong/ Illawarra and Shoalhaven Local Health Network District (ISLHD) Social Science HREC is constituted and functions in accordance with the NHMRC National Statement on Ethical Conduct in Human Research.
Appendix QQ: The research study second ethical amendment approval

AMENDMENT APPROVAL LETTER
In reply please quote: HE15/396
Further information Phone: 4221 3386

15 March 2016
School of Health and Society
Building 15
University of Wollongong

Dear Dr Kelly,

I am pleased to advise that the amendments dated 9/03/16 to the following Human Research Ethics application have been approved.

Ethics Number: HE15/396

Project Title: Investigation into the sustained impact of food advertising on children’s dietary intake and its potential to influence children’s weight

Researchers: Dr Bridget Kelly, Dr Anne McMahon, Professor Adrian Bauman, Mrs Jennifer Norman, Professor Louise Baur, A/Professor Lesley King, Dr Emma Boyland, Ms Kathy Chapman, Ms Clare Hughes

Amendments Approved
- Amended Parents Baseline Questionnaire
- Amended Children’s Brand and Recall Recognition task
- Amended Parent Follow up Questionnaire
- Amended screening criteria
- Modified study time
- Permission to take photographs of children
- Additional recruitment strategy
- Updated Participant Information Sheet
- Updated Consent Form

Amendment Approval Date: 15 March 2016
Expiry Date: 29 October 2016

Please remember that in addition to reporting proposed changes to your research protocol the HREC requires that researchers immediately report:
- serious or unexpected adverse effects on participants immediately
- unforeseen events that might affect continued ethical acceptability of the project.

A condition of approval by the HREC is the submission of a progress report annually and a final report on completion of your project. The progress report template is available at http://www.uow.edu.au/research/ethics/UOW009385.html. This report must be completed, signed by the appropriate Head of School and returned to the Research Services Office prior to the expiry date.

Ethics Unit, Research Services Office
University of Wollongong NSW 2522 Australia
Telephone: (02) 4221 3386 Facsimile: (02) 4221 4338
Email: no-ethics@uow.edu.au Web: www.uow.edu.au
If you have any queries regarding the HREC review process, please contact the Ethics Unit on phone 4221 3386 or email rse-ethics@uow.edu.au.

Yours sincerely,

Associate Professor Melanie Randle  
Chair, UOW & ISLHD Social Sciences  
Human Research Ethics Committee

The University of Wollongong/ Illawarra and Shoalhaven Local Health Network District (ISLHD) Social Science HREC is constituted and functions in accordance with the NHMRC National Statement on Ethical Conduct in Human Research.
Appendix RR: Supplementary Table 6.1- Detailed descriptions of marketing techniques and direct brand executional tactics in TV advertisements and online advergames

<table>
<thead>
<tr>
<th>Brand</th>
<th>Description of advertisement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nestle Kokokrunch (TV ad) (Brand A) Length: 25 seconds</td>
<td>Action cartoon showing a ‘villain’ character in a helicopter chasing the Nestle Kokokrunch train. The train is a locomotive with a large container of liquid chocolate on the back. The villain cackles and says, ‘There’s the Kokokrunch train. All the delicious chocolate will be mine.’ We then see the helicopter flying away with the chocolate container. The young boy character urgently says to the Nestle Kokokrunch promotional lion, ‘Oh no Koko!’ To the villain he says, ‘You’ll never get away with this’. The Nestle Kokokrunch lion then jumps from the train to the helicopter and grabs onto the chocolate container. The lion undoes the container and the chocolate pours out. He shouts to the young boy, ‘Quick, throw the Kokokrunch now!’ And the young boy starts throwing the Nestle Kokokrunch cereal pieces into the chocolate stream. The lion says, ‘All the delicious chocolate goes into every piece of Kokokrunch!’ We see the chocolate coating the cereal. ‘That’s why it tastes so good!’ The advert then briefly focuses on a bowl of Nestle Kokokrunch with milk being poured onto it. We then see the young boy and the lion sitting in the train eating the Nestle Kokokrunch with a bottle of milk on the table. Both characters say, ‘Mmm!’ and look happy. Lion voiceover says, ‘Kokokrunch, the great chocolatey taste!’</td>
</tr>
</tbody>
</table>

