Original research

Adolescents’ food-related beliefs and behaviours: a cross-sectional study

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Abstract

Objective: To examine differences in food and nutrition-related beliefs, behaviours and concerns across school years in a northern Australian provincial high school population.

Design: A cross-sectional study of high school students using self-administered questionnaires.

Subjects: 902 high school students in years 8, 10, 11 and 12.

Setting: Four of the six private schools in Townsville.

Main outcome measures: Description of the food-related beliefs, attitudes, knowledge and behaviours of high school students.

Statistical analyses: Statistical tests used were summary statistics (mean and standard deviation, median and interquartile range); frequency distributions; chi-square test; chi-square test for trend; Kruskal-Wallis test; and logistic regression (prevalence odds ratio and 95% confidence intervals).

Results: Only 45% of these adolescents had eaten food from all five core food groups (cereals, fruit, vegetables, dairy products and meat) daily during the previous week. Older girls ate dairy products less often than younger girls. Knowledge of minimum core food requirements for adolescent health was poor. The majority of students reported a relationship between negative emotions and food. The major concerns about food were fat, sugar and pesticide content, and the major sources of information about food and nutrition were television, parents and schools, with magazines an important information source for girls.

Conclusion: The intake of fruit, vegetables, dairy products and cereal foods were below recommended dietary intake, and knowledge of requirements of these foods was also low. Dealing with negative emotions may be a more useful weight control measure for some adolescents than providing nutritional advice. A combination of the education and health sectors and the media and food industry would provide a powerful mechanism for promoting healthful eating habits among adolescents. (Nutr Diet 2002;59:244–52)

Key words: adolescents, nutrition, beliefs, behaviours, knowledge, gender differences

Introduction

The incidence of overweight and obesity are increasing among Australian adults, adolescents and children (1–3). Prevention is the most likely way to reverse this trend as treatment of obesity is known to be very difficult (4). Well targeted programs are required to combat the increasing incidence of weight-related diseases in developed countries. Since children, adolescents and adults have different knowledge, beliefs, attitudes and interests at different ages, such programs need to be specific for each group. The best way to prevent overweight is to start early in life as there is a high likelihood that overweight teenagers will become overweight adults (5) with the associated physical (6) and socioeconomic disadvantages (5). Adolescence is a time when many people are beginning to make their own decisions about food intake (7) and to establish their own beliefs. They are highly susceptible to peer pressure (8), are intensely interested in their body image (9) and may take drastic measures to alter it, resulting in further risk of current and future ill health (7).

The increase in weight is probably due to a combination of the ready availability of high fat and high sugar foods, increase in labour saving devices, decrease in incidental activity and more sedentary leisure activities such as viewing television and videos and using computers (6,10). Television also provides considerable nutrition information (which is not always accurate) to school-aged Australian and New Zealand children (11,12) and exposes them to the ‘slim image’ (13) as well as considerable advertising for high fat, high sugar foods (11), which can influence their food choices (14).

Recommended dietary intakes for Australians have been established for nutrients (15) and core foods (16). In a recent national survey the mean intake of nutrients for adolescents has been shown to generally meet the Recommended Dietary Intake (RDI); however, between 10% and 25% of adolescents did not achieve 70% of the RDI for some minerals i.e. calcium, iron, zinc and magnesium (17). Moreover, there are regional differences in food and nutrient intake within Australia (17–19) and the intake of some core foods by adolescents is low (18,20,21).

This baseline data collection was undertaken to examine differences in food and nutrition-related beliefs, behaviours and concerns across a high school population, in a provincial city, in order to develop a nutrition education program specifically targeted for this region which has high levels of overweight (22) and low intakes of some...
core foods (20,23). This information may be relevant to adolescents living in other regional centres in Australia.

Methods

Subjects

The subjects were the same 902 high school students (54.0% male) for whom weight- and shape-related beliefs, behaviours and views about the importance of food have been reported previously (24,25). Briefly, they were students in years 8, 10, 11 and 12 from four of the six private schools in Townsville. The study sample included co-educational and single sex schools, Catholic and non-Catholic schools, and both day students and those attending school as boarders. The study was conducted in 1993. Questionnaires were answered by all students who were in class on the day of testing with no refusals.

