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Food-based recommendations to reduce fat intake: An evidence-based approach to the development of a family-focused child weight management programme

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Objectives: To develop food-based recommendations to lower fat and energy intake for use in a family-focussed weight management programme for 6–9 year old children.
Methods: Secondary analysis of the 1995 National Nutrition Survey (NNS95) informed the development of food-based recommendations aiming to reduce fat and energy intake. Each recommendation was used to progressively modify a model 3-day high fat dietary intake with the accumulative effect on energy and nutrient intake of each recommendation assessed.
Results: Six to nine-year-olds in the NNS95 consuming 35–45% energy as fat ($n = 280$) consumed more total energy (mean $\pm$ SD, 8671 $\pm$ 2741 vs. 7571 $\pm$ 2328 kJ/day) than children consuming a 'low fat' (23–27% energy as fat, $n = 85$) diet ($P < 0.002$). Food-based recommendations found to be most effective for reducing energy and fat intake included; changing to reduced fat milk, reducing intake of cereal-based and snack foods and replacing juice or soft drink with water. These changes, together with avoiding adding fat to vegetables and using sources of lean meat, reduced energy intake by ~10%, total fat intake by ~30% and saturated fat intake by 53%.
Conclusions: Modifying six areas of food choices results in a moderate reduction in fat and energy intake. An eating pattern that is consistent with Australian dietary guidelines and uses foods commonly eaten by children is achievable for children aged 6–9 years. These food-based recommendations provide an evidence-based dietary framework for prevention and management of overweight in children.

Key words: child nutrition; diet surveys; diet; fat restricted; food habits; obesity.

Management of childhood obesity requires a multifaceted approach, including moderation of energy intake, increased physical and decreased sedentary activity, use of behavioural strategies to promote change in lifestyle patterns, together with parental involvement in these processes.[1–3] Energy intake can be moderated through changes in food amount and energy density. The optimal diet to reduce energy intake safely and effectively in children is unclear.[4] Fat is a major determinant of energy density, therefore reducing fat intake is likely to be a useful strategy for reducing energy intake.[5–8]

The Dietary Guidelines for Children and Adolescents recommend 25–30% of energy be provided by fat in children, with no more than 10% from saturated fat.[9] Australian 6–9-year-olds consume 33 $\pm$ 7% of their energy as fat with saturated fat contributing 14 $\pm$ 4% of daily energy intake. Thirty-seven percent consume more than 35% of energy as fat, with 43% consuming more than 15% energy as saturated fat.[10] A reduction in the total and saturated fat content of Australian children's diets is required to meet the dietary guidelines and could assist with the treatment and prevention of obesity.

Diets used in child obesity studies are highly structured and commonly utlize self-monitoring of fat or energy intake by the child.[3] Use of child-centred prescriptive 'diets' may adversely impact on the diet of the child during treatment, increase the risk of disordered eating and limit the ability to achieve sustained dietary change.[1] Parents are the key agent of promoting dietary change for young children as they play an important role in shaping children's eating behaviours, influencing food choice through role modelling and as the primary decision-makers of when, what and how children eat.[11,12] Dietary advice for child weight management should be practical and easily utilized by the whole family. This may be facilitated by focusing on the types of food eaten at the family level rather than restricting diets of the child. This may also promote children's capacity to self-regulate intake and prevent disordered eating.[11,13]

In clinical practice, reducing fat intake by reviewing family eating habits, food shopping, meal and snack choices, is used to encourage a lower energy density diet.[14,15] Modifying the family-eating pattern is the dietary treatment of choice, as is maintaining or improving dietary adequacy consistent with the Dietary Guidelines.[4,9] Food selection guides such as the Food pyramid or The Australian Guide to Healthy Eating (AGHE) are commonly used as the nutrition education tools to achieve this.[15–17] This approach has not been formally evaluated and is currently based on clinical experience.

Differences in food patterns between children with comparatively high and low fat intakes could guide development of intervention strategies aimed at reducing energy intake and improving dietary adequacy in the context of family eating patterns. Highlighting changes that do this most effectively could both limit and prioritize the number of changes required, facilitating long-term change.[18]

The National Nutrition Survey (NNS95) 1995 provides information on the dietary intake of Australians.[19] Using secondary analyses of the NNS95 and dietary modelling, it was postulated that identifying nutrient and food differences between children aged 6–9 years whose intake differed by level of fat could guide development of food recommendations that would reduce fat and energy intake in children's diets.

