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ORIGINAL COMMUNICATION

Contribution of 'noncore' foods and beverages to the energy intake and weight status of Australian children

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Objectives: The Australian Guide to Healthy Eating is based on five core food groups and water. Foods or beverages that do not fit into these groups are considered extra or 'noncore'. We tested the hypotheses that noncore foods and beverages make a greater proportional contribution to mean daily energy intakes of: (1) children, compared with other age groups; and (2) overweight and obese children, compared with healthy weight children.
Design, setting and subjects: We used data from 13 858 participants aged 2 to 80 + y who had 24-h dietary recall data collected in the 1995 cross-sectional Australian National Nutrition Survey. ANOVA was used to compare the percentage of energy provided by noncore foods and beverages by age and weight status.
Results: Children (5 to 12 y) and adolescents (13 to 18 y) obtained significantly more ($P<0.001$) of their daily food energy from noncore foods (41.5 and 43.4%, respectively) than all other age groups. These age groups also obtained significantly more ($P<0.001$) of their daily beverage energy from noncore beverages (30.7 and 36.9%, respectively). Results were not consistent with weight status, although very young (2–4 y) obese children obtained significantly more energy ($P<0.05$) from noncore beverages than children in a healthy weight range. Younger children may also have consumed a greater quantity of foods and beverages. Under-reporting may have obscured similar results for older children.
Conclusions: By definition, noncore foods and beverages are surplus to the requirements of a healthy diet. We found that Australian children consume these foods and beverages in excess.
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Keywords: noncore foods; energy intake; children; overweight; obesity; noncore beverages; Australia

Introduction

The Australian Guide to Healthy Eating (AGHE) is a food selection guide to help Australians choose a healthy diet using a variety of foods (Smith *et al*, 1998). The guide is based on five core food groups and it recommends that appropriate serves of food from each of these groups be consumed every day to provide the nutrients the body needs. Water and milk are also considered core. Foods or beverages that do not fit into these groups are extra or 'noncore', recommended to be consumed sometimes or in small amounts. The guide recommends up to 1–2 servings of these noncore foods and beverages per day for children up to 11 y and a maximum of three serves for all older age groups. For anyone under 11 y, this is equivalent to 1200 kJ (600 kJ per serve) (Smith *et al*, 1998).

Recent data suggest that Australian children may have increased their consumption of noncore foods and beverages. The Australian Food and Nutrition Monitoring Unit found that due to increased consumption of processed foods such as cakes, biscuits, pies and pizza as well as confectionary and soft drink, children aged 10 to 15 y in 1995 were consuming more total energy, carbohydrate (particularly sugar) and fat than children of the same age in 1985 (Cook *et al*, 2001). A previous analysis of the 1995 National Nutrition Survey has shown that more than one-third of

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children, aged 2 to 18 y of age did not eat any fruit and 20% did not eat any vegetables on the day prior to interview (Magarey *et al*, 2001). About one-third consumed snack foods (eg potato crisps and extruded snacks), over a half consumed confectionery and over 70% consumed cakes, biscuits and pastries (Magarey, 2003, personal communication). Moreover, of the top five food groups contributing to energy intake from food eaten by Australian children at school, only bread could be considered a core food (Bell & Swinburn, 2004). The others were fast food (including pies, hot chips, pizza and hamburgers), fruit/cordial drinks, fat spreads and sweet biscuits and crackers.

There are many factors that may be influencing these eating patterns. Children's food choices are to some extent genetically determined but they are also strongly influenced by the environment (Campbell & Crawford, 2001). Parents play a major role in determining children's food preferences through their control of food purchasing and preparation and also through the modelling of eating behaviours. There is a growing body of evidence to suggest that one of the most powerful influences on children's food preferences (both directly and through parents or peers) is television viewing (Coon & Tucker, 2002). Not only do children who watch television frequently request and consume advertised foods but they are inactive and often eat while watching (Story, 2003).

