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Optimizing dietary fat in a weight-loss trial requires advice based on a structured "whole-of-diet" model

Abstract

Dietary trials may link macronutrient intakes to health outcomes, but adherence to dietary targets requires advice based on an understanding of food composition and consumption patterns. Using data from a weight loss trial, we hypothesized that structured advice would be required for significant fat modification to occur. We compared participants' food choice patterns in response to advice based on a structured "whole-of-diet" model vs a general approach to healthy eating. Overweight participants ($n = 122$) were randomized to 2 advice arms (saturated fat [SFA] < 10% energy [E]): (1) general low fat (LF) control—(a) isoenergy, (b) -2000 kJ; and (2) structured LF high polyunsaturated fat (PUFA) ($\sim 10\%$ energy PUFA; PUFA to SFA ratio ≥ 1) (LF-PUFA)—(a) isoenergy, (b) -2000 kJ. Intakes of E and fat and fat from food groups (percentage of total fat intake) were compared at baseline, 3 months, $P < .05$. Baseline diets were similar, with most fat from high-SFA foods (59%): meat and milk-based staple meals and high-fat snacks. By 3 months, all groups reduced E and met the SFA target. Polyunsaturated fat targets were met by the LF-PUFA groups only ($P < .001$), enabling targeted between-group differences. In response to general advice, LF groups simply switched to LF alternatives of the same foods ($P < .05$). In comparison, LF-PUFA groups shifted fat intake to high-PUFA choices (54%), consuming more fat than controls from nuts ($P < .001$), whole grains ($P < .001$), and oils and spreads ($P < .05$). Significant reductions in E were achieved regardless of advice, but significant shifts in dietary fat profile relied on structured whole-of-diet advice on a range of meal and snack food sources of fat subtypes.

Keywords

Macronutrients, fat type, food choice, food patterns, randomized controlled trial

Disciplines

Arts and Humanities | Life Sciences | Medicine and Health Sciences | Social and Behavioral Sciences

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**Significant shifts in the dietary fat profile required structured whole diet advice
in a weight loss trial**

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ABBREVIATIONS

AGHE; Australian Guide to Healthy Eating

BMI; body mass index

E; energy

Fig; figure

HELP; Healthy Eating and Lifestyle Program

kCal: kilocalorie

LF; general low fat dietary intervention group

LF-PUFA; low fat high polyunsaturated fat dietary intervention group

MUFA; monounsaturated fat

PUFA; polyunsaturated fat

P:S; polyunsaturated to saturated fat ratio

SFA; saturated fat

t; time

RMANOVA; repeated measures analysis of variance

%; percent

%E; percentage of energy

Abstract

Intervention trials can link macronutrients and health outcomes, but adherence to dietary targets requires an understanding of food composition and consumption patterns. In a weight loss trial, we hypothesized that significant fat modification would require structured whole diet advice to free-living groups. The analysis compares participants' food choice patterns in response to structured versus general (control) advice to meet energy and fat targets. Overweight participants (n=122) randomized to 2 advice arms (total fat $\leq 30\%$ E, SFA $< 10\%$ E): 1. general low fat control (LF) - A. isoenergy; B. -500kCal; 2. structured low fat high PUFA ($\sim 10\%$ E PUFA; P:S ≥ 1) (LF-PUFA) - A. isoenergy; B. -2MJ. Intakes of total energy and fat, and fat from food groups (% fat) were compared at baseline and 3 months, $p < 0.05$. Baseline diets were similar, with most fat from foods high in SFA (59%): meat and milk-based staple meals and high fat snacks. By 3 months all groups reduced energy and met the SFA target. PUFA targets were met by LF-PUFA groups only ($p < 0.001$), enabling between-group differences for comparison. In response to general advice, LF groups simply switched to low fat alternatives of the same foods ($p < 0.05$). In comparison, LF-PUFA groups shifted fat intake to high PUFA choices (54%), consuming more fat than LF controls from nuts ($p < 0.001$), whole grains ($p < 0.001$), oils, spreads ($p < 0.05$). Significant reductions in energy were achieved regardless of advice, but significant shifts within the dietary fat profile relied on structured whole diet advice on a range of meal and snack food sources of fat sub-types.