| ✓ | Two or more emotional appeals |
| x | Two or more food product appeals |

<table>
<thead>
<tr>
<th>Category</th>
<th>Subcategory</th>
<th>How appeals appear in advertisement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emotional appeals</td>
<td>Smiling/happiness</td>
<td>Young boy and Nestle Kokokrunch promotional lion smile at each other at the end when they are eating their cereal</td>
</tr>
<tr>
<td></td>
<td>Action/adventure</td>
<td>Train chase with villain stealing the chocolate</td>
</tr>
<tr>
<td></td>
<td>Fantasy/imagination</td>
<td>Action cartoon</td>
</tr>
<tr>
<td></td>
<td>Social enhancement/peer acceptance</td>
<td>Characters eating together at the end of advert</td>
</tr>
<tr>
<td>Food product appeals</td>
<td>Palatability</td>
<td>Chocolate referred to throughout. ‘Kokokrunch, the great chocolatey taste!’ Both characters say, ‘Mmm!’ when eating it.</td>
</tr>
<tr>
<td>Visual</td>
<td>Promotional characters</td>
<td>Cartoon characters, featuring the Nestle Kokokrunch promotional lion</td>
</tr>
<tr>
<td></td>
<td>Meal portrayed</td>
<td>Breakfast</td>
</tr>
<tr>
<td></td>
<td>Food Setting</td>
<td>On a train</td>
</tr>
<tr>
<td></td>
<td>Supplementary food references</td>
<td>Cereal served with milk</td>
</tr>
<tr>
<td></td>
<td>Brand prominent/central to ad</td>
<td>Yes</td>
</tr>
<tr>
<td>Audio</td>
<td>Music/jingles</td>
<td>Action music and sound effects</td>
</tr>
<tr>
<td></td>
<td>Direct audience address</td>
<td>Lion voiceover at the end says, ‘Kokokrunch, the great chocolatey taste!’</td>
</tr>
<tr>
<td></td>
<td>Sound of food being eaten</td>
<td>Yes</td>
</tr>
<tr>
<td>Brand execution</td>
<td>Visual frequency</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Verbal frequency</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Dual mode</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Early branding</td>
<td>Visual: 1 second</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Verbal: 1 second</td>
</tr>
<tr>
<td>Brand</td>
<td>Description of advertisement</td>
<td></td>
</tr>
<tr>
<td>-------</td>
<td>------------------------------</td>
<td></td>
</tr>
<tr>
<td>Hershey’s chocolate spread (Brand B)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Length: 25 seconds</td>
<td>Fast beat, uplifting catchy music playing throughout advert. Advert opens to young adult couple eating Hershey’s Chocolate Spread (HCS) whilst camping. Quick switch to Girl (aged ~8) and grandfather eating HCS whilst out in the wilderness. Another quick switch to 2 young boys (aged ~6-8) eating HCS in the kitchen with Dad. Final new characters are young adult women eating HCS in their lounge room. All characters smiling and laughing. Voiceover throughout the advert.</td>
<td></td>
</tr>
</tbody>
</table>

| √ | Two or more emotional appeals |
| √ | Two or more food product appeals |

### How appeals appear in advertisement

<table>
<thead>
<tr>
<th>Category</th>
<th>Subcategory</th>
<th>Visual actors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emotional appeals</td>
<td>Smiling/happiness</td>
<td>• All characters laughing and smiling</td>
</tr>
<tr>
<td>Action/adventure</td>
<td>• Characters depicted on outdoor adventures</td>
<td></td>
</tr>
<tr>
<td>Social enhancement/peer acceptance</td>
<td>• All characters in couples or small group, eating and laughing</td>
<td></td>
</tr>
<tr>
<td>Parent</td>
<td>• Child characters shown with older adults – grandfather and dad – endorsing okay to eat product</td>
<td></td>
</tr>
<tr>
<td>Parental-themes</td>
<td>• Themes of family life – throughout advert</td>
<td></td>
</tr>
<tr>
<td>Food product appeals</td>
<td>Palatability</td>
<td>• All characters eating and smiling and laughing whilst consuming product</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• ‘Spread the delicious taste you know and love’</td>
</tr>
</tbody>
</table>

### Visual

- Human actors
- -Age | • All generations included
- -Food activity | • All actors in the advertisement are depicted eating
- Meal portrayed | • Snack
- Food Setting | • Camping, in the wilderness, in the kitchen, in the lounge room
- Supplementary food references | • Late teen girls eating HCS with fruit
- Product central to ad | • Yes

### Audio

- Music/jingles | • Fast beat song playing throughout advert
- Direct audience address | • Voiceover throughout advert |
| | • Language – ‘anything, anywhere, anytime, anyone’ spread the delicious taste you know and love - Hershey’s is mine, yours, our chocolate spreads’. Possessive pronouns. |

### Brand execution

- Visual frequency | • 4
- Verbal frequency | • 1
- Dual mode | • Yes
- Early branding | • Visual: 1 second
| | • Verbal: 10 seconds |
**Brand** | **Description of advertisement**
---|---
Maynards Discovery Patch (Brand C) | Features Cartoon Hedgehogs in their lounge room. Mum, Dad and child hedgehog. Dad reading the paper. Mum and child hedgehog sitting together with a packet of Maynards Discovery Patch. Child says, ‘Ooo, Maynards Discovery Patch’. Mum reads out a question from the back of the packet. ‘What do hedgehogs do when they are scared?’ and she tips out the packet of lollies into a saucer on the table. Child hedgehog picks up a lolly, again says ‘Ooo!’ and ‘They cry!’ Corrects herself and says, ‘No, they do a spiky dance!’ and jumps on the sofa. Mum and child dance together. Child picks up another lolly and says, ‘Ooo! A tiger!’ and growls. At which point the Dad’s eyes open wide in fright and he curls up in a ball. The child laughs, points at the Dad and says to the Mum, ‘Oh, I know! They curl up into a fat spiky ball!’ The Mum laughs. Then the voiceover says ‘Maynards Discovery Patch’ and the logo and packets of the lollies appear with the tagline ‘Give your imagination something to chew on.’