The major implications of poor eating patterns in childhood are the tracking of these behaviours into adulthood (Kelder *et al*, 1994; Kemper *et al*, 1997), the risk of obesity (Dietz, 1994) and a range of other chronic diseases (Must, 1996; Berenson *et al*, 1998). The aims of this study were to test the hypotheses that noncore foods make a greater proportional contribution to mean daily energy intakes of: (1) children, compared with other age groups; and (2) overweight and obese children (as classified by the International Standard Definition) (Cole *et al*, 2000) compared with healthy weight children.

Methods

Survey design and participants

In 1995–1996, the Australian Bureau of Statistics (ABS) conducted a National Health Survey (NHS) in all states and territories across urban and rural areas. Households were selected at random using a stratified multistage area sample. The National Nutrition Survey (NNS95) was conducted several weeks later as a subcomponent of the NHS. Details of the survey have been published elsewhere (McLennan & Podger, 1995).

Dietary and other measurements

The NNS95 survey used a single face-to-face 24-h recall interview to estimate food and beverage intake. The method was adapted from that used in the Continuing Survey of Food Intake by Individuals 1994–1996 from the United States (US Department of Agriculture, 2000). It involved three phases: the completion of a quick list of foods eaten or beverages consumed during the previous 24 h; collection of detailed information for each food and drink item listed in the quick list; and a recall-review to allow respondents to report any foods that may have been forgotten. Further details have been previously reported (McLennan & Podger, 1995). Parents or carers were interviewed on behalf of children aged 0–14 y, while those aged 15 y and older reported their own intakes.

The NNS95 data were provided by ABS as a confidentialised unit record file that identifies food groups by a code. Using these codes, we separated foods and beverages into core and noncore categories. Definitions for these categories were based on the AGHE (Smith *et al*, 1998). Core foods and beverages were defined as those included in the following five groups: (1) bread, cereals, rice, pasta and noodles; (2) vegetables, legumes; (3) fruit; (4) yogurt, cheese, milk and (5) meat, fish, poultry, eggs, nuts (legumes are also included in this AGHE category). Water, coffee and tea were included as core beverages. All other foods and beverages were classified as noncore. In a majority of cases, the distinction between core and noncore was clear. Where this was not the case, a consensus opinion was reached. For example, fish was considered a noncore food if it was battered as were potatoes if they were prepared as fries. On the other hand, breakfast cereals were considered core foods, including sweetened breakfast cereals. We separated beverages from foods because energy density is very different for foods compared to beverages (see Table 1). Foods and beverages additional to those described above (such as infant foods, meal replacements and flavourings) were grouped into a separate category and omitted from analyses because they either contained very little energy or they were rarely consumed by the age groups of interest. A complete list of the foods and their classification is available from the authors or on the following website (www.deakin.edu.an\dhs\sentinel_site.php). Quantity (g) and energy (kJ) of all foods in the two categories were determined and energy density was calculated as kilojoules per gram.

The NNS95 recorded age as 31 different categories. We divided the sample into seven age categories: 2 to 4 y of age (preschool), 5 to 12 y (primary school age), 13 to 18 y (secondary school age), 19 to 25 y (young adults), 26 to 39 y (adults), 40 to 64 y (older adults) and over 65 y (seniors). Subjects aged 2 to 18 y were classified as healthy weight (includes underweight and healthy weight), overweight or obese using international standards (Cole *et al*, 2000).

