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Abstract

Objectives: The aim of this study was to identify the most prevalent reported activities performed by Australian children during the lunchtime and after school periods; and estimate the mean duration of a typical bout of the most prevalent activities performed during the lunchtime and after school periods.

Design: This study was a secondary data analysis of the 2007 Australian National Children's Nutrition and Physical Activity Survey. **Method:** Use of time data were collected from Australian children aged 10.0-13.9 years (n = 794) using the Multimedia Activity Recall for Children and Adults (MARCA). The most prevalent self-reported activities for the lunchtime and after school period on school days were determined by mean duration across the sample. The estimated energy cost for each of the activities was reported based on the Compendium of Energy Expenditures for Youth. **Results:** A list of the 20 most prevalent lunchtime activities and 30 most prevalent after school activities is presented. Of the most prevalent lunchtime activities, 35% were classified as sedentary and 65% as moderate to vigorous physical activities. During the after school period, 57% of the most prevalent activities were classified as sedentary and only 43% as moderate to vigorous physical activities. **Conclusions:** These data may assist in the development or refinement of activity checklists with greater content validity, which may be used in combination with objective measures to provide important contextual information about the types of activities being performed and inform the development of appropriately targeted interventions.

Keywords

children, australian, performed, lunchtime, after, school, periods, during, activities, type, prevalence

Disciplines

Education | Social and Behavioral Sciences

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The type and prevalence of activities performed by Australian children during the
lunchtime and after school periods

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Method: Use of time data were collected from Australian children aged 10.0-13.9 years ($n = 794$) using the Multimedia Activity Recall for Children and Adults (MARCA). The most prevalent self-reported activities for the lunchtime and after-school period on school days were determined by mean duration across the sample. The estimated energy cost for each of the activities was reported based on the Compendium of Energy Expenditures for Youth.

Results: A list of the 20 most prevalent lunchtime activities and 30 most prevalent after school activities is presented. Of the most prevalent lunchtime activities, 35% were classified as sedentary and 65% as moderate to vigorous physical activities. During the after school period, 57% of the most prevalent activities were classified as sedentary and only 43% as moderate to vigorous physical activities.

Conclusions: These data may assist in the development or refinement of activity checklists with greater content validity, which may be used in combination with objective measures to provide important contextual information about the types of activities being performed and inform the development of appropriately targeted interventions.

Keywords: Physical activity; Australia; Checklist; Sedentary lifestyle; Leisure activities; Health behavior

1. Introduction

Understanding children's physical activity behaviour and assessing the relationship between health and physical activity are important for health promotion. While use of objective measures, such as accelerometers, is widespread in assessing and quantifying physical activity, a limitation of using objective measures of physical activity is the inability to identify the types of activities performed [1]. Identifying activity type is necessary to provide contextual meaning to objective physical activity output data. In addition, it has been found that specific types of activity have been associated with important health outcomes [2-4]. For example, high levels of overall screen time have been found to be strongly related to poorer health status [4]. Therefore, having an understanding of the types of activities children typically perform during unique periods of physical activity opportunity will assist in determining whether or not children are engaging in specific types of health enhancing activities. This can direct the appropriate design of interventions to increase physical activity and decrease sedentary time.

Self-report time diaries and checklists are often used to provide descriptive detail of types of activities performed [5]. These lists can only be effective if they display content validity, that is the activity checklist reflects the types of activities most commonly performed by children [1, 6]. In many cases, it is unclear how the activities in existing checklists are identified. Studies tend to comment on identifying and using "common" activities in checklists but lack detailed information and/or a strong evidence-base about how they define "common". The development of existing physical activity checklists vary considerably in methodology. Some checklists are based on consensus from expert groups [7], while others are developed through focus groups [8] or assumptions of common activities by the authors [9]. In addition, a number of checklists are purposively defined depending on the intention of the study (e.g. some lists only contain sports or leisure activities [8]). Content validity is continuously evolving with the emergence of new activities for children [6]. Activity checklists need to reflect specific activities that are typically performed by the specific population in the physical activity context under investigation [1, 6, 10]. This will ensure that we are obtaining a clear understanding of physical activity patterns during the specific physical activity context, thus potentially increasing the reliability and validity of the findings.

The aims of this study were two-fold: (1) to identify the most prevalent reported activities performed by Australian children during the lunchtime and after school period; and (2) to estimate the mean duration of a typical bout of the most prevalent activities performed during the lunchtime and after school periods, using data from the 2007 Australian National Children's Nutrition and Physical Activity Survey.