Questionnaire

The questionnaire has been described previously (20). The questions related to: food intake (27 questions); food habits (eight questions); food and nutrition-related beliefs (11 questions); attitudes (five questions; Table 3); and concerns (seven questions); sources of information about food and nutrition (eight questions); nutrition knowledge (ten questions); and six questions to provide a demographic description. The questions relating to food intake were ‘how many days did you eat/drink this food last week?’ (response options zero to seven days). The foods listed were: bread; cereal; rice; pasta/noodles/spaghetti; fruit (including dried fruit, fruit juice); green vegetables (cabbage, beans, broccoli, peas, lettuce, cauliflower, etc.); yellow/orange vegetables (pumpkin, corn, carrots); potatoes; milk (plain or flavoured); cheese; 3 or more glasses of water; yoghurt; ice-cream; eggs; chicken; fish (fresh or tinned); meat (e.g. steak, chops, mince, roast); sausages; cakes and biscuits; muesli bars; lollies or chocolates; chips or twists; nuts; soft drink or cordial; fried food (e.g. hot chips, fried fish, fried chicken, dim sims, chicko rolls etc.); and other takeaway food (e.g. hamburgers, pizza, pies, pasties, sausage rolls, hot dogs etc.). The questions on food habits were ‘how many days did you eat/drink this food last week?’ (response options zero to seven days) for: wholemeal or wholegrain foods; low fat milk; add salt to your meals; eat breakfast; eat lunch; eat dinner; eat between meal snacks; and take vitamin pills.

The statements posed on food-related beliefs were: the food I eat plays a role in my overall health; eating fried food is bad for your health; too much fat in the diet may lead to heart disease; most takeaway foods contain a lot of fat; you should not eat the fat on meat; it is better to eat grilled fish than battered fish; most people need to take vitamin and mineral pills; everyone needs to add salt to their food; red meat is bad for you; raw sugar is better for you than white sugar; and carob bars are better for you than chocolate bars (response options strongly disagree/ strongly agree).

The questions on concerns about constituents of and additives to foods were: ‘are you worried about the amount of the following in foods?’—vitamins, sugar, additives, fat, pesticide, salt, and other (response options no/yes; ‘please specify’ for ‘other’). The questions on sources of information on food and nutrition were ‘where do you get information about food and nutrition from?’: your parents; your friends; classes at school; TV; radio; newspapers; magazines; and other (response options no/yes; ‘please specify’ for ‘other’). The questions relating to nutrition knowledge were: ‘is there a minimum amount of food that a teenager needs to eat every day to be healthy?’ (no/yes/don’t know); ‘if your answer was yes then how much is the minimum amount per day?’ for the following—slices of bread; bowls of cereal; pieces of fruit; serves of vegetables; serves of rice or pasta; glasses of milk; serves of meat or fish or chicken or egg; and glasses of fluid. There was a ‘don’t know’ option for the initial part of this question. A further question asked ‘is there anything else that a teenager needs to eat to be healthy?’ (no/yes, if yes please specify).

The questions relating to food intake and food habits were based on questions from the Nutrition Education and Teenagers project (NEAT,26). The questionnaires were administered by teachers and answered anonymously during a single school period. Ethics approval was obtained from the James Cook University Ethics Committee and clearance was obtained from the Queensland Department of Education.

Food consumption frequency in the previous seven days was compared to attempts to lose weight in the previous year using data published elsewhere (20), because we had previously shown a difference among year 8 students and wanted to determine whether this behaviour continued in later school years.

Statistical analysis

Data were analysed using the statistical packages STATA (STATA Corporation, College Station, Texas, version 3.1 1993) and SPSS for Windows (SPSS Inc, Chicago, release 6.1.3 1995). A significance level of 0.05 was adopted a priori.

As the food intake data were skewed, the median and interquartile range (IQR: i.e. 25th- and 75th-percentile) are presented and the variation across school years was analysed using Kruskal-Wallis tests. Composite variables were constructed to measure the number of days during the previous week on which each of the five core foods were consumed: cereal foods (bread, rice, pasta, breakfast cereals); vegetables (green vegetables, yellow vegetables, potato); fruit (fruit, fruit juice), the ‘meat group’ (meat, fish, chicken, eggs, nuts) and dairy products (milk, cheese, yoghurt). Dichotomous variables (eating these core foods on each of the previous seven days or not) were constructed and compared across the school years by chi-square tests for trend. Gender comparisons were by chi-square tests.