Statistical analysis

We used analysis of variance (ANOVA) to compare the percentage of energy provided by noncore foods and beverages across each of the seven age groups. Children ($n = 3007$ aged 2–18 y) were subsequently categorised into six 'younger' age groups for further analysis in relation to weight

Table 1 Total (mean±standard deviation) daily energy intake (kJ) from foods and beverages, quantity of foods and beverages consumed (g), and energy density (kJ/g) for core *vs* noncore foods and beverages by age group

		Energy (kJ)		*Weight (g)*		*Energy density (kJ/g)*			
Age category (y)	n	*Food*	*Beverage*	*Food*	*Beverage*	*Core foods*[a]	*Noncore*[a] *foods*	*Core*[a] *beverages*	*Noncore*[a] *beverages*
2–4	583	4806±1794	1645±908	686±307	880±465	6.2±2.0	13.6±5.8	1.9±0.7	2.8±2.1
5–12	1496	6925±2582	1553±990	899±387	873±500	6.7±2.4	13.8±4.8	1.9±0.8	2.5±1.8
13–18	928	8581±4079	1845±1460	1102±551	1151±782	6.8±2.5	14.0±5.3	1.6±0.9	2.3±1.6
19–25	1060	8500±4156	1650±1405	1145±595	1344±835	6.5±2.4	14.7±5.8	1.1±0.9	2.0±1.3
26–39	3513	8164±3684	1218±1102	1154±549	1470±856	6.2±2.2	15.1±5.9	0.7±0.7	2.3±1.8
40–64	4318	7401±3125	873±831	1151±499	1523±852	5.6±1.9	15.4±6.1	0.5±0.5	2.4±2.2
65+	1960	6308±2574	736±606	1061±443	1329±626	5.1±1.8	15.6±6.2	0.5±0.4	2.6±2.6

[a]See Methods for definition of core and noncore foods and beverages.

status. Weight and/or height data were missing from 54 children aged 2 to 18 y so the total number for analyses including anthropometric data was 2953. A series of contrasts were used to compare the percentage of energy provided by noncore foods and beverages, as well as the quantity of noncore and core food and beverage (g) consumed and the overall energy intake (kJ), across three weight status categories (healthy weight, overweight or obese), (Cole *et al*, 2000) within each of the six 'younger' age groups. The first contrast tested for differences between the healthy weight group and combination of overweight and obese groups. The second contrast tested for differences between the overweight and obese groups. Data were managed using *Stata (version 7)*, College Station, TX, USA and analysed using SPSS (version 11.5, SPSS International). Statistical significance was accepted as $P<0.05$.

Results

Table 1 shows mean energy intake, the quantity of food and beverage consumed and the energy density of food and beverages, split into core and noncore components. Energy intake from foods and beverages increased across the youngest age groups, peaked in the 13- to 18-y-old age group and declined into the older age groups. The quantity of food and beverage consumed also increased with age but remained remarkably constant across the middle and older age groups. Mean energy density of noncore foods was more than double that of core foods. The energy density of noncore beverages was also higher than that for core beverages.

On average, 34% of food energy came from noncore foods (Figure 1). Noncore foods made a significantly greater ($P<0.05$) contribution to the energy intakes of children (5 to 12 y) and adolescents (13 to 18 y) compared to all other age groups. They obtained 43.4% (95% CI, 42.4–44.4) and 41.5% (95% CI, 40.1–43.0), respectively of their food energy from noncore foods. Of the energy that came from beverages, an average of 24% came from noncore beverages. As was the case for foods, the proportion of beverage energy

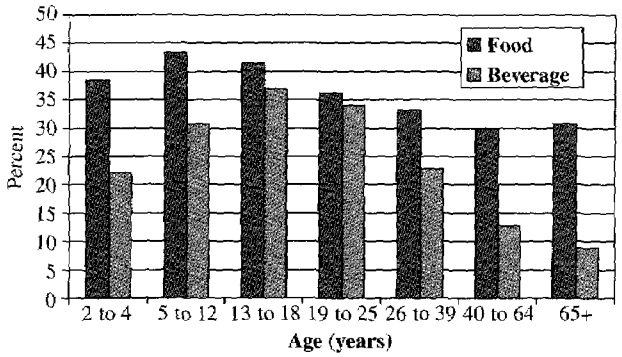

Figure 1 Proportion of food energy from noncore foods and proportion of beverage energy for noncore beverages by age group.

that came from noncore beverages was significantly higher, for children 30.8% (95% CI, 29.1–32.5) and adolescents 36.9% (95% CI, 34.5–39.3), respectively (Figure 1) compared to other age groups, although the proportion was also significantly higher 34.0% (95% CI, 31.7–36.3) for young adults (19 to 25 y). Similar analyses using noncore food or beverage weight (g) rather than energy (kJ) yielded similar results (not shown).