2. Methods

The Australian National Children's Nutrition and Physical Activity Survey involved interviewing 4487 children and their parents aged 2 – 16 years, of whom 2200 were aged 9 – 16 years and completed the Multimedia Activity Recall for Children and Adults (MARCA) between March and August 2007 [11]. The survey design has been described in detail elsewhere [11]. Briefly, clusters of postal code areas were randomly selected from around Australia, with the exception of very remote areas. Random-digit dialling was used to contact households within each cluster, and households with at least one child aged between 2-16 years were invited to participate. One child from each household was surveyed. The overall response rate (ratio of completing participating households to contactable eligible households) was 41%.

Use of time data were collected using the MARCA [5]. Using a segmented day format with self-determined anchor points (i.e. wake up; start of school; start of recess break; start of lunch break; end of school; and bedtime for a school day recall), respondents reported all they did on the previous day from wake-up to bedtime. Each activity is assigned a MET code in order to estimate intensity and energy expenditure [12]. The MARCA has a same-day test-retest reliability of $r = 0.84-0.92$ for moderate to vigorous physical activity (MVPA), physical activity level (PAL) and screen time (the number of minutes spent watching television, playing videogames and using a computer), and criterion validity with reference to pedometry of $\rho = 0.54$ for PAL in this study [13].

At the face-to-face interview, participants completed the MARCA for the preceding two days. One to three weeks later, participants received a follow-up phone interview in which they completed the

MARCA for a further two days (the two days immediately preceding the day of the phone interview).

Wherever possible, at least one of the four days sampled was a non-school day.

For the purpose of this analysis, only school day profiles were analysed for Australian children aged 10.0-13.9 years (n=794). This coincides with one of the major life transitions, in which physical activity has been found to decrease as children hit puberty and move from primary to secondary school [14]. Each participant provided 1-3 one school day recall profiles (total n = 1804 profiles). The participant characteristics are shown in Table 1.

****Insert table 1 about here****

In order to list self-reported activities for the lunchtime and after-school period, the MARCA analysis module was programmed to output all self-reported activities (type, duration and intensity) for 45 min after the self-designated start of the lunch anchor point and for 90 min after the self-designated end of school anchor point. The most prevalent activities were then determined by mean duration across the sample (i.e. total minutes reported across the sample / total number of profiles). The number of bouts reported across the 1804 1-d profiles and the median duration of each bout for each activity were also calculated. Finally, the estimated energy cost for each of the activities was provided based on the Compendium of Energy Expenditures for Youth [12]. Sedentary activity was defined as any activity estimated to elicit 0-2.9 METs and moderate to vigorous physical activity was defined as any activity estimated to elicit ≥ 3 METs [12].

3. Results

Tables 2 and 3 present the most prevalent lunchtime and after school activities self-reported by 10.0 – 13.9 year olds in the Australian 2007 National Children's Nutrition and Physical Activity Survey. Summing the mean duration of the 20 most prevalent lunchtime activities covers 38 minutes of the 45 minute lunchtime period assessed (84%). Using the Compendium of Energy Expenditures for Youth [12],

of these activities, 35% were classified as sedentary, accounting for 18 minutes of the lunchtime period, and 65% as moderate to vigorous physical activities, accounting for 20 minutes of the lunchtime period. The 30 most prevalent after school activities cover 78 minutes of the 90 minute after school period (87%), of which 57 minutes was spent in sedentary activities and 21 minutes was spent in moderate to vigorous activities. Of the 30 most prevalent after school activities a higher percentage were classified as sedentary (57%) with 18% of the sedentary activities being screen-based activities and contributing 19 minutes to the total mean duration. Only 43% of activities were classified as moderate to vigorous physical activities during the after school period, based on the Compendium of Energy Expenditures for Youth [12].

****Insert Table 2 about here****

****Insert Table 3 about here****

4. Discussion

This study presents a list of the twenty most prevalent lunchtime activities and the thirty most prevalent after school activities self-reported by Australian children in the 2007 Australian National Children's Nutrition and Physical Activity Survey. These lists were derived from a comprehensive dataset using the MARCA, a tool with comparable validity and reliability to other self-report use-of-time measures [5]. These data may assist in the development of activity checklists with greater content validity for use with Australian children populations, which may be used in combination with objective measures to compensate for the lack of contextual detail about the types of activities performed in specific day segments.

Even though the MARCA is a self-report recall with good reliability and validity when used with this population [5] and can collect more detailed information than activity checklists, there may be some instances where the use of the MARCA or other use-of-time recalls may not be suitable or feasible. For example, the MARCA does place a certain level of time burden on participants and needs to be

administered by someone with MARCA training. The use of activity checklists can reduce participant burden in terms of time and ease of administration and could be an alternative method to capture detail about the types of activities performed in a defined period.