Key words: Macronutrients, fat type, food choice, food patterns, randomized controlled trial

Introduction

Randomized controlled trials are well positioned to test the effects of dietary variables on health outcomes. However, manipulating the intakes of free-living groups for hypothesis testing is challenging in practice. For example, the authors of a trial comparing weight-loss diets of different macronutrient proportions concluded the weight loss observed across all dietary groups was due to reductions in energy alone regardless of varying the fat, protein or carbohydrate content [1]. However, lack of adherence to the macronutrient targets in that study clearly affected results from the intention-to-treat analysis and demonstrates the importance of adherence measures in studies linking dietary intakes and health. In the context of weight management, a reduction in calories is central to advice [2, 3]. However, observational studies suggest that attention to the macronutrient content may provide added metabolic benefits beyond those attributed to energy restriction and weight loss [4-6], and these continue to be reported in large numbers of subjects [7, 8]. Subsequent randomized controlled trials have demonstrated reductions in cardio-metabolic risk from varying the macronutrient composition [9, 10-12]. The effects of different macronutrient proportions on weight loss and metabolism and on obesity-related risk factors need further investigation and longer studies to support nutritional recommendations [13].

While adherence to weight-loss protocols has been positively associated with rates of weight loss, severe calorie restriction has negative connotations [14-16], suggesting more moderate calorie restriction and a greater focus on strategies that enhance dietary adherence might be of benefit [14, 16, 9]. Studies demonstrating favourable modifications to the overall food pattern have relied on the free provision of

foodstuffs to ensure achievement of dietary targets. For example, a Mediterranean-style diet was achieved in the PREDIMED study by providing participants with regular amounts of palatable key high fat foods [17], but its application may be difficult to replicate in free-living settings. In contrast, general approaches to advice, for example, choose low fat foods in ad libitum fashion do not appear to support significant changes to the macronutrient profile [18, 19]. Intervention trials can demonstrate adherence to dietary targets and expose the impact of consumption patterns and individual food choices under free living conditions. The Healthy Eating and Lifestyle Program (HELP) was conducted to test the effects of dietary fat modification and energy restriction on weight loss, adiposity and obesity-related risk factors. These outcomes are reported elsewhere [11]. The researchers hypothesized that in order to achieve the proportional changes in saturated: polyunsaturated fat (P:S) ratio being tested in the trial free-living intervention groups would need structured whole diet advice targeting food group sources of saturated and polyunsaturated fat sub-types. For comparison, control groups received general low fat advice that was not expected to significantly impact on proportional fat intakes. This paper compares the influence of the different advice approaches on food choice patterns of dietary change to meet energy and fat targets by intervention and control groups.

Methods and materials

The Healthy Eating & Lifestyle Program (HELP) study was a randomized controlled intervention trial involving 150 healthy overweight or obese adult volunteers aimed at testing the effects of fat modification alone and in combination with energy restriction on weight loss and obesity-related risk factors. Baseline dietary data were collected

from 122 of the 150 participants enrolled in the study (mean Body Mass Index (BMI)= 31.00 ± 3.9 kilograms /metre², 96 female, 38 male), aged 44.7 ± 10.9 (range 18-67) years, and on 95 of the 122 who provided dietary data at the completion of the three month intervention. Details of the study design are published elsewhere [11]. Approval for the trial was provided by the university Human Research Ethics Committee. All subjects were required to sign informed consent forms prior to beginning the study.

Eligible participants were randomized to one of four weight management groups within two alternative advice arms aimed at achieving ~30% energy (E) as total fat intake and <10%E as saturated fat (SFA) intake: two groups received general low fat (LF) advice (control) – 1. isocalorie and 2. low calorie (-500kCal deficit); and two groups received structured advice targeting low fat and high polyunsaturated fat (PUFA) intakes (~10%E PUFA intake and P:S ratio>1) (LF-PUFA) – 3. isocalorie and 4. low calorie. Participants were blinded to the differences between interventions.

Advice for the LF arm was based on core food groups outlined in the Australian Guide to Healthy Eating (AGHE) [21]. The number of servings per day was estimated from usual intake reported at baseline (isocalorie group) or usual intake with approximately 500kCal deficit (low calorie group). Also included was education on food product label reading, glycemic index and fat types, with a two serving per day allowance for unsaturated fat-rich food choices, such as oils (all cooking and salad), spreads (margarines and nut-based spreads) and nuts.