Of those aged 2 to 18 y of age, 15.8% were overweight and 5.3% were obese. Prevalence varied inconsistently within this age range, ranging from 17.1% (12.1% overweight and 5.0% obese) in 5- to 7-y olds to 25.8% (19.2% overweight and 6.6% obese) in those aged 17 to 18 y. Figure 2 shows the proportion of energy obtained from noncore foods for healthy weight *vs* overweight and obese individuals for each of the six 'younger' age groups. Children aged 2–4 y and 5–7 y, who were in the healthy weight range, obtained a significantly greater proportion of their food energy from noncore foods when compared with overweight and obese children ($P<0.05$). This pattern with weight status was repeated in the older age groups, although in most cases the differences were not significant. The overall pattern was different when we considered the association between energy intake from noncore beverages and weight status across these age groups (Figure 3). For 2- to 4-y olds, there

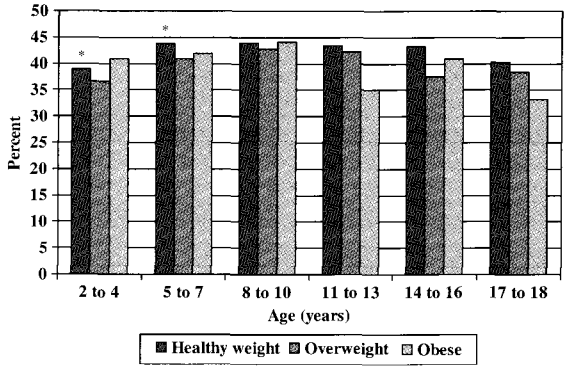

Figure 2 Proportion (standard error) of energy from noncore foods by weight status and age group. *$P<0.05$ compared to combined overweight and obese category in same age group.

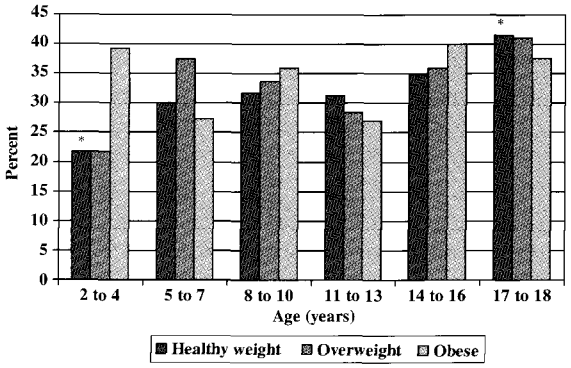

Figure 3 Proportion (standard error) of energy from noncore beverages by weight status and age group. *$P<0.05$ compared to combined overweight and obese category in same age group.

was a significant difference ($P<0.05$) between those who were healthy weight or overweight (21.7%) and those who were obese (39.3%) in total beverage energy intake from noncore beverages. Also, while the differences were not statistically significant, overweight and obese children in each age group, with the exception of 11- to 13-y olds and 17- to 18-y olds, tended to have higher intakes of noncore beverage energy than healthy weight children.