A number of different checklists are currently being used to identify types of physical activities performed by children in Australia [8, 15], however, not all are developed for the Australian population [16, 17]. This raises a number of concerns in terms of the appropriateness of these checklists to the Australian context, and thus the content validity and reliability. The current list of prevalent activities includes activities that are specific to the Australian context, such as Australian Rules Football, and focus on time periods where children have more autonomous choice regarding their use of time and opportunities to be active.

There are a number of differences in the prevalent activities listed here and activities found in existing checklists. The Canadian-designed Physical Activity Questionnaire for Older Children (PAQ-C) [17] and Physical Activity Questionnaire for Adolescents (PAQ-A) [16] have a very strong focus on sporting activities. Only ten activities from the PAQ-C and PAQ-A correspond to either the lunchtime list or the after school list. Some of these activities included soccer, football, basketball, chasey/tips/tiggy, running and skipping. The sporting activities included in the PAQ-C and PAQ-A that were not prevalent in this study include badminton, street hockey and ice hockey, reflecting cultural differences in popular sports between Canada and Australia. On the other hand, the majority of the activities found in the Australian-designed Children's Leisure Activities Study Survey (CLASS) [8] and the Adolescent Sedentary Activity Questionnaire (ASAQ) [15] were also on the most prevalent list of activities reported here. Only a small number of moderate to vigorous activities, including mucking around outdoors and rugby league, and sedentary activities, including sitting and eating, were not featured on any of the pre-existing Australian-designed checklists. If these checklists were used in the lunchtime and after school periods, without the use of any other option (which do exist in these questionnaires), the PAQ-C and PAQ-A would only capture 19 minutes of the 45 minute lunchtime period and 16 minutes of the 90 minute after school period. Alternatively, the CLASS would only capture 23 minutes of the lunchtime

period but would capture 66 minutes of the 90 minute after school period. The ASAQ has been designed to measure sedentary activities in the after school period and would capture 46 minutes of the 90 minute after school period, compared to 57 minutes that would be captured using the list in this study. This comparison of Canadian-designed and Australian-designed activity checklists confirms the importance of reviewing activity checklists prior to use to ensure the activities listed are both comprehensive and relevant for the population being studied.

An important finding to emerge from the data is the higher proportion of sedentary activities, in particular screen-based sedentary activities, during the after school period in comparison to the lunchtime period. This could suggest that children have greater access to sedentary opportunities during the after school period than other parts of the day. Watching TV was the most prevalent activity during the after school period with the highest average number of minutes reported and accounting for 13% of the 90 minute after school period. This activity tends to only be accessible during out of school hours. Atkin and colleagues [18] also found that TV viewing was the most prevalent activity during the after school period in UK children. Boys spent on average 36 min watching TV while girls spent 32 min watching TV. Taking the average number of minutes for boys and girls together, watching TV accounted for 19% of the after school period, which is not dissimilar to our findings. Hohepa and colleagues [19] found that TV viewing in New Zealand children was significantly and inversely related to physical activity during the after school period, suggesting that TV viewing is in direct competition with physical activity opportunities, and thus an important intervention target.

Research has shown that children who report higher incidence of active play during the after school period are more active overall and active at a greater intensity than those who report fewer incidences of after school active play [20]. This indicates that the after school period is a pertinent window in the promotion of physical activity. The after school hours generally provides children with the freedom to choose how they use their time, away from parental curfews and school constraints [18], which lends itself to promotion of unstructured active play [20]. Based on evidence showing that children who spend more time outdoors are more likely to accumulate larger quantities of physical activity [20-

22], the lunchtime period could also be a critical window for physical activity promotion as children typically spend the majority of this period outdoors. However, given these outdoor opportunities, research has shown that children are not making the most of the lunchtime period to be active [23, 24]. While the two most prevalent lunchtime activities identified in this study are considered sedentary (i.e. eating and talking), there were more moderate to vigorous physical activity and outdoor activities reported in the lunchtime period compared to the after school period. The accumulation of 20 mean minutes of moderate to vigorous physical activities suggest that Australian school children are accruing approximately one third of the daily recommended amounts of moderate to vigorous physical activity (i.e. 60 min per day) at school lunch time. Interventions during the lunchtime and particularly the after school periods should encourage active play and focus on restricting sedentary opportunities, which has been found to dominate the after school period in this study and potentially reduce opportunities for more active pursuits.