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METHODS

Secondary analysis 1995 National Nutrition Survey

Sample selection

Subjects were a subset selected by percentage of energy consumed as fat of 6–9-year-old participants ($n = 749$) of the 1995 nationally representative National Nutrition Survey (NNS95).[19] The 'low fat' diet group consisted of the children consuming 23–27% of energy as fat ($n = 85$) and the 'high fat' group were the children who consumed 35–45% of energy as fat ($n = 280$). The definitions for 'low fat' and 'high fat' were arbitrarily chosen based on fat intake recommendations and current fat intake patterns in Australian children.

The range 23–27% energy from fat for the 'low fat' group was used to reflect fat intake recommendation for overweight sedentary individuals of 25% energy intake, with a range chosen to allow for individual variation and flexibility.[7,9] Greater than 35% energy as fat for the 'high fat' group reflects current intake patterns for a significant number of Australian children in this age group, with 37% of 6–9-year-olds consuming greater than 35% of energy from fat.[10] The 10% point gap between the groups was also desirable to promote a difference between 'low' and 'high' fat intake levels so differences in nutrient and food intake patterns were maximized. Data were provided by the Australian Bureau of Statistics as a confidentialized Unit Record File (CURF).[10]

Diet analysis

Dietary intake in the NNS95 was assessed using a 24-h diet recall of all food and beverage consumed on the day prior to the interview. Children in the age group 6–9 years were asked to provide their own food intake information with the assistance of an adult household member. Twenty-four hour recalls were analysed using the Australian nutrient database (AUSNUT).[19] Foods were divided into 21 categories allowing assessment of food intake patterns.[20] For the purposes of this secondary analysis the categories meat, poultry and game products and dishes, fish and seafood products and dishes and egg products and dishes were combined. Sugar products and dishes were combined with confectionery. Food categories with either minimal intake by children or negligible impact on fat or energy intake were not analysed. These included legumes, nuts and seeds, soups, sauces and condiments, infant formulae, special dietary foods, miscellaneous and alcoholic beverages. Analysis was performed on the remaining 10 food categories which together contributed more than 90% of energy intake (Table 1). The following were compared between the low and high fat intake groups: daily intake of total food, energy, macronutrients and selected micronutrients, energy density (total energy/total grams food including fluids other than plain water) and contribution of each food category to total food, energy, total and saturated fat intake.

Statistical analysis

Statistical analyses were undertaken using SPSS for Windows 10.0 (SPSS Inc, Chicago, SPSS for Windows, version 10.0, 2001). The fat intake groups were compared by age, height and weight, gender and weight status (Independent *t*-tests and Pearson χ^2, respectively). Weight status was assessed using the international standard definitions.[21] Independent *t*-tests and Mann–Whitney U with Bonferroni corrections were used to test for differences in nutrient intake and food intake, respectively. For normally distributed variables, means (standard deviation) are reported; otherwise medians (interquartile ranges) are used.

Dietary modelling

The NNS95 secondary analysis highlighted food categories that differentially contributed to total food or energy intake in 'high fat' versus 'low fat' eating patterns. Using these food categories, together with the Australian Guide to Healthy Eating[16] as the framework to guide overall nutritional adequacy, food-based recommendations were formulated. Foods were targeted for modification if they were found to make a significantly higher contribution to total food or energy intake in the NNS95 'high fat' group compared to the 'low fat' group or if the intake of a particular food group promotes excess intake of non-core foods as defined by the Australian Guide to Healthy Eating.[16] The recommendations also aimed to maintain or improve adequate micronutrient intake.

Dietary modelling was then used to determine the extent to which implementing the proposed food-based recommendations in a 'high fat' diet resulted in reductions in energy and fat intake. Based on the secondary analysis, a model 3-day 'high fat' intake representative of the energy, macro- and micro-nutrient and food intake pattern of NNS95 participants aged 6–9 years consuming a diet containing more than 35% of energy as fat was developed using SERVE© (M&H Williams Pty, NSW, SERVE© nutritional management system, version 3.99, 1999). The food-based recommendations were implemented in a stepwise fashion resulting in a 'reduced fat' model. The impact of implementing each recommendation on energy and fat intake was examined, as was the combined effect of implementing all the proposed recommendations.