Dichotomous variables were constructed for the consumption of all five core foods and for the consumption of three main meals on each of the previous seven days. Prevalence-odds ratios (OR) and 95%-confidence intervals (CI) were calculated to predict the likelihood of eating all core foods each day according to whether subjects ate all three main meals or not. Composite variables were constructed for some of the non-core foods: high fat savoury foods (fried food, other takeaways, chips and twisties); and high fat sweet foods and high sugar foods (cakes and biscuits, lollies and chocolates, soft drinks and cordials).
Differences across school years for concerns about food and nutrition and for sources of information about food and nutrition were analysed using chi-square tests for trend. Comparisons between genders were made using chi-square tests.

Differences in beliefs about food and nutrition across school years were analysed by chi-square tests for trend after generating respective dichotomous variables (agree versus disagree or don’t know) for the original five-point Likert scale variables (strongly agree to strongly disagree). Relationships between negative associations with eating (sometimes I eat because I am bored; I eat more when I feel depressed; I often eat too much and feel guilty; I feel guilty when I eat junk food) and attempting weight loss using data published elsewhere (25) were assessed using chi-square tests. Differences across school years in knowledge of minimum food requirements for health were assessed using chi-square tests for trend.

Results

Participant profile

There were 254 year 8 students (144 males, 110 females) with a mean age (and standard deviation) of 12.9 ± 0.5 years, 254 year 10 students (123 males, 131 females) mean age 15.0 ± 0.7 years, 251 year 11 students (135 males, 116 females) mean age 15.9 ± 0.7 years, and 143 year 12 students (85 males and 58 females) mean age 17.1 ± 0.8 years. The numbers of students answering the questions varied as not all students answered all questions and some questions were answered inappropriately.

Food intake

Overall a higher proportion of girls than boys ate fruit and vegetables on each of the previous seven days, whereas a higher proportion of boys than girls consumed dairy products on each of those days (Table 1). Boys ate breakfast cereal (median = 6, IQR = 3 to 7 days) and drank milk (median = 7, IQR = 6 to 7) on more days than girls (median = 3, IQR = 0 to 6 and median = 7, IQR = 3 to 7, respectively) whereas girls ate fruit (excluding juice) (median = 5, IQR = 3 to 7), green vegetables (median = 7, IQR = 5 to 7), yellow vegetables (median = 5, IQR = 3 to 7) and potatoes (median = 7, IQR = 3 to 7) on more days than boys (median = 4, IQR = 2 to 7; median = 5, IQR = 3 to 7; median = 4, IQR = 2 to 6; and median = 4, IQR = 3 to 6, respectively).

There were few differences across the school years in the number of days during the week that each of the foods were consumed with the major differences being that older females consumed breakfast cereal (P = 0.13), rice (P = 0.001), and pasta (P = 0.006), less often than younger girls.

Overall, 45% of the students had eaten foods from all five core food groups on each day of the previous week, with no significant linear trend across the school years for males. However, the proportion of females who had eaten all these core foods on each of the previous seven days decreased across the school years, with fewer girls in higher than lower school years eating meat and dairy products daily (Table 1). More females than males had consumed fruit, fruit juice and vegetables on each of the preceding seven days and more males than females had consumed dairy products on those days. More students had drunk fruit juice than had eaten fruit on each of the previous seven days (Table 1).

Boys were more likely to consume non-core food than girls (Table 2). Boys ate high fat savoury foods more often than girls (males: median = 6, IQR = 3 to 9 times, females: median = 4, IQR = 2 to 7 times, P < 0.001). Younger girls ate these foods more often than older girls (P = 0.023) but there were no significant differences across school years in the frequency of consumption of these foods by boys. Boys also ate high fat sweet foods and high sugar foods more often than girls (males: median = 9, IQR = 6 to 13 times, females: median = 5, IQR = 5 to 12 times, P = 0.006). Younger girls ate these foods more often than older girls (P = 0.005), but there were no significant differences across school years in consumption of these foods by boys.