Advice for the LF-PUFA arm was in the form of a structured whole diet meal plan that referred to a set of food groups and high PUFA alternatives: Vegetables; Fruit; Starch (bread, cereals, starchy vegetables and legumes or high PUFA soy and linseed bread); Milk (low and reduced fat cow's milk or high PUFA soymilk or soy yoghurt); Protein foods (lean meat including white fish, low fat cheese and eggs or high PUFA oily fish or soybean products). Exchange servings of preferred high fat foods were listed as either high PUFA or high MUFA: margarines and nut-based spreads; cooking and salad oils; and varieties of nuts and other snack-type foods. Development of the meal plan has been previously described [22]. A sample meal plan calculated from mean estimates of target energy, macronutrients and fat sub-types was used as a reference model for individualised advice on the amount and frequency of servings from each of the food groups to meet individual energy requirement (isocalorie) or energy requirement with 500kCal deficit (low calorie) group. The inclusion of high PUFA alternatives was based on individual food preferences to meet the PUFA target. Dietary counselling for all participants was provided by the dietitian approximately one to two weeks following the baseline assessment with one support session provided by the same dietitian each month for three months. All participants purchased and prepared their own food in their normal living environment.

Dietary intakes were measured at baseline ($t=0$) and three months ($t=3$) by diet history interview using a standardised proforma and food frequency checklist [23, 24]. Food intake data from the diet history interviews were analysed using FoodWorks nutrient analysis software (Professional edition version 3.0, 2002: Xyris Australia Pty Ltd, Brisbane, Australia; AusBrands database (for commercial foods with known branding) and AUSNUT 1999 database [25]. Food and nutrient data were exported

into Microsoft Excel (2000 version: Microsoft Corporation, USA) for calculation of %fat from food groups. Food intake data were converted to energy and macronutrient values and expressed as kCal and percentage of energy (%E), respectively, and reported as mean and standard deviation. Dietary fat intakes were compared to study targets.

For the analysis of food choices as sources of fat, categories were formed on initial consideration of the five core food groups and non-core 'extra foods' outlined in the AGHE [21] and then further sub-divided according to the main type of fat (saturated or unsaturated) contributed from meals and individual food components. Other considerations for grouping foods were culinary use, cuisine similarities and whether foods were consumed as meals or snacks. This categorisation exercise produced seven categories of meal staple foods and six categories of extra foods identified as highest in either saturated or unsaturated fats (Table 1). The amount of total fat, SFA, MUFA and PUFA consumed from individual food choice categories was expressed in grams and as a percentage of total fat intake (%fat), and reported as mean and standard error of the mean.

Statistical analyses

Data for all participants were exported into SPSS statistical software (version 12.0.1, 2003: Lead Technologies, Chicago, USA) for statistical analysis. To assess between-group differences in energy and macronutrients and the relative contributions to dietary fat intake from individual food categories, repeated measures analysis of variance (RMANOVA) was applied. Post hoc analysis used the Bonferroni test to determine the interaction effect between groups. Significance was assessed as $p < 0.05$.

On initial assessment, energy intake data were not significantly different between advice groups at baseline and three months. Therefore, in order to focus on macronutrient intakes, data from isocalorie and low calorie groups were collapsed into the two alternative advice arms: LF versus LF-PUFA.