Table 1 National Nutrition Survey 1995 (NNS95) food categories, abbreviation used in this paper and examples of foods included in each category[20]

NNS95 food category	Abbreviation	Food examples
Cereals and cereal products	Bread and cereals	Bread, breakfast cereal, pasta, rice, flour, couscous
Vegetable products and dishes	Vegetables	All vegetables and dishes where vegetables are the major component, e.g. potato, peas, tomato, cauliflower cheese, hot chips, coleslaw
Fruit products and dishes	Fruit	Fresh, canned, stewed, dried fruit and dishes where fruit is the major component, e.g. banana, sultanas, apple crumble
Milk products and dishes	Dairy products	Plain or flavoured dairy or soy milk, yoghurt, custard, cheese, ice cream
Meat, poultry, game, fish	Meat and alternatives	Steak, chicken, fish, eggs, sausages, luncheon meats, seafood, egg products and dishes
Non-alcoholic beverages	Beverages	Fruit and vegetable juices and drinks, cordial, soft drinks, bottled and tap water
Fats and oils	Fats and oils	Butter, margarine and oils
Cereal-based products and dishes	Cereal-based foods	Sweet and savoury pastries, biscuits, cakes, doughnuts, savoury crackers, pizza, hamburgers, packet pasta
Extruded snack foods	Extruded snacks	Potato crisps, corn chips, prawn crackers, pretzels, etc.
Sugar products and dishes	Confectionery	Sugar, honey, lollies, chocolate, fruit-bars and confectionery

RESULTS

Secondary analysis NNS95

Age, gender, weight, height and weight status were not significantly different between 'high' and 'low' fat groups. Total food, daily energy and macronutrient intake for the fat groups are shown in Table 2. The 'high fat' group consumed 140 g (8%) less food ($P < 0.05$) but 1100 kJ (15%) more energy ($P < 0.002$) than the 'low fat' group. The energy density of the diet was 27% higher for the 'high' fat group (5.6 ± 1.3 vs. 4.4 ± 1.0 kJ/g, $P < 0.005$).

There were few differences in vitamin and mineral intakes between the 'low' and 'high' fat groups. The 'high fat' group had a lower intake of vitamin C (93 ± 87 mg vs. 144 ± 158, $P < 0.002$) and higher intake of phosphorous (1284 ± 482 mg vs. 1042 ± 429, $P < 0.002$), however, intakes for both groups were above recommended dietary intakes (RDI) for children aged 6–9 years.[22] Calcium intake was higher in the 'high fat' group (859 ± 440 mg vs. 683 ± 454 mg, $P < 0.002$). Seventy-four percent of children in the 'low fat' group had a calcium intake less than the RDI (800–900 mg/day depending on age and gender) compared with 51% in the 'high fat' group ($P < 0.01$). Thirty-seven percent of children in the 'low fat' group fell below 70% RDI (560–630 mg/d depending on age and gender) compared with 24% of the 'high fat' group ($P < 0.02$).

The intake of various food categories and the proportion of energy contributed by each category for the two fat levels are shown in Table 3 and Figure 1, respectively. Dairy product, cereal-based foods and extruded snack intakes were higher in the 'high fat' group in terms of weight (Table 3) and percent energy (Figure 1). Conversely, the 'high fat' group consumed less breads and cereals, fruit and nonalcoholic beverages by weight (Table 3). No other differences in median intake were found between fat intake groups, however, the 'high fat' group derived almost three times more energy from vegetables and

Table 2 Mean ± standard deviation of grams of food, energy and macronutrient intake per day for children in National Nutrition Survey 1995[18] aged 6–9 years consuming a 'high fat' (35–45% of energy) or 'low fat' (23–27% energy) diet