- **√** Two or more emotional appeals
- **√** Two or more food product appeals

**Category** | **Subcategory** | **Description**
---|---|---
Emotional appeals | Smiling/happiness | Mum and child hedgehog smile and laugh throughout
| Fun/humor | Mum and child joking together and laughing at the Dad
| Sports/physical performance | Child hedgehog shown dancing
| Fantasy/imagination | Cartoon Hedgehogs
| Achievement/accomplishment | Advert centred around child hedgehog solving the question, ‘What do hedgehogs do when they are scared?’
| Social enhancement/peer acceptance | Characters together as a family
| Anti-adult/parent themes | Humor – child and Mum hedgehog laugh at the Dad curled up in a ball after he gets a fright
| Parent-pleasing | Mum tips lollies out into the saucer, offering them to child
| Parental-themes | Themes of family life – home situation portrayed

Food product appeals | Palatability | When mother pours out the lollies – child picks up one and says ‘Ooo’ in a positive way
| Novelty/new | New Maynards Discovery Patch
| Visual | Promotional characters | Cartoon Hedgehogs
| Meal portrayed | Snack
| Food setting | Home setting portrayed
| Brand prominent/central to ad | Yes

Audio | Music/jingles | Incidental music used as characters move
| Direct audience address | Voiceover at end says ‘New Maynards Discovery Patch’

Brand execution | Visual frequency | 6
| Verbal frequency | 2
| Dual mode | Yes
| Early branding | Visual: 2 seconds
| Verbal: 2 seconds

337
**Brand**

**Burger King (Brand D)**  
**Length:** 15 seconds

**Description of advertisement**

Burger King Meal Deal ‘5 for $4’. Food focus of advert. Advert opens with Burger King crown being lifted off the five items being advertised with a ‘Woo!’ Fast beat music playing. Each item of food introduced as a voiceover with a close up and sound effects eg sizzle sound for burger. Voiceover at end says ‘It’s not just a deal, it’s a full meal! Five items for just $4!’

<table>
<thead>
<tr>
<th>Category</th>
<th>Subcategory</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emotional appeals</td>
<td></td>
<td>Nil</td>
</tr>
<tr>
<td>Food product appeals</td>
<td>Palatability</td>
<td>• Food central to ad and described with close ups, sizzling noises – ‘Flame grilled cheeseburger, crispy nuggets…’</td>
</tr>
<tr>
<td></td>
<td>Economical</td>
<td>• ‘It’s not just a deal, it’s a full meal! Five items for just $4!’</td>
</tr>
<tr>
<td>Visual</td>
<td>Meal portrayed</td>
<td>• Described as full meal</td>
</tr>
<tr>
<td></td>
<td>Food setting</td>
<td>• White background</td>
</tr>
<tr>
<td></td>
<td>Product central to ad</td>
<td>• Yes</td>
</tr>
<tr>
<td>Audio</td>
<td>Music/jingles</td>
<td>• Fast beat music</td>
</tr>
<tr>
<td></td>
<td>Direct audience address</td>
<td>• Enthusiastic voice introducing food items. Voiceover at end says ‘It’s not just a deal, it’s a full meal! Five items for just $4!’</td>
</tr>
<tr>
<td></td>
<td>Sound of food being eaten/cooking</td>
<td>• Yes</td>
</tr>
<tr>
<td>Brand execution</td>
<td>Visual frequency</td>
<td>• On screen whole time</td>
</tr>
<tr>
<td></td>
<td>Verbal frequency</td>
<td>• 2</td>
</tr>
<tr>
<td></td>
<td>Dual mode</td>
<td>• Yes</td>
</tr>
<tr>
<td></td>
<td>Early branding</td>
<td>• Visual: 1 second</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Verbal: 1 second</td>
</tr>
</tbody>
</table>
Taco Bell (Brand E)
Length: 30 seconds

Adult voice over. The scene opens to a young man standing in his home. We do not see his head but the camera focuses on his hands 'creating' different menu items. It has the semblance of a magic show with small flames appearing when he creates hot/fiery items. The new Taco Bell app with Hands shown creating different menu items