Table 1
Food groups and their constituent items

Meal staple foods						
Breads and cereals (unsaturated)	Vegetable dishes with added fat (unsaturated)	Legumes (unsaturated)	Milk, yoghurt, and cheese (saturated)	Meat-based dishes (saturated)	Fish and seafood (unsaturated)	Nuts and seeds (unsaturated)
Bread—white, whole meal, whole grain; breakfast cereal, couscous, tabouli, crumpet, focaccia, muesli, oats, pappadam, pasta with sauce-only, pastry-filled rice dishes, all rice cakes, stuffing mix, taco shell, and plain Yorkshire pudding	Nonstarch vegetables, fat-added to potato—baked, mashed, hash brown; fat-added to pumpkin, sweet potato; fat-added to potato in mayonnaise; pie—vegetable, potato; ratatouille, soup—pumpkin, leek and potato; salad, coleslaw—with oil dressing; vegetable curry, vegetables in sauce	Baked beans, bean curd, tofu, miso, chickpeas, hummus, lentils—dhal; soup-pea, bean; fat-added to salad, mixed bean salad, soy—cheese; drink, yoghurt	Cheese, cream, custard, milk, quiche, frittata, thick shake, smoothie, yoghurt, fruche	Bacon, sausage, salami, beef, veal, chicken, lamb, turkey, crepe—meat-filled; curry dishes—meat; egg—omelet, scrambled; pasta in meat sauce, pate-chicken liver, rabbit, shepherd's pie, beef taco lasagna, meat pie-family	Anchovy, tuna, salmon, sardine, calamari, octopus, fish—blue grenadier, dory, flathead, perch, snapper, whiting oyster, prawn	Nuts—almond, brazil, cashew, peanut, pecan, pistachio, walnut linseed, sesame and almond mix, mixed nuts, peanut butter, seeds—all types, sesame seed bar
Extra foods						
Snack foods (saturated)	Take-away foods (saturated)	Butter and cooking fats (saturated)	Dressings and sauces (unsaturated)	Oils and spreads (unsaturated)	Other fats (unsaturated)	
Bar—breakfast, muesli, snack-type; biscuit-brownie, cracker, corn or rice cake, cheesecake, trifle, pavlova, muffin, croissant, bun, scone, chocolate, ice cream, fudge, Milo milk powder, mousse, Nutella—hazelnut paste; pancake, waffle, pastry goods, pretzels, crisps, banana chips, corn chips	Deep-fried foods, french fries, hot chips, fried chicken, hamburger meals, mixed take-away meals, pizza-all types; spring roll, dim sum, sushi	Butter, coconut milk, ghee, dip—cream-based; gravy, pasta/simmer sauce—butter or cream added	Dip—oil-based; salad dressing—oil-based, guacamole, mayonnaise, pasta/simmer sauce—oil added	Oil—olive, canola, vegetable; margarine—olive, canola, polyunsaturated, sterol margarines, other spreads	Avocado, olives	

Results

There were no significant differences in mean energy and macronutrient intakes between LF and LF-PUFA advice groups at baseline (Table 2). Mean SFA intakes were higher than the study target of <10%E SFA for all groups. Mean PUFA intake and proportional fat intakes were well below the targets of ~10%E and P:S $\geq$ 1 that were set for the intervention groups (Table 2).

Table 2

Dietary intakes and dietary targets for both dietary advice intervention groups at baseline and 3 months

Variable	Target	LF ^a diet group (n = 47)		LF-PUFA ^b diet group (n = 48)		RMANOVA (<i>P</i> value)*		
		Baseline	3 mo	Baseline	3 mo	Time	Group	TxG
E (kJ)		9248.65 ± 3213.82	6988.74 ± 2254.64	9933.24 ± 3384.93	7610.83 ± 2190.05	.000	.204	.908
Protein (% E)		20.19 ± 3.78	21.80 ± 3.94	19.21 ± 2.53	20.73 ± 3.25	.000	.085	.901
Carbohydrate (% E)		41.05 ± 6.54	43.79 ± 6.66	44.13 ± 6.52	44.71 ± 5.68	.012	.082	.097
Total fat (% E)	30% E	32.05 ± 5.13	31.75 ± 5.28	31.46 ± 5.47	29.26 ± 5.62	.000	.403	.043
SFA (% E)	<10% E	11.33 ± 2.45	8.85 ± 2.11	11.60 ± 2.63	7.86 ± 2.11	.000	.352	.025
PUFA (% E)	≥8% E	5.45 ± 2.10	5.31 ± 2.00	4.79 ± 1.26	9.24 ± 3.76	.000	.000	.000
MUFA (% E)		12.28 ± 2.31	6.30 ± 2.70	12.11 ± 3.00	6.07 ± 3.08	.000	.648	.933
P:S ratio	≥1	0.50 ± 0.23	0.63 ± 0.28	0.44 ± 0.19	1.28 ± 0.64	.000	.000	.000

Values are means ± SD. Significant *P* < .05. T×G indicates time × group interaction.^a General LF intervention.^b Low-fat high-PUFA intervention.

Three-month data are also presented in Table 2. After three months, LF and LF-PUFA advice groups achieved significant reductions in mean total energy intakes producing a main effect for time ($p < 0.001$) regardless of the differences in energy targets and advice (isocalorie or calorie deficit) ($p = 0.908$). Changes were observed for all major macronutrients due to significant time effects ($p < 0.05$) but there were no group effects for protein and carbohydrate intakes, and both advice strategies achieved reductions in total fat and SFA to meet the study targets for all groups of ~30%E and <10%E, respectively. However, participants following structured advice (LF-PUFA) achieved the greatest reductions, producing significant time by group effects for total fat and SFA intakes ($p < 0.05$). Significant time by group effects were also observed for PUFA intakes ($p < 0.001$) and P:S ratio ($p < 0.001$). Post hoc analysis confirmed that, compared to the LF advice group, the LF-PUFA group now consumed significantly higher mean intakes of dietary PUFA ($p < 0.001$) and had higher mean P:S ratio ($p < 0.001$).