To investigate the possibility that overweight and obese children may have consumed greater quantities of food and beverage (both noncore and core) than those in the healthy weight range, we compared total energy from all foods and beverages as well as the total quantity of both noncore and core foods and beverages consumed across the three weight status categories (Tables 2 and 3). Overall, children aged 2 to 18 y obtained an average of 7057 kJ from 924 g of food (core and noncore) per day and 1562 kJ from 509 g of beverages (core and noncore). As might be expected, energy intake from and the quantity of food and beverages consumed increased across the age groups. For food intake (Table 2),

Table 2 Total food energy (kJ) (mean ± standard deviation), and quantity of food (g) from noncore and core categories by weight status and age group

	Healthy weight[a]				*Overweight*[a]				*Obese*[a]			
Age group (y)	n	*Total food energy (kJ)*	*Amount of noncore food (g)*	*Amount of core food (g)*	n	*Total food energy (kJ)*	*Amount of noncore food (g)*	*Amount of core food (g)*	n	*Total food energy (kJ)*	*Amount of noncore food (g)*	*Amount of core food (g)*
2–4	431	4764 ± 1784*	168 ± 123*	510 ± 294*	91	5072 ± 1730**	176 ± 152**	543 ± 232**	24	5651 ± 1858	179 ± 152	643 ± 494
5–7	493	5920 ± 1959*	224 ± 159*	560 ± 329*	72	6215 ± 2179**	234 ± 197	629 ± 274	30	6608 ± 2364	236 ± 133	572 ± 261
8–10	428	7269 ± 2598	275 ± 201	653 ± 381	88	7269 ± 2387	252 ± 174	680 ± 322	30	7661 ± 3287	296 ± 276	637 ± 351
11–13	414	8298 ± 3363*	311 ± 257*	773 ± 448*	104	8007 ± 3372**	302 ± 262**	702 ± 406	24	7554 ± 2905	232 ± 190	801 ± 555
14–16	364	8671 ± 3918*	326 ± 285*	767 ± 465*	59	7901 ± 3547	291 ± 269	706 ± 418	30	7710 ± 3134	293 ± 277	704 ± 396
17–18	201	8989 ± 4711*	314 ± 312*	840 ± 526*	52	7859 ± 3766**	228 ± 215	902 ± 763**	18	7005 ± 3670	202 ± 191	636 ± 354

[a]Assessed using international reference cutoffs of Cole *et al* (2000). Healthy weight includes underweight and healthy weight individuals.
*Significantly different from overweight and obese children combined, $P<0.05$.
**Significantly different from obese children, $P<0.05$.

overweight and obese children in the younger age groups (ie 2–4 y, 5–7 y) had higher energy and gram intakes than healthy weight children suggesting they ate more food (both noncore and core). Obese children in these age groups also had higher energy and gram intakes than overweight children. For children aged 8–10 y, no significant differences were evident across the three weight-status groups. For the three older age groups, a reverse pattern was observed such that children in the healthy weight range reported significantly higher energy and gram intakes than overweight and obese children. Similar patterns were observed for beverage intake (Table 3).

Table 3 Total beverage energy (kJ) (mean ± standard deviation), and quantity of beverage (g) from noncore and core categories by weight status and age group

	Healthy weight[a]				Overweight[a]				Obese[a]			
Age group (y)	n	*Total beverage energy (kJ)*	*Amount of noncore beverage (g)*	*Amount of core beverage (g)*	n	*Total beverage energy (kJ)*	*Amount of noncore beverage (g)*	*Amount of core beverage (g)*	n	*Total beverage energy (kJ)*	*Amount of noncore beverage (g)*	*Amount of core beverage (g)*
2–4	431	1633 ± 899	186 ± 306*	689 ± 420	91	1666 ± 947	184 ± 289**	718 ± 473	24	1726 ± 985	336 ± 379	627 ± 453
5–7	493	1485 ± 880*	236 ± 317*	588 ± 389*	72	1620 ± 902	313 ± 363	554 ± 447	30	1367 ± 846	280 ± 474	539 ± 331
8–10	428	1627 ± 1021	290 ± 360	604 ± 418*	88	1394 ± 831	285 ± 371	575 ± 407	30	1502 ± 791	333 ± 318	574 ± 327
11–13	414	1646 ± 1187	294 ± 415	651 ± 506	104	1603 ± 1000	305 ± 413	660 ± 479	24	1553 ± 1580	351 ± 476	603 ± 479
14–16	364	1847 ± 1571*	373 ± 540*	712 ± 584	59	1776 ± 1319	388 ± 444	762 ± 580	30	1531 ± 1080	387 ± 425	740 ± 497
17–18	201	2022 ± 1556*	506 ± 622*	831 ± 730*	52	1721 ± 1180**	384 ± 452	871 ± 590	18	2041 ± 1700	481 ± 586	1105 ± 742