	'High fat' group ($n = 280$)	'Low fat' group ($n = 85$)	Significance (P)
Total grams food (g)[†]	1570 (1246–1950)	1711 (1421–2122)	<0.05
Energy (kJ)	8671 ± 2741	7571 ± 2328	<0.002*
Fat			
total (g)	90 ± 30	51 ± 16	<0.002
saturated fat (g)	40 ± 15	21 ± 8	<0.002
polyunsaturated fat (g)	11 ± 5	8 ± 4	<0.002
monounsaturated (g)	32 ± 12	18 ± 6	<0.002
Carbohydrate			
starch (g)	124 ± 45	122 ± 53	0.67
sugars (g)	121 ± 54	155 ± 60	<0.002
Protein (g)	70 ± 27	60 ± 22	<0.002
Percent energy as fat			
total	38 ± 26	25 ± 11	<0.002
saturated	17 ± 3	10 ± 2	<0.002
Percent energy as carbohydrates			
total	47 ± 5	60 ± 4	<0.002
starch	25 ± 6	27 ± 7	0.003
sugars	22 ± 6	33 ± 7	<0.002
Percent energy as protein	13 ± 3	13 ± 4	0.03

*Set level for significance following Bonferonni correction of $P < 0.05$; [†]Median (interquartile range, IQR).

Table 3 Median (Interquartile range) intake in grams of food categories as defined in the National Nutrition Survey 1995[18] (NNS 95) for children aged 6–9 years consuming a 'high fat' (35–45% of energy) or 'low fat' (23–27% energy) diet

NNS95 food category	'High fat' group	'Low fat' group	Significance (P)
Breads and cereals	121 (78–180)	180 (108–275)	<0.003*
Vegetables	109 (18–211)	80 (0–174)	0.08
Fruit (excludes fruit juice or drink)	86 (0–160)	140 (0–296)	<0.003
Dairy products	343 (147–575)	258 (63–410)	<0.003
Meat and alternatives	69 (73–133)	57 (0–117)	0.50
Non-alcoholic beverages	392 (215–668)	544 (343–820)	<0.003
Fats and oils	8 (4–16)	6 (2–12)	0.08
Cereal-based foods	93 (25–192)	38 (0–132)	<0.003
Extruded snacks	0 (0–25)	0 (0–1)	<0.003
Confectionery	9 (0–49)	22 (0–56)	0.27
Total fluid intake	1142 (780–1648)	1031 (842–1438)	0.09
Plain water	400 (125–750)	318 (125–691)	0.03
Milk as a beverage or on cereal	258 (8–516)	129 (1–323)	<0.003
Sweetened beverages	259 (0–472)	397 (251–653)	<0.003
Fruit juice and fruit drink	0 (0–262)	132 (0–265)	0.02
Cordial and soft drink	0 (0–259)	138 (0–393)	<0.003
Other fluids	0 (0–0)	0 (0–125)	0.08

*Set level for significance following Bonferonni correction of $P < 0.05$.