The median intake of wholemeal or wholegrain foods by these students was: males two days (IQR = 0 to 4); females two days (IQR = 1 to 5) (P = 0.010). More boys than girls had not eaten these products at all during the previous week (males 34.39% females 24.76%; P = 0.002) and 15.9% had eaten them on all seven days of the previous week. The median intake of low fat milk by these students was two days (IQR = 0 to 2) with 66% having none during the week and 15.5% consuming low fat milk on all seven days of the previous week. These students added salt to their meals on a median of two days (IQR = 0 to 5) during the previous week with 36.6% not adding it to meals at all and 19.6% adding it daily.

More boys than girls had eaten breakfast on each of the previous seven days (boys 73.6%, girls 63.6%: P = 0.001) with significant differences for frequency of consumption of breakfast across school years. More boys than girls had eaten three main meals on each of the previous seven days (males 63.8%, females 50.6%: P < 0.001) with no significant differences across school years for either boys or girls and 73.6% of the students had eaten three main meals on five days of the previous week. Students who ate breakfast, lunch and dinner every day were more likely to have eaten all five core foods on each of the previous seven days than students who did not eat three main meals per day (Odds Ratio, OR = 1.83, CI = 1.37 to 2.46, n = 765).

Beliefs about food and nutrition

Almost 90% of the students believed that food was important to their health with more boys in higher than lower school years holding this belief (82% in year 8, 86% in year 10, 88% in year 11, 95% in year 12; P = 0.005). An average of 91% of girls held this belief, with no significant differences across school years.

Many of the beliefs about food relating to fat, sugar and salt did not change across the school years. More than three quarters of the students believed that dietary fat is bad for health and could identify some of the sources. Few students believed common myths about vitamins, salt and red meat, while almost 40% did believe that raw sugar and carob ‘are better for you’ than white sugar and chocolate respectively, with around 50% being unsure. There were no significant differences for these beliefs across school years. Only 19% of students believed vitamin tablets were
Table 1. Percentage of students who consumed core foods on each day during the week prior to the study