<table>
<thead>
<tr>
<th>Category</th>
<th>Subcategory</th>
<th>How appeals appear in advertisement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emotional appeals</td>
<td>Achievement/accomplishment</td>
<td>• Appeal to creativity -what will you create - millions of combinations.</td>
</tr>
<tr>
<td>Food product appeals</td>
<td>Novelty/new</td>
<td>• New Taco Bell app</td>
</tr>
<tr>
<td></td>
<td>Convenience</td>
<td>• Order through app</td>
</tr>
<tr>
<td></td>
<td>Premium offer</td>
<td>• Get a free Doritos Locos Taco with any mobile purchase</td>
</tr>
<tr>
<td>Visual</td>
<td>Human actors</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-Age</td>
<td>• One young adult (aged ~ 25) – we don’t see his face</td>
</tr>
<tr>
<td></td>
<td>-Food activity</td>
<td>• Actor ‘creates’ different food items</td>
</tr>
<tr>
<td></td>
<td>Meal portrayed</td>
<td>• Lunch/dinner/drink</td>
</tr>
<tr>
<td></td>
<td>Food Setting</td>
<td>• Home setting</td>
</tr>
<tr>
<td></td>
<td>Product central to ad</td>
<td>• No</td>
</tr>
<tr>
<td>Audio</td>
<td>Music/jingles</td>
<td>• Slow guitar throughout advert then bell clang at the end with Taco Bell logo</td>
</tr>
<tr>
<td></td>
<td>Direct audience address</td>
<td>• Adult voiceover throughout</td>
</tr>
<tr>
<td>Brand execution</td>
<td>Visual frequency</td>
<td>• 1</td>
</tr>
<tr>
<td></td>
<td>Verbal frequency</td>
<td>• 1</td>
</tr>
<tr>
<td></td>
<td>Dual mode</td>
<td>• Yes</td>
</tr>
<tr>
<td></td>
<td>Early branding</td>
<td>• Visual: 28 seconds</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Verbal: 23 seconds</td>
</tr>
<tr>
<td>Brand</td>
<td>Description of advertisement</td>
<td></td>
</tr>
<tr>
<td>-------</td>
<td>-----------------------------</td>
<td></td>
</tr>
<tr>
<td>Hula hoops (Brand F) Length: 30 seconds</td>
<td>Advert opens with a female dancer dressed in a shimmering red midriff top and short skirt dancing in the spotlight on a stage with two male dancers indistinct in the background. There is a fast beat song playing and there are two white frame-like structures on either side of the stage. On closer inspection there is something unusual about the female dancer’s legs – they are fingers with Hula Hoops on the ends. Close up of female’s face – she is heavily made-up and pouts to the camera. The female dancer then starts to flip in the air and the male back up dancers rush towards her towards her Close up of female’s face and she looks very confused. Flash to an image of a little girl (aged ~8) smiling and we see her two fingers in the foreground with Hula Hoops on the ends. Little girl puts her fingers into her mouth and crunches on the Hula Hoops and eats them. Scene opens to kitchen setting – girl is in foreground at kitchen bench. On the bench is an open packet of Hula Hoops with a salt and pepper shaker prominent – reminiscent of the frame-like structures from the stage. In the background are a young boy (aged ~10) doing his homework with his mother sitting next to him helping. Music continues, girl continues to eat the Hula Hoops, crunching noises and girl licks her fingers. Girl turns around to mother and they smile at each other and mother laughs. Logo appears. Girl has Hula Hoops on fingers on other hand and ‘dances’ them through the salt and pepper shakers. ‘Fun never grows up’ slogan appears then we hear a loud crunch.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>√</th>
<th>Two or more emotional appeals</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Emotional appeals</td>
</tr>
</tbody>
</table>
| Smiling/happiness | • Young girl character smiles and laughs whilst playing with and eating the Hula Hoops  
• Mother and child smile at each other when child eats Hula Hoops |
| Fun/humor | • Young girl having fun playing with the Hula Hoops |
| Sports/physical performance | • Ad opens with female dancer performing on stage |
| Fantasy/imagination | • Shows female dancer with fingers for legs with Hula Hoops as shoes |
| Anti-adult/parent themes | • Young girl controlling dancer – dancer looks shocked as she flips upside down, girl is laughing. Accompanying dancers rush to help her |
| Parent-pleasing | • Mother smiles and laughs as child eats and plays with Hula Hoops |
| Parental-themes | • Themes of family life – scene within the kitchen at home |
| Nostalgia | • Fun never grows up – intimating that the Mother used to do the same thing with her Hula Hoops or that you are never too old to put Hula Hoops on your fingers |

<table>
<thead>
<tr>
<th>x</th>
<th>Two or more food product appeals</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Food product appeals</td>
</tr>
</tbody>
</table>
| Palatability | • Crunching noises as child eats  
• Child smiles as she eats Hula Hoops, licking her fingers |
<p>| Visual | Human actors |
| -Age | • Three young adult dancers (aged ~ 20s); girl child (aged ~8); boy child (aged ~10); children’s mother |
| -Food activity | • Girl child eats Hula Hoops with mother seen smiling and laughing as she does |
| Meal portrayed | • Snack |
| Food Setting | • Family home |
| Supplementary food references | • Bowl of fruit on table |
| Product central to ad | • Yes |</p>
<table>
<thead>
<tr>
<th>Audio</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Music/jingles</td>
<td>Fast beat song playing throughout advert</td>
</tr>
<tr>
<td>Direct audience address</td>
<td>Adult voiceover at end ‘Fun never grows up’</td>
</tr>
<tr>
<td>Sound of food being eaten</td>
<td>Yes</td>
</tr>
<tr>
<td>Brand execution</td>
<td></td>
</tr>
<tr>
<td>Visual frequency</td>
<td>4</td>
</tr>
<tr>
<td>Verbal frequency</td>
<td>0</td>
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<tr>
<td>Dual mode</td>
<td>No</td>
</tr>
<tr>
<td>Early branding</td>
<td>Visual: 21 second</td>
</tr>
<tr>
<td></td>
<td>Verbal: not mentioned</td>
</tr>
</tbody>
</table>
### Brand Description of advertisement

**McCoy’s (Brand G)**

**Length: 30 seconds**

Scene opens to barbecue party – young adults (aged ~ 25) standing around laughing and eating McCoy’s crisps. We hear crunching. ‘Steve’ is standing at the barbecue looking on. A character with a tiger head on it, dressed identically to Steve, appears and says ‘Steve, I’m your inner man. Listen to me to get your share of McCoy’s Ultimate.’ Both characters lick their lips with slurping noises. Tiger Steve says, ‘Your friends are not friends, they are hyenas.’ Scene goes into slow motion and we focus on the friends eating the crisps. Tiger Steve says, ‘You brought them back to the table, you feed first.’ Steve is nodding and then runs through the party, through a paddling pool to get to the crisps. Small boy (aged ~8) watches on. Voice over ‘New McCoy’s Ultimate, it’s the way of the tiger’ with a picture of three packets of McCoy’s and a tiger arm reaches in to one of the bags. Advert finishes with a young adult female eating from a packet of McCoy’s and she turns around to Steve, who is hanging over a tree branch (as a tiger would do) eating a handful of McCoy’s crisps.