The mean pattern of food choice was similar in the baseline diets of all groups. While meal staple foods contributed 66% of total fat intake for all participants, a large proportion (34%) of dietary fat was from non-core ‘extra foods’. Of the 13 individual

food choice categories developed for this analysis (Table 1), just seven (five meal staple foods: meat-based dishes, milk, yoghurt, cheese, nuts & seeds, breads & cereals and fish & seafood; and two categories of extra foods: snack foods and oils & spreads) contributed the majority (83%) of fat consumed at baseline. Of these, just three (meat and milk-based dishes and snack foods) contributed the majority of SFA and were also major sources of MUFA and PUFA in the baseline diet (Fig 1). Foods highest in unsaturated fat contributed just 24% of total fat intake at baseline.

Figure 1: Dietary fat intakes at baseline (for all participants) and three months (LF^a vs LF-PUFA^b) showing food choice contributions to A: saturated fat, B: monounsaturated fat, and C: polyunsaturated fat

Values are means + standard error of the mean.

■ All participants at baseline ■ LF^a diet group at 3 months □ LF-PUFA^b diet group at 3 months
 Repeated Measures Analysis of Variance: *time effect, **group effect, *** time x group interaction effect, significant p-value<0.05.

^aLF- General low fat intervention, ^bLF-PUFA- Low fat, high polyunsaturated fat intervention

After three months of intervention the pattern of intake for both LF and LF-PUFA advice groups was largely characterized by reductions in all fat sub-types from food categories that contributed the most fat at baseline ($p<0.001$) (Fig 1). In contrast, there were significant increases in dietary PUFA from: nuts & seeds, breads & cereals, and fish & seafood ($p<0.001$). Significant time by group interaction effects were observed for nuts & seeds, breads & cereals, and oils & spreads ($p<0.001$), with the LF-PUFA advice group achieving the greatest increases in PUFA from these food sources (<0.05). Compared with the LF advice group, the LF-PUFA advice group now consumed more dietary PUFA from nuts & seeds ($p<0.001$), breads & cereals ($p<0.001$) and oils & spreads ($p<0.05$). Nuts, wholegrain breads and cereals, fish, and added oils and margarines now contributed the majority of fat (54%) to the LF-PUFA diet at three months.

Discussion

This study provides a descriptive food-based analysis of dietary change to meet energy and fat targets in a weight loss intervention trial. The results confirm the hypothesis that free-living intervention groups need structured whole diet advice to achieve the significant changes in the dietary fat profile being tested. General low fat core food advice was also shown to be an appropriate approach for control groups with limited impact on their proportional fat intakes. By three months all overweight and obese study volunteers lowered total energy and fat intakes and achieved the SFA target of $<10\%E$ for all groups. While the LF (control) groups maintained the relative proportions of SFA and PUFA observed for all participants at baseline, the LF-PUFA (intervention) groups achieved substantial modification ($\sim 10\%E$ PUFA and $P:S \geq 1$, $p<0.001$) and the significant difference between groups for further hypothesis testing

($p < 0.001$). Previous trials have shown the usefulness of appreciating the macronutrient composition of foods for demonstrating adherence to nutrient targets [10] and subsequent health benefits [26]. For example, virgin olive oil (1L/week) and mixed nuts (30g/day) were used in the PREDIMED Study to enable participants to achieve the Mediterranean-style diet being tested [17]. However, the study design included the free provision of specific high fat foods and, therefore, did not provide evidence for free-living food choices in response to advice alone. Our study has demonstrated the utility of structured advice and attention to the type of fat in meal and snack foods to guide free-living food choices. In contrast, low fat core food advice focused on total fat reduction was too blunt to bring about proportional changes in fat sub-types.

Our baseline data indicated that the usual intakes of study volunteers reflected over-consumption of calories and SFA whilst under-consuming PUFA compared to study targets. The consequent macronutrient profile was associated with increased health risks [27], and allowed for significant dietary change to test the research hypothesis.