[a]Assessed using international reference cutoffs of Cole *et al* (2000). Healthy weight includes underweight and healthy weight individuals.
*Significantly different from overweight and obese children combined, $P<0.05$.
**Significantly different from obese children, $P<0.05$.

Discussion

When combined, noncore foods and beverages contributed 41% of total energy intake for children and adolescents. Moreover, very young children who were obese appeared to obtain more energy from noncore beverages than their healthy weight counterparts.

The high consumption of noncore foods and beverages among children was not unexpected as similar results have been reported. One-third of Australian children aged 2 to 18 y ate snack foods such as potato crisps, 50% ate confectionery and 75% ate high-fat/sugar cereal-based products such as biscuits, cakes and pastries (Magarey, 2003, personal communication). Similarly, trend data from the USA indicate that energy intakes from salty snacks, candy, French fries, cheeseburgers and pizza all increased significantly from 1977/1978 through to 1994/1996 for those aged 2 to 18 y (Neilsen *et al*, 2002). The increase in total energy was also significant. What was unexpected was just how high the consumption of noncore foods and beverages was. The AGHE recommends two serves of noncore foods and/or beverages (or 1200 kJ) for children up to 12 y of age. Based on the average energy intake of children aged 5 to 12 y in this study (8478 kJ), the recommended proportion of energy from noncore foods and beverages is 14%. Even for older children where the recommended number of noncore serves is increased to three, these foods and beverages should, at most, contribute 17% of total energy (1800/10 426 kJ from Table 1). Based on our results, the actual contribution of noncore foods and beverages to total energy intake was 41%, 2 to 3 times the recommended levels. It should be noted that we combined food and beverage data for these comparisons as the AGHE does not have separate recommendations for foods and beverages.

Given the high noncore beverage intakes reported in this study, we believe that separate recommendations should be seriously considered. Also, the energy contained in beverages is handled differently by the body than the energy in food. Liquid carbohydrate (carbonated soft drinks) has been shown to promote positive energy balance compared to solid carbohydrate (jelly beans) because the additional energy from the latter was precisely compensated for

(DiMeglio & Mattes, 2000). This may explain why soft drinks have been implicated as an independent risk factor for obesity in children (Ludwig *et al*, 2001), and decreased consumption of soft drinks has been associated with weight loss (James *et al*, 2004). A final reason for separate recommendations for beverages is that current AGHE recommendations are confusing. Milk is included in a food group and the recommendation for water specifically states that *'all fluids, other than alcoholic drinks, [can] contribute to this requirement [for water]'*. A clear distinction is needed between noncore and core beverages so that milk and water are clearly identified as the most appropriate drinks for children.

Our results in relation to weight status were inconsistent. Overweight and obese children did not appear to consume a higher proportion of noncore foods than healthy weight children. Similar findings were observed in a cross-sectional study of adolescents from the US (Bandini *et al*, 1999). Obese adolescents did not consume more calories from high-calorie, low-nutrient dense foods (noncore) than nonobese adolescents. Also, as we found in younger children, both nonobese and obese adolescents consumed a substantial portion of reported energy intake from these high-calorie foods. This US study was able to adjust for under-reporting (Bandini *et al*, 1999). It is well recognised that overweight and obese individuals, including children and adolescents (Fisher *et al*, 2000), under-report energy intake (Livingstone & Robson, 2000) and, in adults, noncore foods are those most likely to be under-reported (Heitmann *et al*, 2000). In our study, younger obese children consumed more energy from noncore beverages than healthy weight children and younger overweight and obese children consumed a greater quantity of food, both core and noncore. One explanation for these findings may be that under-reporting of food intake was more common for older children and among those who were overweight or obese. Under-reporting of beverage intake may not have been as common. We were not able to adjust for under-reporting of particular foods by particular individuals and therefore cannot verify these observations. Also, because the data are cross-sectional we do not know if participants had modified their food and beverage intake in response to their weight. A reduction in noncore, energy dense foods is one of the first dietary changes recommended for managing overweight in childhood (Epstein *et al*, 1998; NHMRC, 2003).