<table>
<thead>
<tr>
<th>Category</th>
<th>Subcategory</th>
<th>How appeals appear in advertisement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emotional appeals</td>
<td>Smiling/happiness</td>
<td>· Characters eating McCoy’s are smiling and laughing</td>
</tr>
<tr>
<td></td>
<td>Fantasy/imagination</td>
<td>· Steve’s inner man has a tiger head</td>
</tr>
<tr>
<td></td>
<td>Social enhancement/peer acceptance</td>
<td>· Small group of young adults depicting belonging/peer acceptance</td>
</tr>
<tr>
<td>Food product appeals</td>
<td>Palatability</td>
<td>· Crunching noises as people eating crisps; ‘twice flavoured, richer taste’</td>
</tr>
<tr>
<td></td>
<td></td>
<td>· Central theme to advert is for Steve to get the crisps – Steve and Tiger Steve look on licking their lips</td>
</tr>
<tr>
<td></td>
<td>Novelty/new</td>
<td>· New product – ‘New McCoy’s Ultimate’, ‘Twice flavoured, richer taste, get your share’</td>
</tr>
<tr>
<td>Visual</td>
<td>Human actors</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-Age</td>
<td>· Young adults (aged ~25) plus one child, small boy (aged ~8)</td>
</tr>
<tr>
<td></td>
<td>-Food activity</td>
<td>· Actors in the advertisement are depicted eating</td>
</tr>
<tr>
<td></td>
<td>Promotional characters</td>
<td>· Tiger Steve</td>
</tr>
<tr>
<td></td>
<td>Meal portrayed</td>
<td>· Snack</td>
</tr>
<tr>
<td></td>
<td>Food Setting</td>
<td>· Outdoor barbecue party</td>
</tr>
<tr>
<td></td>
<td>Supplementary food references</td>
<td>· Sausages being cooked at barbecue but only the McCoy’s seen being eaten</td>
</tr>
<tr>
<td></td>
<td>Product central to ad</td>
<td>· No</td>
</tr>
<tr>
<td>Audio</td>
<td>Music/jingles</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Direct audience address</td>
<td>· Adult voiceover – taking the role of Steve’s inner man</td>
</tr>
<tr>
<td></td>
<td>Sound of food being eaten/cooking</td>
<td>· Yes</td>
</tr>
<tr>
<td></td>
<td>Number of verbal mentions of brand/product</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>· 2</td>
</tr>
<tr>
<td>Brand execution</td>
<td>Visual frequency</td>
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<tr>
<td></td>
<td></td>
<td>· 4</td>
</tr>
<tr>
<td></td>
<td>Verbal frequency</td>
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<td>· 2</td>
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<td></td>
<td>Dual mode</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>· Yes</td>
</tr>
<tr>
<td></td>
<td>Early branding</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>· Visual: 4 second</td>
</tr>
<tr>
<td></td>
<td></td>
<td>· Verbal: 10 second</td>
</tr>
</tbody>
</table>
### Walkers MixUps (Brand H)

**Length:** 30 seconds

Features Dad (Gary Lineker) in a hospital bed eating a packet of Walkers MixUps. Three children (aged ~ 10-14) enter the room. Dad picks out a chip, names each one as he eats it. A lot of crunching and Dad looks satisfied. Dad does not offer children any of the chips. Children watch Dad and their faces start looking irritated. Dad can be heard groaning from the bed.

Children grab hospital bed control and the Dad’s bed snaps together, trapping the Dad and allowing the children to take the packet of chips. Children start eating the packet of chips, looking satisfied with themselves and smile at each other.

- **Two or more emotional appeals**
  - Smiling/happiness
    - Dad smiles as he eats
    - Children smile at each other once they have stolen the packet
  - Fun/humor
    - Humor as kids trap Dad in bed
  - Social enhancement/peer acceptance
    - Small group of children depicting belonging/peer acceptance
  - Anti-adult/parent themes
    - Humor – kids gang up on Dad
  - Parent-pleasing
    - Dad is shown eating product first – endorsing that product is good to eat
  - Parental-themes
    - Themes of family life – children visiting Dad in hospital
  - Nostalgia
    - Gary Lineker – International soccer star in 70s and 80s

- **Two or more food product appeals**
  - Palatability
    - Food central to ad and food eaten – lots of crunching
    - Food described by Dad – ‘good’ and ‘love those’
  - Convenient
    - ‘All your favourites in one bag’

### Category

#### Emotional appeals
- Smiling/happiness
  - Dad smiles as he eats
  - Children smile at each other once they have stolen the packet
- Fun/humor
  - Humor as kids trap Dad in bed
- Social enhancement/peer acceptance
  - Small group of children depicting belonging/peer acceptance
- Anti-adult/parent themes
  - Humor – kids gang up on Dad
- Parent-pleasing
  - Dad is shown eating product first – endorsing that product is good to eat
- Parental-themes
  - Themes of family life – children visiting Dad in hospital
- Nostalgia
  - Gary Lineker – International soccer star in 70s and 80s

#### Food product appeals
- Palatability
  - Food central to ad and food eaten – lots of crunching
  - Food described by Dad – ‘good’ and ‘love those’
- Convenient
  - ‘All your favourites in one bag’