<table>
<thead>
<tr>
<th>Core food</th>
<th>Sex</th>
<th>n&lt;sup&gt;(a)&lt;/sup&gt;</th>
<th>Year 8 (%)</th>
<th>Year 10 (%)</th>
<th>Year 11 (%)</th>
<th>Year 12 (%)</th>
<th>Total (%)</th>
<th>Pyear&lt;sup&gt;(b)&lt;/sup&gt;</th>
<th>Pgender&lt;sup&gt;(c)&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cereal group&lt;sup&gt;(d)&lt;/sup&gt;</td>
<td>M</td>
<td>480</td>
<td>92.9</td>
<td>98.3</td>
<td>93.7</td>
<td>93.8</td>
<td>94.7</td>
<td>0.788</td>
<td>0.071</td>
</tr>
<tr>
<td></td>
<td>F</td>
<td>406</td>
<td>94.2</td>
<td>92.0</td>
<td>87.7</td>
<td>92.6</td>
<td>91.5</td>
<td>0.263</td>
<td></td>
</tr>
<tr>
<td>Fruit group&lt;sup&gt;(e)&lt;/sup&gt;</td>
<td>M</td>
<td>479</td>
<td>61.2</td>
<td>76.0</td>
<td>63.9</td>
<td>63.9</td>
<td>66.2</td>
<td>0.666</td>
<td>&gt; 0.001</td>
</tr>
<tr>
<td></td>
<td>F</td>
<td>407</td>
<td>78.3</td>
<td>77.5</td>
<td>73.0</td>
<td>81.5</td>
<td>77.0</td>
<td>0.836</td>
<td></td>
</tr>
<tr>
<td>Vegetable group&lt;sup&gt;(f)&lt;/sup&gt;</td>
<td>M</td>
<td>472</td>
<td>82.1</td>
<td>89.2</td>
<td>86.4</td>
<td>90.5</td>
<td>86.6</td>
<td>0.090</td>
<td>&gt; 0.001</td>
</tr>
<tr>
<td></td>
<td>F</td>
<td>401</td>
<td>93.4</td>
<td>96.9</td>
<td>92.1</td>
<td>94.8</td>
<td>94.4</td>
<td>0.998</td>
<td></td>
</tr>
<tr>
<td>Dairy group&lt;sup&gt;(g)&lt;/sup&gt;</td>
<td>M</td>
<td>467</td>
<td>83.0</td>
<td>87.6</td>
<td>85.4</td>
<td>85.4</td>
<td>85.3</td>
<td>0.560</td>
<td>&gt; 0.001</td>
</tr>
<tr>
<td></td>
<td>F</td>
<td>406</td>
<td>85.1</td>
<td>76.4</td>
<td>69.3</td>
<td>65.5</td>
<td>75.1</td>
<td>0.002</td>
<td></td>
</tr>
<tr>
<td>Meat group&lt;sup&gt;(h)&lt;/sup&gt;</td>
<td>M</td>
<td>472</td>
<td>74.0</td>
<td>88.4</td>
<td>80.6</td>
<td>75.0</td>
<td>79.7</td>
<td>0.537</td>
<td>0.059</td>
</tr>
<tr>
<td></td>
<td>F</td>
<td>405</td>
<td>81.9</td>
<td>75.2</td>
<td>72.9</td>
<td>60.3</td>
<td>74.2</td>
<td>0.005</td>
<td></td>
</tr>
<tr>
<td>All 5 core foods</td>
<td>M</td>
<td>477</td>
<td>32.1</td>
<td>56.7</td>
<td>44.5</td>
<td>47.4</td>
<td>44.9</td>
<td>0.031</td>
<td>0.845</td>
</tr>
<tr>
<td></td>
<td>F</td>
<td>411</td>
<td>55.2</td>
<td>50.9</td>
<td>36.1</td>
<td>33.3</td>
<td>45.6</td>
<td>0.002</td>
<td></td>
</tr>
<tr>
<td>Fruit (including dried)</td>
<td>M</td>
<td>476</td>
<td>26.3</td>
<td>40.2</td>
<td>23.1</td>
<td>20.5</td>
<td>28.0</td>
<td>0.321</td>
<td>0.016</td>
</tr>
<tr>
<td>fruit, excluding juice</td>
<td>F</td>
<td>412</td>
<td>36.1</td>
<td>36.4</td>
<td>36.9</td>
<td>29.8</td>
<td>35.6</td>
<td>0.641</td>
<td></td>
</tr>
<tr>
<td>All core foods, but</td>
<td>M</td>
<td>476</td>
<td>18.9</td>
<td>32.4</td>
<td>16.8</td>
<td>21.8</td>
<td>22.3</td>
<td>0.987</td>
<td>0.893</td>
</tr>
<tr>
<td>excluding fruit juice</td>
<td>F</td>
<td>408</td>
<td>29.6</td>
<td>22.9</td>
<td>19.6</td>
<td>15.1</td>
<td>22.7</td>
<td>0.027</td>
<td></td>
</tr>
</tbody>
</table>

(a) Number of students who answered the question.
(b) Pyear: significance testing for changes across school years by chi-square test.
(c) Pgender: significance testing for gender differences by the chi-square test.
(d) Cereal group includes: bread, cereal, rice, pasta.
(e) Fruit group includes: fruit (including dried fruit), fruit juice.
(f) Vegetable group includes: green vegetables, yellow/orange vegetables, potatoes.
(g) Dairy group includes: milk (plain or flavoured), cheese, yoghurt.
(h) Meat group includes: meat, fish, chicken, eggs, nuts.

Table 2. Intake of some non-core foods across school years, presented as median (and interquartile range) of the number of days during the previous week on which the food or drink was consumed