Why do Australian children and adolescents obtain more of their daily energy from noncore foods and beverages than any other age group? Zuppa *et al* (2003) have shown that Australian children receive a particularly high exposure to noncore foods through television advertising. They found that in 63 h of programmes classified as suitable for children's viewing, there were 544 food advertisements. Almost 50% of these were for fast foods, chocolate and confectionary, and overall 79% of advertisements were for noncore foods. Given that Australian children are exposed to a television environment that predominantly promotes noncore foods, it is reasonable to assume that advertising may encourage children to change their own and their parent's food purchasing behaviour. This may partly explain our findings. However, the high intake of noncore foods across all age groups (>30% of food energy) suggests that other factors are also at play. When whole populations have uniformly unhealthy eating behaviours, such as reported here, population approaches to promoting healthy eating are warranted. Regulation of television advertising of noncore foods to all age groups, and particularly to children, should be part of such an approach. Other initiatives designed to promote fruit and vegetable consumption, encourage manufacturers to provide a range of healthy food and beverage options for children and to educate parents and schools on healthy choices for children (State Government Victoria, Department of Education & Training, 2003), should also be taken. Particularly attention should be paid to discouraging excess consumption of noncore beverages (Ludwig *et al*, 2001).

Of all age groups, children are the group that most need support in establishing and maintaining healthy eating patterns (NHMRC & DHA, 2003). Our data suggest that children and adolescents, regardless of weight status, are overconsuming noncore foods and beverages. Consequently, they have eating patterns that fall well short of the recommendations contained in the Australian Guide to Healthy Eating (Smith *et al*, 1998). To improve eating patterns, a comprehensive, population-based approach is needed to raise awareness of what constitutes a healthy diet and to change the environment so that healthy choices are easy choices (Swinburn & Bell, in press). Updating the Australian Guide to Healthy Eating to include separate recommendations for beverages should be considered as an important first step.

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References

Bandini LG, Vu D, Must A, Cyr H, Goldberg A & Dietz WH (1999): Comparison of high-calorie, low-nutrient dense food consumption among obese and non-obese adolescents. *Obes. Res.* **7**, 438–443.

Bell AC & Swinburn BA (2004): What are the key food groups to target for preventing obesity and improving nutrition in schools? *Eur. J. Clin. Nutr.* **58**, 258–263.

Berenson GS, Srinivasan SR & Nicklas TA (1998): Atherosclerosis: a nutritional disease of childhood. *Am. J. Cardiol.* **82**, 22T–29T.

Campbell K & Crawford D (2001): Family food environments as determinants of preschool-aged children's eating behaviours: implications for obesity prevention policy. A review. *Aust. J. Nutr. Diet* **58**, 19–25.

Cole TJ, Belizzi MC, Flegal KM & Dietz WH (2000): Establishing a standard definition for child overweight and obesity worldwide: international survey. *BMJ* **320**, 1240–1243.

Cook P, Rutishauser IHE & Seelig M (2001): *Comparable Data on Food and Nutrient Intake and Physical Measurements from the 1983, 1985 and 1995 National Nutrition Surveys*. Brisbane: Australian Food and Nutrition Monitoring Unit.

Coon KA & Tucker KL (2002): Television and children's consumption patterns. A review of the literature. *Minerva Pediatr.* **54**, 423–436.