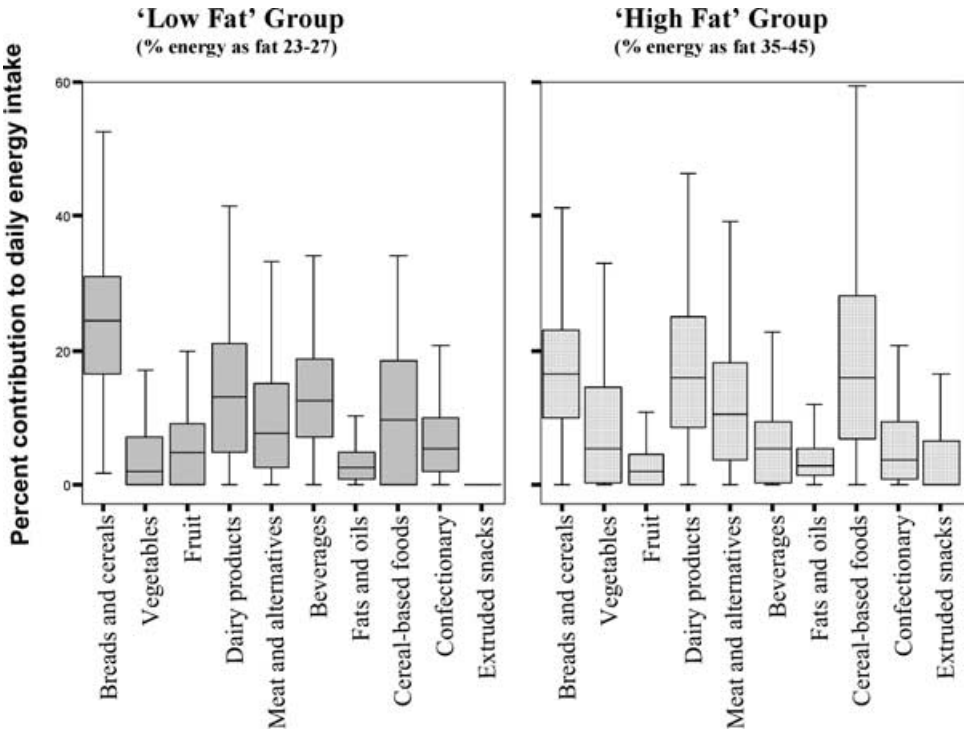

Fig. 1 The median (IQR) percentage energy provided by food categories as defined by the National Nutrition Survey 1995[20] for high fat and low fat groups

meat and alternatives (Figure 1 $P < 0.003$). Total fluid intake did not differ by fat intake group (1142 g (780–1648) 'high' vs. 1031 g (842–1438) 'low' fat group), however, there were differences in beverage type (Table 3).

Dietary modelling

On the basis of higher intake (grams of food and/or contribution to energy intake) by the high fat group, cereal-based foods, dairy products, extruded snacks, meat and alternatives, and vegetables were identified for modification to reduce fat intake. As the 'low fat' group consumed less calcium, dairy products were modified by using lower fat varieties rather than by reducing the volume consumed. Given the intake of sweetened beverages in both fat groups and the high intake and contribution to energy intake in the 'low fat' group, a low intake of energy-yielding, low-nutritive beverages was desirable and was an additional target for energy moderation.[15]

Table 4 shows a model 3-day 'high fat' intake constructed to reflect food and nutrient intake patterns of 6–9-year-old participants in the NNS95 who consumed 35–45% energy as fat. Table 5 lists the food-based recommendations and the nutritional impact of implementing these recommendations on the model 3-day 'high fat' diet. The resulting model 3-day 'reduced fat' diet is presented in Table 4. Implementing the food-based recommendations, which target six food categories, resulted in an energy reduction of 1000 kJ and total fat reduction of 30 g with 75% of this fat being saturated. The resulting 'reduced fat' diet model derived 28% of energy from fat.

DISCUSSION

Secondary analysis of the NNS95 indicates that children with varying levels of percent energy as fat have different energy, nutrient and food intakes. Children aged 6–9 years with a 'high fat' intake (35–45% energy) consumed 15% more total daily energy than children consuming a 'low fat' diet (23–27% energy from fat) a level in line with current fat intake recommendations.[9] Children consuming a 'high fat' diet ate less total food (grams of food/day) but as expected had almost 30% higher energy density, highlighting the role fat plays in determining energy density of diets. This illustrates that moderation of energy intake does not necessarily require a decrease in the total amount of food consumed, rather selection of foods lower in energy density.

The differences in energy and macronutrient intake were not reflected in a difference in weight status between groups. This is not unexpected as the NNS95 is a cross-sectional survey of a single day's intake and activity level was not accounted for. Weight gain results from an interaction between genetic background, high energy intake and sedentary lifestyle potentially leading to long-term positive energy balance and weight gain.[7] NNS95 data were used here to describe 'at risk' eating patterns to identify food based strategies that can be used to alter current energy balance, rather than implying a cause-effect relationship between fat intake and weight status.

The difference in energy intake between the two fat intake groups was primarily, but not solely, explained by fat intake. Children consuming a low fat diet derived a greater proportion of energy from total carbohydrates.[9] However, the higher intake of carbohydrates in the 'low fat' group was secondary to 28% higher intake in simple sugars with no difference in starch intake between fat groups. This was consistent with differences in food intakes, with a 61% and 65% higher intake of fruit and sweetened beverages, respectively, in the low fat group.