### Visual

- Human actors
  - Age
    - Three children (aged ~ 10-14); one adult
  - Food activity
    - All actors in the advertisement are depicted eating
- Promotional characters
  - Gary Lineker (sports star) – unlikely Australian children would know him
- Meal portrayed
  - Snack
- Food setting
  - Hospital
- Supplementary food refs
  - Grapes on bedside cabinet
- Product central to ad
  - Yes

### Audio

- Music/jingles
  - No music
- Direct audience address
  - Child’s voiceover at end – ‘Walkers MixUps – All your favourites in one bag’. Possessive pronoun used ‘your’.
- Sound of food being eaten
  - Yes
- Number of verbal mentions of brand/product
  - 6

### Brand execution

- Verbal frequency
  - 6
- Dual mode
  - Yes
- Early branding
  - Visual: 1 second
  - Verbal: 3 seconds
### Brand

#### McVitie's BN (Brand I)

**Length:** 30 seconds

Advert opens to two girls (aged ~ 9-11) sitting in front of the TV, dressed in Karate wear (depicting just home from after school activity). Girls looking quite expressionless, one looks bored. Mum walks in with a tray with two glasses of milk and a packet of McVitie’s BNs. Mum places the tray on the sofa behind the girls. One girl turns around and reaches for the packet of biscuits. Camera focuses on the packet of biscuits as an imaginary cuddly owl pops out (one of McVities’ ‘Sweeet friends’). Girls’ expressions change from blank to amazed. The tune the ‘Banana song’ starts and we see the owl sitting on one of the girls’ heads. The girls’ expressions are still amazed but happy. Two owls appear – very cute characters, both sitting on the girls’ heads. Banana song ends, and owls disappear, and we see girls and Mum eating biscuits. Crunching sound and voiceover, ‘Crunchy sandwich biscuits, McVitie’s BN. The cheeky wink of McVities. Sweeet!’

<table>
<thead>
<tr>
<th>Category</th>
<th>Subcategory</th>
<th>How appeals appear in advertisement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emotional appeals</td>
<td>Smiling/happiness</td>
<td>Girls and Mum smile at each other when eating biscuits</td>
</tr>
<tr>
<td></td>
<td>Fantasy/imagination</td>
<td>Show imaginary characters (owl) – cuddly, big eyes, very cute</td>
</tr>
<tr>
<td></td>
<td>Social enhancement/peer acceptance</td>
<td>Girls eating together with Mum after school</td>
</tr>
<tr>
<td></td>
<td>Parent-pleasing</td>
<td>Child characters eating with the Mum and the Mum smiling at them as she eats</td>
</tr>
<tr>
<td></td>
<td>Parental-themes</td>
<td>Themes of family life – sitting in front of TV with Mum after school</td>
</tr>
<tr>
<td>Food product appeals</td>
<td></td>
<td>Main focus of advert are the cuddly owls</td>
</tr>
<tr>
<td>Visual</td>
<td>Human actors</td>
<td>Two girls (aged ~ 9-11) and mother</td>
</tr>
<tr>
<td></td>
<td>- Age</td>
<td>Two girls (aged ~ 9-11) and mother</td>
</tr>
<tr>
<td></td>
<td>- Food activity</td>
<td>All actors in the advertisement are depicted eating</td>
</tr>
<tr>
<td></td>
<td>Promotional characters</td>
<td>Owls – promotional characters – McVities’ ‘Sweeet friends’</td>
</tr>
<tr>
<td></td>
<td>Meal portrayed</td>
<td>Snack</td>
</tr>
<tr>
<td></td>
<td>Food Setting</td>
<td>Lounge room</td>
</tr>
<tr>
<td></td>
<td>Supplementary food references</td>
<td>Milk served with biscuits</td>
</tr>
<tr>
<td></td>
<td>Product central to ad</td>
<td>No</td>
</tr>
<tr>
<td>Audio</td>
<td>Music/jingles</td>
<td>Catchy music (theme ‘Banana song’) starts when owls appear</td>
</tr>
<tr>
<td></td>
<td>Direct audience address</td>
<td>Adult voiceover at end - ‘Crunchy sandwich biscuits, McVities BN. The cheeky wink of McVities. Sweeet!’</td>
</tr>
<tr>
<td></td>
<td>Sound of food being eaten</td>
<td>Yes</td>
</tr>
<tr>
<td>Brand execution</td>
<td>Visual frequency</td>
<td>8</td>
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<tr>
<td></td>
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<tr>
<td></td>
<td>Dual mode</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Early branding</td>
<td>Visual: 2 seconds</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Verbal: 24 seconds</td>
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<tr>
<td>Brand</td>
<td>Description of advertisement</td>
<td></td>
</tr>
<tr>
<td>-------</td>
<td>------------------------------</td>
<td></td>
</tr>
</tbody>
</table>
| McVities Delichoc (Brand J) | Young adults sitting in library working  
| Length: 30 seconds | Girl gets packet of McVitie’s Delichoc out of bag  
| | Opens packet and a Llama promotional character pops out (one of McVities ‘Sweeet friends’) accompanied by catchy music (theme from 80s children’s program Grange Hill)  
| | Adult characters smile and laugh and look surprised  
| | Llamas start eating books and pieces of furniture with crunching sounds  
| | One adult cuddles and strokes Llama  
| | Two or more emotional appeals  
| | Two or more food product appeals  
| | All three adults then start eating biscuits looking very satisfied  
| | Voiceover – ‘Crunchy biscuit meets Belgium chocolate. The crunchy commotion of McVities’ |