<table>
<thead>
<tr>
<th>Food or drink</th>
<th>Sex</th>
<th>n&lt;sup&gt;(a,b,c)&lt;/sup&gt;</th>
<th>Year 8 days/week</th>
<th>Year 10 days/week</th>
<th>Year 11 days/week</th>
<th>Year 12 days/week</th>
<th>Total days/week</th>
<th>Pyear&lt;sup&gt;(d)&lt;/sup&gt;</th>
<th>Pgender&lt;sup&gt;(e)&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soft drinks</td>
<td>M</td>
<td>478</td>
<td>4(2–7)</td>
<td>5(3–7)</td>
<td>5(3–7)</td>
<td>4(2–7)</td>
<td>4(3–7)</td>
<td>0.036</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Ice-cream</td>
<td>F</td>
<td>412</td>
<td>3(1–5)</td>
<td>3(2–6)</td>
<td>3(1–6)</td>
<td>2(0–3)</td>
<td>3(1–5)</td>
<td>0.002</td>
<td></td>
</tr>
<tr>
<td>Muesli bars</td>
<td>M</td>
<td>471</td>
<td>0(0–0)</td>
<td>0(0–3)</td>
<td>0(0–3)</td>
<td>0(0–3)</td>
<td>0(0–3)</td>
<td>0.886</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Lollies or chocolates</td>
<td>M</td>
<td>474</td>
<td>3(1–5)</td>
<td>2(1–4)</td>
<td>2(1–4)</td>
<td>2(0–3)</td>
<td>2(1–4)</td>
<td>0.016</td>
<td>0.574</td>
</tr>
<tr>
<td>Cakes and biscuits</td>
<td>F</td>
<td>412</td>
<td>3(1–5)</td>
<td>3(1–4)</td>
<td>3(2–4)</td>
<td>3(1–4)</td>
<td>3(1–4)</td>
<td>0.29</td>
<td>0.033</td>
</tr>
<tr>
<td>Chips or twisties</td>
<td>M</td>
<td>472</td>
<td>2(1–4)</td>
<td>3(1–4)</td>
<td>3(1–4)</td>
<td>3(1–4)</td>
<td>2(1–4)</td>
<td>0.075</td>
<td></td>
</tr>
<tr>
<td>Sausages</td>
<td>M</td>
<td>471</td>
<td>1(0–2)</td>
<td>1(0–2)</td>
<td>1(0–2)</td>
<td>1(0–2)</td>
<td>1(0–2)</td>
<td>0.795</td>
<td>0.063</td>
</tr>
<tr>
<td>Fried food&lt;sup&gt;(f)&lt;/sup&gt;</td>
<td>M</td>
<td>481</td>
<td>2(1–4)</td>
<td>2(1–3)</td>
<td>2(1–3)</td>
<td>2(1–3)</td>
<td>2(1–3)</td>
<td>0.579</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Other takeaways&lt;sup&gt;(f)&lt;/sup&gt;</td>
<td>M</td>
<td>480</td>
<td>1(1–3)</td>
<td>1(1–3)</td>
<td>2(1–3)</td>
<td>2(1–3)</td>
<td>2(1–3)</td>
<td>0.311</td>
<td>&lt; 0.001</td>
</tr>
</tbody>
</table>

(a) Number of students who answered the question.
(b) n(males) year 8, 137–9; year 10, 119–22; year 11, 130–3; year 12, 83–5.
(c) n(females) year 8, 107–10; year 10, 128–31; year 11, 111–6; year 12, 56–8.
(d) Pyear: significance testing for changes across school years by Kruskal-Wallis test.
(e) Pgender: significance testing for gender differences by the Wilcoxon ranksum test.
(f) Fried foods include: hot chips, fried fish, fried chicken, dim sims, chicko rolls etc.
(g) Other takeaways include: hamburgers, pizza, pies, pasties, sausage rolls, hot dogs etc.
necessary, with fewer students in higher than lower school years holding these beliefs (32% year 8, 15% year 12; \( P < 0.001 \)); overall, 48% of the students disagreed with the statement while a consistent 32% were unsure. Although only 15% of year 12 students believed that most people need to take vitamin tablets, 34% reported taking them during the previous week.

**Food-related attitudes**

The majority of the students reported trying to choose healthy food, with more females in higher school years than lower school years reporting this practice (Table 3). A higher proportion of students who reported trying to select foods they knew were good for them, compared to those who did not, had eaten all five core foods daily (males: 52.9% vs 35.0%, \( P < 0.001 \); females: 49.8% vs 34.0%; \( P = 0.008 \)). More of these students consumed fruit juice daily (males: 71.5% vs 59.2%, \( P = 0.006 \); females: 79.6% vs 70.0%; \( P = 0.042 \)). More girls, but not boys, who tried to select healthy food, had consumed fruit excluding juice daily (39.9% vs 23.4%; \( P = 0.002 \)), whereas more of the boys, but not the girls, consumed vegetables daily (92.6% vs 80.2%; \( P < 0.001 \)). There was no difference for the daily consumption of cereals, meat or dairy foods for either boys or girls. Students who reported trying to select healthy foods were also likely to eat high fat savoury foods (males OR = 0.67, CI = 0.46, 0.98, \( n = 441 \); females OR = 0.54, CI = 0.33, 0.86, \( n = 400 \)) and high sugar foods (males OR = 0.64, CI = 0.49, 0.83, \( n = 455 \); females OR = 0.67, CI = 0.50, 0.89, \( n = 406 \)) less often than students who did not try to eat well.