Even though this study provides a comprehensive list of the most prevalent activities children engage in during the lunchtime and after school periods, a few limitations should be noted. The use of a pre-designated lunchtime duration (i.e. 45 mins) is likely to have resulted in some non-lunchtime activities, such as writing, to have been extracted from the use of time profiles as some schools have lunchtime durations shorter than 45 minutes. Despite the after school period being typically defined as the time directly after school until dinner, the use of a pre-designated after school duration of 90 mins was chosen to reflect typical daylight hours during autumn/winter in Australia. It is acknowledged that this timeframe may not have captured some important activities occurring between 5pm and dinner and is a limitation of this study. The use of self-reports is another important limitation of this study. It is acknowledged that children's recall of activities can potentially result in reporting and memory bias. However, this methodology is required to report on activity type and the MARCA has been found to have good validity and reliability [5]. Participation in particular types of organised activity are likely to vary across the year due to the availability of school and club competitions. The data were collected during early autumn and winter, limiting the ability to generalise findings to other times of the year. To obtain a more accurate picture of the most prevalent activities, data could be collected across different seasons as a

comparison. Another limitation of this study relates to the use of one to three recall profiles per participant. Each recall profile was included in the analyses of the most prevalent activities, rather than averaged per participant, resulting in a potential over-representation of children providing multiple profiles relative to children who provided just one. Despite these limitations, this study was able to provide a comprehensive picture of the average intensity, frequency and duration of activities identified as the most prevalent across lunchtime and after school periods, increasing our overall understanding of the physical activity and sedentary activity behaviour patterns of children aged 10 to 14 years.

5. Conclusion

With the continual emergence of new activities for children, it is important to understand the types of activities that are typically performed in differing activity contexts. Findings from this study can be used by researchers to develop or refine Australian-specific self-report physical activity questionnaires or activity checklists to improve content validity. These questionnaires and checklists can be used in conjunction with other objective measures to provide important contextual information about the types of activities being performed and inform the development of appropriately targeted interventions. Intervention design can also be informed by the results presented in this study, either through targeting the most prevalent sedentary behaviours, or to promote more participation in physical activities that children engage in and enjoy. The activities presented in this study are prevalent in Australian children, but other activities may be important in children from other countries. A similar methodology could be employed in other countries to identify the prevalence of activities commonly performed by children in specific contexts.

6. Practical Implications

- The list of the most prevalent lunchtime and after school activities can be used to develop or refine physical activity checklists.

- Sedentary activities were more prevalent in the after school period than the lunchtime period where children have greater access to sedentary opportunities. Interventions specific to the after school period should target the restriction of sedentary activities.
- Moderate to vigorous activities were more prevalent in the lunchtime period compared to the after school period, highlighting the importance of outdoor active play opportunities.

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1 Table 1

2 Participant characteristics

	Boys	Girls	All
n	385	409	794
Age (years)	11.9 (1.1)	12.0 (1.1)	11.9 (1.6)
Mass (kg)	45.0 (11.5)	47.5 (12.6)	46.3 (13.2)
Height (cm)	151.9 (10.2)	152.5 (9.6)	152.2 (14.9)
% overweight (not including obese) ^a	17.9	24.0	21.0
% obese ^a	5.2	7.1	6.2
SEIFA ^b	1007.9 (64.6)	999.3 (63.1)	1003.4 (64.0)

3 Values are shown as percentages or means (SDs) where appropriate.

4 ^a Overweight and obesity are classified using the criteria described by Cole and colleagues [25]

5 ^b SEIFA = Socio-economic indicators for areas. SEIFA is a series of indexes of socio-economic status

6 devised by the Australian Bureau of Statistics using a range of indicators, such as educational and

7 employment status. The index used here is the Index of Relative Disadvantage, calculated at the postal

8 area level. The national average is 1000 and the SD is 100. Higher values indicate more advantages areas.

9

- 1 Table 2
- 2 The twenty most prevalent lunchtime activities self-reported by 10 – 13.9 year olds in the Australian 2007
- 3 National Children's Nutrition and Physical Activity Survey