Baseline food choice patterns were similar between dietary advice groups. Meal staple foods delivered two thirds of mean total fat intake of all participants, mainly from animal foods (meat, poultry, and egg-based dishes as well as milk, yoghurt, cheese and cream-based dishes combined). Other studies have noted similar high intakes of meats and milk in Western populations [28, 29]. However, a large proportion (34%) of all dietary fat consumed by the current study participants was from non-core 'extra foods', mainly from high calorie, high fat snack-type foods including biscuits, cake, chocolate, crisps, ice cream. Low intakes of 'takeaway' foods such as pizza and hamburgers within this category suggest study participants had made some dietary

changes prior to the study, indicating a readiness for change that may have motivated enrolment into a weight loss study. This did not unduly bias the study [30], as the patterns of intake at baseline were similar across advice groups. Meat and milk-based meal staple foods and snack food choices at baseline were identified as major sources of total fat and SFA intake. Intakes of MUFA largely followed the pattern of SFA intake, a phenomenon reported in other studies looking at food sources of dietary fat in various populations [31, 32]. High PUFA food sources were clearly limited within the baseline diet, with varieties of nuts and seeds, wholegrain breads and cereals, fish and other seafood, and added oils and margarines together contributing just 24% of total fat intake. This pattern of intake reflected the observed low intakes of PUFA as percentage of total energy at baseline.

After three months of intervention, the overall pattern of intake by the LF advice group remained surprisingly similar to that at baseline, albeit at significantly reduced amounts (grams) of fat from high fat meal staple meat and milk-based food choices ($p<0.001$). Anecdotally, participants in the LF advice group largely switched to low-fat alternatives of the same foods, simultaneously reducing total fat and SFA. Despite some small increases (grams) from nuts, wholegrain breads, and fish ($p<0.05$), PUFA intakes by the LF groups remained relatively low. A two-serving per day allowance for 'extra' foods limited uptake of a range of high fat foods. In comparison, the LF-PUFA advice group switched to high PUFA food sources. Nuts, wholegrain breads & cereals, fish & seafood, and added oils and margarines now contributed 54% of total fat intake and were identified as important foods for shifting the dietary fat profile: compared to control groups, LF-PUFA groups now consumed significantly more fat from nuts ($p<0.001$), whole grain breads ($p<0.001$), and to a lesser extent oils and

spreads ($p < 0.05$). An increased allowance of fat from these foods was important, but did not unduly impact on total energy and fat intakes due to the use of a structured meal plan calculated to meet individual energy and macronutrient requirements. A greater acceptance by the free-living participants of whole staple food choices versus added oils and margarines alone was also apparent in the LF-PUFA group. Some examples of food preferences by individual participants were soy & linseed bread as an alternative staple food and walnuts consumed as a snack.

Adherence to advice was important in order to establish energy and macronutrient differences between groups for comparison in the trial. In terms of energy intakes, significant reductions were readily achieved by intervention and control groups at three months regardless of the approach to advice (isocalorie versus low calorie). This result suggests either a short-term response to advice or under-reporting by isocalorie groups in line with expectations of being in a weight loss trial. Blinding of participants may have influenced this result and a longer trial may have provided further information on long-term adherence to advice. Under-reporting of energy and fat in overweight individuals is reported in the literature as a common study limitation [33]. However, mean baseline energy intakes in the current study were higher than those reported by similar study samples in our previous trials [12, 34], which may indicate lower levels of under-reporting within this overweight and obese cohort. The main limitations of this study relate to the collection and analysis of dietary data. Although not specifically developed for an overweight group of subjects, the diet history interview included a food frequency checklist that was modified to specifically identify fat-rich food sources. Nutrient analysis was conducted using Australian food composition data from 1999, the only relevant data available at the time of the study,

but it was important that values related to the local food supply. Two databases, one containing specific information on commercial food brands and the other containing data on generic food items, were used in order to increase the accuracy of data entry for individual foods. While there is always likely to be some variation in composition within food groupings, an analysis of dietary change using the same food composition data is valid. The categorisation of foods will be influenced by the aims of the study and the nature of the research question. In this analysis, sub-groups of existing core food groups and non-core foods were necessary for the analysis of fat sub-types within those groups.

This study examined the dietary changes of a group of free-living overweight and obese study volunteers in response to advice. The results provide insights into the way in which advice can guide food choice to meet dietary targets in an intervention trial. Modifying the dietary fat profile required substantial shifts in baseline proportions of SFA and PUFA intakes and this was achieved by providing structured advice that enabled individuals to selectively change high fat food choices within energy restricted diets. Attention to the fat content of a range of meal staple foods and snack foods was an important strategy for supporting free-living participants to achieve significant dietary change in an intervention trial aimed at linking macronutrients and health.

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