### How appeals appear in advertisement

<table>
<thead>
<tr>
<th>Category</th>
<th>Subcategory</th>
<th>How appeals appear in advertisement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emotional appeals</td>
<td>Smiling/happiness</td>
<td>Young adult character smile and laugh at each other when Llamas appear</td>
</tr>
<tr>
<td></td>
<td>Fun/humor</td>
<td>Sense of fun as cuddly Llamas appear</td>
</tr>
<tr>
<td></td>
<td>Fantasy/imagination</td>
<td>Show imaginary characters (Llama) – cuddly, adult character hugs and strokes llama</td>
</tr>
<tr>
<td></td>
<td>Social enhancement/peer acceptance</td>
<td>Small group of young adults depicting belonging/peer acceptance</td>
</tr>
<tr>
<td></td>
<td>Nostalgia</td>
<td>Music theme from 80s children’s program Grange Hill</td>
</tr>
<tr>
<td>Food product appeals</td>
<td>Palatability</td>
<td>Crunching noises central to advert – when characters eat biscuit, they say ‘Mmm’, and nod their heads in approval</td>
</tr>
<tr>
<td></td>
<td>Novelty/new</td>
<td>New product – ‘The new flavour of McVities’</td>
</tr>
<tr>
<td>Visual</td>
<td>Human actors</td>
<td>Three young adults (aged ~ 18)</td>
</tr>
<tr>
<td></td>
<td>-Age</td>
<td>All actors in the advertisement are depicted eating</td>
</tr>
<tr>
<td></td>
<td>-Food activity</td>
<td>Snack</td>
</tr>
<tr>
<td></td>
<td>Promotional characters</td>
<td>Llamas – promotional characters – McVities’ ‘Sweeet friends’</td>
</tr>
<tr>
<td></td>
<td>Meal portrayed</td>
<td>Library</td>
</tr>
<tr>
<td></td>
<td>Food Setting</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Product central to ad</td>
<td></td>
</tr>
<tr>
<td>Audio</td>
<td>Music/jingles</td>
<td>Catchy music (theme from 80s children’s program Grange Hill) starts when Llamas appear</td>
</tr>
<tr>
<td></td>
<td>Direct audience address</td>
<td>Adult voiceover at end - ‘Crunchy biscuit meets Belgium chocolate. The crunchy commotion of McVities’</td>
</tr>
<tr>
<td>Brand execution</td>
<td>Visual frequency</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Verbal frequency</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Dual mode</td>
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</tbody>
</table>
| | Early branding | Visual: 5 seconds  
<p>| | | Verbal: 27 seconds |</p>
<table>
<thead>
<tr>
<th>Brand</th>
<th>Description of advergame</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nestle Kokokrunch (online Advergame) (Brand A) ‘Chococannon’</td>
<td>The game is a space invaders arcade style game. You are the lion. His arms and hands are visible holding a piece of Nestle Kokokrunch as the game piece. You tap the cereal piece and chocolate pellets shoot out. The aim is to destroy the space invaders. When you lose, chocolate pours over the screen</td>
</tr>
<tr>
<td>√ Two or more emotional appeals</td>
<td></td>
</tr>
<tr>
<td>x Two or more food product appeals</td>
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</table>

<table>
<thead>
<tr>
<th>Category</th>
<th>Subcategory</th>
<th>How appeals appear in advergame</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emotional appeals</td>
<td>Smiling/happiness</td>
<td>• Characters are grinning in the opening screenshot</td>
</tr>
<tr>
<td></td>
<td>Achievement/accomplishment</td>
<td>• Aim of game is to shoot all the space invaders and progress to the next level</td>
</tr>
<tr>
<td></td>
<td>Fantasy/imagination</td>
<td>• The player ‘is’ the Nestle Kokokrunch lion</td>
</tr>
<tr>
<td>Food product appeals</td>
<td>Nil</td>
<td></td>
</tr>
<tr>
<td>Visual</td>
<td>Promotional characters</td>
<td>• Cartoon characters, featuring the Nestle Kokokrunch promotional lion</td>
</tr>
<tr>
<td></td>
<td>Supplementary food references</td>
<td>• No</td>
</tr>
<tr>
<td></td>
<td>Branded food items during game</td>
<td>• Yes – cereal is game piece and you are shooting with chocolate</td>
</tr>
<tr>
<td></td>
<td>Branded product packages during game</td>
<td>• No</td>
</tr>
<tr>
<td>Audio</td>
<td>Music/jingles</td>
<td>• No music</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Brand</th>
<th>Description of advergame</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nestle Kokokrunch (Advergame) (Brand A) ‘Chocablock’</td>
<td>Game opens with screen shot of the Nestle Kokokrunch lion sitting with rows of chocolate. Nestle Kokokrunch logos at top of screen. The lion is looking very happy. At the bottom of the screen in small font it says, ‘This is advertising Nestle ©Copyright 2017’. The game is an arcade style game. You are the lion. His arms and hands are visible holding a piece of Nestle Kokokrunch as the game piece. The aim of the game is to avoid the space invader who is shooting at you and to break down the chocolate wall by keeping a chocolate ball in play.</td>
</tr>
<tr>
<td>√ Two or more emotional appeals</td>
<td></td>
</tr>
<tr>
<td>x Two or more food product appeals</td>
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</table>