An inverse relationship between sugar and fat intake is well documented, with good evidence supporting a role for moderate to high carbohydrate diets in preventing weight gain and obesity.[6,23] However, the role of carbohydrates

Table 4 Three day 'high fat' diet model, based on average energy and nutrient intake of 6–9 years old children in National Nutrition Survey 1995[18] (NNS 95) consuming 35–45% energy as fat and the resulting 'reduced fat' diet following implementation of food-based recommendations (see Table 5) designed to reduce energy and fat intake

	'High fat' diet (39% energy from fat)†			'Reduced fat' diet (28% energy from fat)‡		
	Day 1	Day 2	Day 3	Day 1	Day 2	Day 3
Breakfast	30 g Rice Bubbles™ 250 mL 4% milk 8 g sugar 125 mL juice	30 g high fibre toast 20 g butter 20 g honey 250 mL 4% flavoured milk	30 g pancakes lemon juice 20 g sugar 250 mL 4% flavoured milk	30 g Rice Bubbles™ 250 mL 1–2% milk 8 g sugar 125 mL juice	30 g high fibre toast 20 g margarine 20 g honey 250 mL 1–2% flavoured milk	30 g pancakes lemon juice 20 g sugar 250 mL 1–2% flavoured milk
Morning snack	12 g doughnut 125 mL water	40 g confectionery 125 mL water	42 g fruit leather strap 125 mL juice	75 g pikelet 27 g jam 100 mL water	30 g muesli bar 200 mL water	165 g apple 6 g rice crackers 125 mL juice
Lunch	65 g white bread 25 g peanut paste 20 g potato crisps 250 mL cordial	150 g sausage roll 200 mL soft drink	65 g white bread 20 g butter 20 g ham 60 g cheese 60 g tomato	65 g white bread 25 g peanut paste 110 g pear 200 mL water	60 g cob corn 250 mL soup 60 g bread roll 250 mL juice 40 g sultanas	65 g white bread 20 g butter 20 g ham 30 g cheese 60 g tomato
Afternoon snack	250 mL 4% flavoured milk 22 g choc-chip biscuits 25 g choc beans	125 mL 4% flavoured milk 135 g instant noddles 60 g banana 150 mL water	20 g potato crisp 200 mL water	200 mL 1–2% flavoured milk 20 g almonds 60 g fruit loaf 10 g margarine	30 g cereal 180 mL 1–2% milk 60 g banana 150 mL water	20 g potato crisps 200 mL water
Evening meal	130 g Schnitzel (fried) 20 g butter 60 g oven fries 90 g peas 40 mL gravy 250 mL coke 105 g tinned peaches 25 g ice cream	160 g pizza 75 g salad 250 mL soft drink	45 g sausage 30 g chop (with fat) 40 g salad 90 g potato salad 250 mL soft drink 60 g ice cream dessert	130 g Schnitzel (oven baked) 95 g medium oven potato 90 g peas, 40 mL gravy 200 mL water 105 g tinned peaches 100 g yoghurt	115 g thin pan pizza 75 g side salad 200 mL 'diet' soft drink 120 g low fat yoghurt	45 g sausage 30 g chop (with fat) 40 g salad 90 g potato salad 200 mL 'diet' soft drink 60 g ice cream dessert

†Average intake/day 8217 kJ. 87 g fat, 43 g saturated fat. 845 mg calcium, 126 g sugars; ‡Average intake/day 7400 kJ. 57 g fat, 20 g saturated fat. 1160 mg calcium, 124 g sugars.

Table 5 Food-based modifications designed to reduce energy and fat intake of a high fat diet, the impact of implementing these modifications on energy and nutrients and the modifications translated into food-based recommendations for use within the Australian Guide to Healthy Eating (AGHE) framework

	Food-based modifications	Nutritional impact of implementing the modifications on a 3-day 'high fat' diet model	Food-based recommendation to use within the framework of the AGHE framework[15]
Dairy products	• Milk and yoghurt; 4% fat → 1–2% fat • Cheese used only once in 3-day model using reduced fat varieties • Ice-cream used only once in 3-day model, yoghurt used at other times	• Energy intake ↓ 400 kJ • Fat ↓16 g (↓ 8 g saturated fat)	• Ensure 2–3 serves dairy/day to maintain calcium intake • Promote 1–2% fat products • Limit ice-cream/cheese to 1–2 per week (reduced fat varieties)
Beverages (other than milk)	• Cordial/soft drink (regular) → water/diet cordial/soft drink. • Juice limited to 150 mL/day.	• Energy intake ↓400 kJ	• Encourage water as primary fluid. Low joule beverages are appropriate. • Limit juice to maximum of once per day (150 mL).
Lunchbox and snack foods e.g. Cereal-based foods and extruded snacks	• Cereal-based products, extruded snacks replaced with breads & cereals, fruit and vegetables e.g. Sausage roll → soup + corn on cob/bread. Sweet biscuits → raisin loaf.	• Energy intake ↓300 kJ • Fat ↓12 g (↓8 g saturated fat) • Carbohydrate ↓34 g (24 g sugars)	• Encourage lunch box/snack choices from breads & cereals, vegetable, fruit and dairy categories. • Use cereal-based foods sparingly
Main meal items: Meat and alternatives and vegetables	• Untrimmed/fatty cuts of meat and chips were replaced with lean cuts and potato without added fat.	• Energy intake ↓150 kJ • Fat ↓6 g (↓3 g saturated fat)	• Modification of meat and vegetable choices are not highly effective strategies for reducing fat intake in 6–9 years olds