Dietz WH (1994): Critical periods in childhood for the development of obesity. *Am. J. Clin. Nutr.* **59**, 955–959.

DiMeglio DP & Mattes RD (2000): Liquid versus solid carbohydrate: effects on food intake and body weight. *Int. J. Obes. Relat. Metab. Disord.* **24**, 794–800.

Epstein LH, Myers MD, Raynor HA & Saelens BE (1998): Treatment of pediatric obesity. *Pediatrics* **101**, 554–570.

Fisher JO, Johnson RK, Lindquist C, Birch L & Goran M (2000): Influence of body composition on the accuracy of reported energy intake in children. *Obes. Res.* **8**, 597–603.

Heitmann BL, Lissner L & Osler M (2000): Do we eat less fat or just report so? *Int. J. Obes. Relat. Metab. Disord.* **24**, 435–442.

James J, Thomas P, Cavan D & Kerr D (2004): Preventing childhood obesity by reducing consumption of carbonated drinks: cluster randomised controlled trial. *BMJ* **328**, 1237–1240.

Kelder SH, Perry CL & Klepp KI (1994): Longitudinal tracking of adolescent smoking, physical activity and food choices and behaviours. *Am. J. Public Health* **84**, 1121–1126.

Kemper HC, Post GB & Twisk JW (1997): Rate of maturation during the teenage years: nutrient intake and physical activity between ages 12 and 22. *Int. J. Sport Nutr.* **7**, 229–240.

Livingstone MBE & Robson PJ (2000): Measurement of dietary intake in children. *Proc. Nutr. Soc.* **59**, 279–293.

Ludwig DS, Peterson KE & Gortmaker SL (2001): Relation between consumption of sugar-sweetened drinks and childhood obesity: a prospective, observational analysis. *Lancet* **357**, 505–508.

Magarey A, Daniels LA & Smith A (2001): Fruit and vegetable intakes of Australians aged 2–18 years: an evaluation of the 1995 National Nutrition Survey data. *Aust. NZ J. Public Health* **25**, 155–161.

McLennan W & Podger A (1995): *National Nutritional Survey User's Guide*. Canberra: ABS.

Must A (1996): Morbidity and mortality associated with elevated body weight in children and adolescents. *Am. J. Clin. Nutr.* **63** (Suppl 3), S445–S447.

Neilsen SJ, Siega-Riz AM & Popkin BM (2002): Trends in energy intake in U.S. between 1977 and 1996: Similar shifts seen across age groups. *Obes. Res.* **10**, 370–378.

NHMRC (2003): *Clinical Practice Guidelines for the Management of Overweight and Obesity in Children and Adolescents*. Canberra: Commonwealth of Australia.

NHMRC & DHA (2003): *Food for Health: Dietary Guidelines for Children and Adolescents in Australia*. Canberra: Commonwealth of Australia.

Smith A, Kellet E & Schmerlaib Y (1998): *The Australian Guide to Healthy Eating*. Canberra: Commonwealth Department of Health and Family Services.

State Government Victoria, Department of Education and Training (2003): Smart eating for parents and schools. Better Health Channel:www.betterhealth.vic.gov.au.January 2003.

Story M (2003): Television and food advertising: an international health threat to children? *Nutr. Diet* **60**, 72–73.

Swinburn BA & Bell AC: A comprehensive approach to obesity prevention. In: *Clinical Obesity and Related Metabolic Disease in Adults and Children*, eds PG Kopelman, I Caterson, W Dietz, Oxford: Blackwell Publishing, in press.

US Department of Agriculture (2000): Agricultural Research Service. Continuing Survey of Food Intake by Individuals, 1994–1996, 1998. CD-ROM.

Zuppa JA, Morton H & Mehta KP (2003): Television food advertising: Counterproductive to children's health? A content analysis using the Australian Guide to Health Eating. *Nutr. Diet* **60**, 78–84.