Activity Name	Mean duration ^a (min)	Number of reported bouts ^b	Median duration of bout (min)	MET range ^c
Eating	8.9	1537	10.0	1.5-2.0
Talking	5.1	430	20.0	1.4-1.5
Walking	4.3	429	15.0	2.9-4.6
Soccer (field/indoor)	2.8	185	30.0	5.3-8.8
Chasey/tag/tips/tiggy^d	2.1	136	30.0	3.8-6.3
Hand tennis (four-square)	1.8	128	25.0	3.8-6.3
Football (Australian/Gaelic/American)	1.8	104	35.0	6.6-11.0
Mucking around outdoors	1.8	121	30.0	3.8-6.3
Writing	1.2	189	10.0	1.4
Running/jogging	1.2	99	20.0	7.7-9.3
Basketball	1.1	79	25.0	7.2-10.1
Reading	1.0	145	10.0	1.2-1.8
Playground equipment (e.g. monkey bars)	0.8	54	25.0	3.8-6.3
Rugby league/union	0.8	42	32.5	6.6-11.0
Touch football	0.6	41	30.0	6.6-11.0
Arts and crafts	0.6	76	15.0	1.6
Skipping/jump rope	0.6	41	25.0	6.2-10.3
Taking notes/class discussion	0.5	73	10.0	1.4
Computer work (eg typing/internet)	0.5	51	15.0	1.8
Cricket	0.4	29	30.0	2.6-4.4

- 4 The lunchtime period was defined as 45 mins after the self-designated start of lunch time point for each 1-
- 5 d recall profile.

1 ^aMean duration was calculated across the sample as the total minutes reported across the sample divided
2 by the total number of profiles.

3 ^bThe number of reported bouts was across 1804 1-d profiles.

4 ^cMET values based on Compendium of Energy Expenditures for Youth [12]. Bolded activities are
5 considered moderate to vigorous physical activities (≥ 3 METs) based on 'medium' MET values [12].
6 The MET ranges are based on the energy expenditure of activities which may be performed at varying
7 intensities (e.g. light, medium or hard, or in different body positions, such as lying, sitting and standing).

8 ^d Chasey/tag/tips/tiggy is as a running game where one or more children are designated 'it' and chase
9 other children to tag them.

- 1 Table 3
- 2 The thirty most prevalent after school activities self-reported by 10.0 – 13.9 year olds in the Australian
- 3 2007 National Children's Nutrition and Physical Activity Survey

Activity Name	Mean duration ^a (min)	Number of reported bouts ^b	Median duration of bout (min)	MET range ^c
Watching TV	11.3	579	30.0	1.1 – 1.2
Riding in a car/truck	8.8	1304	10.0	1.4
Walking	8.2	1266	10.0	2.9-4.6
Riding in a bus	6.2	444	20.0	1.4
Studying/homework	5.4	314	30.0	1.5
Talking	5.0	566	10.0	1.2-1.8
Eating	4.7	737	10.0	1.5-2.0
Computer/console games (eg playstation/xbox/handheld)	4.6	224	30.0	1.5
Computer work (eg typing/internet)	2.9	160	30.0	1.8
Riding a bicycle/bike	2.1	195	15.0	4.7-7.8
Shopping	1.8	124	20.0	2.3
Mucking around outdoors	1.5	77	30.0	3.8-6.3
Dressing and undressing	1.5	320	5.0	2.7
Football (Australian/Gaelic/American)	1.4	80	30.0	6.6-11.0
Basketball	1.3	76	30.0	7.2-10.1
Soccer (field/indoor)	1.2	56	35.0	6.6-11.0
Reading	1.2	75	20.0	1.2-1.8
Playing with animals (walk/run)	1.0	55	20.0	2.8-5.0
Netball	1.0	40	45.0	7.2-10.3
Sitting quietly	0.8	87	15.0	1.4
Packing/unpacking bag	0.8	172	5.0	2.5
Running/jogging	0.8	89	10.0	7.7-9.3
Writing	0.7	32	30.0	1.2-1.4
Trampoline	0.6	42	22.5	6.5-10.9
Swimming laps	0.6	25	45.0	8.4-11.6

Mucking around indoors (walk/run)	0.6	34	30.0	4.0
Playing cards/puzzles/board games	0.6	32	30.0	1.6
Dancing (general)	0.6	23	45.0	4.1-6.9
Feeding or caring for pets/farm animals	0.5	72	10.0	2.5
Arts and crafts	0.5	24	30.0	1.6

1 The after school period was defined as 90 min after the self-designated end of school time point for each
2 1-d recall profile.

3 ^aMean duration was calculated across the sample as the total minutes reported across the sample divided
4 by the total number of profiles.

5 ^bThe number of reported bouts was across 1804 1-d profiles.

6 ^cMET values based on Compendium of Energy Expenditures for Youth [12]. Bolded activities are
7 considered moderate to vigorous physical activities (≥ 3 METs) based on 'medium' MET values [12].

8 The MET ranges are based on the energy expenditure of activities which may be performed at varying
9 intensities (e.g. light, medium or hard, or in different body positions, such as lying, sitting and standing).