<table>
<thead>
<tr>
<th>Category</th>
<th>Subcategory</th>
<th>How appeals appear in advergame</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emotional appeals</td>
<td>Smiling/happiness</td>
<td>• Lion is grinning in the opening screenshot</td>
</tr>
<tr>
<td></td>
<td>Achievement/accomplishment</td>
<td>• Aim of game is to break down the chocolate wall and progress to the next level</td>
</tr>
<tr>
<td></td>
<td>Fantasy/imagination</td>
<td>• The player ‘is’ the Nestle Kokokrunch lion</td>
</tr>
<tr>
<td>Food product appeals</td>
<td>Nil</td>
<td></td>
</tr>
<tr>
<td>Visual</td>
<td>Promotional characters</td>
<td>• Cartoon character, featuring the Nestle Kokokrunch promotional lion</td>
</tr>
<tr>
<td></td>
<td>Supplementary food references</td>
<td>• No</td>
</tr>
<tr>
<td></td>
<td>Branded food items during game</td>
<td>• Yes – cereal is game piece and you are shooting with chocolate</td>
</tr>
<tr>
<td></td>
<td>Branded product packages during game</td>
<td>• No</td>
</tr>
<tr>
<td>Audio</td>
<td>Music/jingles</td>
<td>• Fast beat, synthesised music</td>
</tr>
<tr>
<td>Brand</td>
<td>Description of advergame</td>
<td></td>
</tr>
<tr>
<td>-------</td>
<td>--------------------------</td>
<td></td>
</tr>
<tr>
<td>Nestle Kokokrunch (Advergame) (Brand A) ‘Chocarace’</td>
<td>Game opens with screen shot of the Nestle Kokokrunch lion sitting with a bowl of cereal. Nestle Kokokrunch logos at top of screen. The lion is looking very happy. At the bottom of the screen in small font it says, ‘This is advertising Nestle ©Copyright 2017’. The game is in the style of ‘Temple Run’ where you, as the lion run down a corridor, collecting both pieces and branded packets of cereal, whilst avoiding different obstacles.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Category</th>
<th>Subcategory</th>
<th>How appeals appear in advergame</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emotional appeals</td>
<td>Smiling/happiness</td>
<td>• Lion is grinning in the opening screenshot</td>
</tr>
<tr>
<td>Achievement/accomplishment</td>
<td>• Aim of game is to collect various branded Nestle Kokokrunch items and progress to the next level</td>
<td></td>
</tr>
<tr>
<td>Fantasy/imagination</td>
<td>• The player ‘is’ the Nestle Kokokrunch lion</td>
<td></td>
</tr>
<tr>
<td>Food product appeals</td>
<td>Nil</td>
<td></td>
</tr>
<tr>
<td>Visual</td>
<td>Promotional characters</td>
<td>• Cartoon character, featuring the Nestle Kokokrunch promotional lion</td>
</tr>
<tr>
<td>Supplementary food references</td>
<td>• No</td>
<td></td>
</tr>
<tr>
<td>Branded food items during game</td>
<td>• Yes – you collect cereal pieces and bowls of cereal during the game</td>
<td></td>
</tr>
<tr>
<td>Branded product packages during game</td>
<td>• Yes – you collect Nestle Kokokrunch cereal packets during the game</td>
<td></td>
</tr>
<tr>
<td>Audio</td>
<td>Music/jingles</td>
<td>• Fast beat, synthesised music</td>
</tr>
</tbody>
</table>
## Appendix SS: Supplementary Table 6.2 - Catalogue of marketing techniques and direct brand executional tactics in TV advertisements and online advergames

<table>
<thead>
<tr>
<th>Marketing techniques</th>
<th>Food brand</th>
<th>F</th>
<th>H</th>
<th>J</th>
<th>A</th>
<th>D</th>
<th>C</th>
<th>E</th>
<th>B</th>
<th>G</th>
<th>I</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Any emotional appeal (n=9)</strong></td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>Characters smiling/laughing (n=8)</td>
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<td>✓</td>
<td>✓</td>
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<td></td>
<td></td>
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<td></td>
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<tr>
<td>Fun/humor (n=5)</td>
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<td>✓</td>
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<td>Fantasy/imagination (n=6)</td>
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<td>Social enhancement/peer acceptance (n=4)</td>
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<td></td>
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<td>Anti-adult themes (n=3)</td>
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<td></td>
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<td>Number of emotional appeals (4 ± 2.4)</td>
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<td>6</td>
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<td>Number of food product appeals (1.6 ± 0.52)</td>
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<td>2</td>
<td>2</td>
<td>1</td>
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<td><strong>Visual elements</strong></td>
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<td>Child actors under 12: main character/s (n=3)</td>
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<td>Youth actors (12–24): main character/s (n=3)</td>
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<td>Adult actors: main character/s (n=5)</td>
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<td>Physical activity e.g. sports, dancing (n=2)</td>
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<td>Cartoon characters (n=2)</td>
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<td>Realistic animal character (n=3)</td>
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<td>Food Setting:</td>
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<td>Home (n=5)</td>
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<td>Public place (outdoors/travel, hospital and cars) (n=4)</td>
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<td>Snacking at non-meal times (n=7)</td>
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*Marketing techniques coded using Hebden et al’s taxonomy (Hebden et al. 2011)  ∀Values in parentheses: mean ± SD