in reducing energy intake through their impact on energy density, appetite and energy cost of metabolism may only occur in the form of increased starch.[23] Thus, while fat remains the primary focus for reduction, the analysis presented in this paper highlights the importance of guiding diet modification to ensure substitutions are consistent with nutritional guidelines.

Children with a high fat intake had a greater percent of energy as saturated fat (17 vs. 10%). The 'high fat' group had a greater intake of dairy products and cereal-based foods (flour and pastry-based products) which are the two greatest sources of saturated fat for children aged 2–11 years contributing approximately 38% and ~20% to saturated fat intake, respectively.[24] The link between saturated fat and risk of heart disease is well documented with the atherosclerotic process commencing in childhood.[25] This highlights the need to specifically target saturated fat and the food-based recommendations described in this paper provided a 53% reduction in saturated fat. This was three-quarters of the overall fat reduction.

On the whole, there were few differences in vitamin and mineral intakes between the 'low' and 'high' fat groups. However, the ability of children to achieve the RDI for calcium appears to be influenced by the level of fat intake and associated eating patterns. Given the importance of calcium to child development, maintaining intake of dairy products as key sources of calcium was given priority when planning food changes aimed at reducing fat intake. As a result use of reduced-fat dairy products was recommended rather than fewer serves of dairy per day. This highlights the need to assess the impact on broader nutritional intakes of dietary manipulations aimed to achieve a particular goal.

Using the preceding findings, food-based recommendations (Table 5) for lowering fat and energy intake were proposed. Their impact on fat and energy intakes trialled through 3-day dietary modelling and the ability to decrease fat and energy intake validated. The reduction in energy intake was approximately ~1000 kJ/day, which when combined with increased energy expenditure over the long-term, may address weight promoting energy imbalance that promotes weight gain.

The changes found to be most effective in reducing fat and energy intake were those relating to the types of lunches, morning and afternoon snacks and beverages provided. Focusing changes on reducing intake of cereal-based foods, switching to fat reduced dairy choices and maintaining water as the preferred beverage for thirst were shown to have the greatest impact on reducing fat and energy. Encouraging cereal products and fruit in place of cereal-based foods and extruded snacks is consistent with the 'low fat' eating pattern and the AGHE.[15] It is important to note that the reduced fat model presented here does not fulfil all the recommendations of the AGHE. For example, wholegrain choices were not included and vegetable intake remains short of recommendations.[15] However, the 'reduced fat' diet model was designed to reflect child eating patterns as described in the NNS95.

The simple food-focused recommendations targeting energy and fat intake could be easily linked with the AGHE framework, serving sizes and supporting literature to form an appropriate education tool for use with families addressing weight issues with children.[15] The strength of utilizing the AGHE and the food-based recommendations presented here is that parents can plan, implement and monitor changes to family members' diets at both the point of purchase, family food preparation and individual child intake level. The benefits are that safe, socially and culturally appropriate, sustainable eating patterns for childhood and later life are established without placing direct responsibility of food choices with the child.

CONCLUSION

The nationally representative NNS95 data, now a decade old, show that a majority of Australian children consume in excess of current dietary guideline recommendations for both total and saturated fat intake suggesting a significant number of children

are at risk of weight gain, obesity and heart disease now and in later life.[7,9] Use of the AGHE and the food-based recommendations presented here, are appropriate for health promotion programmes other than those focusing on weight reduction. Modification of the food supply and diets of all Australian children are essential strategies to slow the obesity epidemic.

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