Females were more likely than males to report negative associations between food and emotions (Table 3). More than half the students (males 60%, females 80%) reported eating from boredom, with this behaviour being more prevalent in the higher school years. Eating in response to depression was reported by 25% of the males and 53% of the females, with more females in higher school years than lower school years exhibiting this behaviour. A feeling of guilt was associated with eating junk food and eating too much by half the females and a fifth of the males, although these feelings decreased across the school years for males to 11% while increasing across the school years for females to 66% (Table 3). Overall 70% of all boys and 94% of all girls reported eating more when depressed; eating from boredom; or associating guilt with eating with no significant differences across school years.

**Table 3. Food-related attitudes of North Queensland adolescents; presented as percentage of adolescents who agreed with the statements**

<table>
<thead>
<tr>
<th>Question</th>
<th>Sex</th>
<th>( n^{(a)(b)(c)} )</th>
<th>Year 8 (%)</th>
<th>Year 10 (%)</th>
<th>Year 11 (%)</th>
<th>Year 12 (%)</th>
<th>( P ) within gender( ^{(d)(e)} )</th>
<th>Total (%)</th>
<th>( P ) between genders( ^{(f)} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>I try to select foods that I know are good for me</td>
<td>M</td>
<td>479</td>
<td>53.3</td>
<td>54.5</td>
<td>54.5</td>
<td>63.5</td>
<td>0.25</td>
<td>55.7</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td></td>
<td>F</td>
<td>414</td>
<td>64.6</td>
<td>75.4</td>
<td>74.6</td>
<td>68.2</td>
<td>0.004( \uparrow )</td>
<td>73.0</td>
<td></td>
</tr>
<tr>
<td>Sometimes I eat because I am bored</td>
<td>M</td>
<td>482</td>
<td>46.8</td>
<td>65.9</td>
<td>61.5</td>
<td>68.2</td>
<td>&lt; 0.001( \uparrow )</td>
<td>59.5</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td></td>
<td>F</td>
<td>415</td>
<td>72.7</td>
<td>78.6</td>
<td>83.6</td>
<td>87.9</td>
<td>0.009( \uparrow )</td>
<td>79.8</td>
<td></td>
</tr>
<tr>
<td>I eat more when I feel depressed</td>
<td>M</td>
<td>479</td>
<td>20.3</td>
<td>25.4</td>
<td>28.4</td>
<td>29.4</td>
<td>0.075</td>
<td>25.5</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td></td>
<td>F</td>
<td>414</td>
<td>41.3</td>
<td>51.9</td>
<td>59.5</td>
<td>65.5</td>
<td>&lt; 0.001( \uparrow )</td>
<td>53.1</td>
<td></td>
</tr>
<tr>
<td>I often eat too much and feel guilty</td>
<td>M</td>
<td>480</td>
<td>25.9</td>
<td>17.9</td>
<td>19.6</td>
<td>10.6</td>
<td>0.01( \downarrow )</td>
<td>19.4</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td></td>
<td>F</td>
<td>414</td>
<td>45.9</td>
<td>58.8</td>
<td>62.1</td>
<td>65.5</td>
<td>0.004( \uparrow )</td>
<td>57.3</td>
<td></td>
</tr>
<tr>
<td>I feel guilty when I eat junk food</td>
<td>M</td>
<td>482</td>
<td>18.7</td>
<td>23.6</td>
<td>15.6</td>
<td>21.2</td>
<td>0.983</td>
<td>19.5</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td></td>
<td>F</td>
<td>412</td>
<td>45.5</td>
<td>47.7</td>
<td>72.2</td>
<td>59.7</td>
<td>0.001( \uparrow )</td>
<td>55.6</td>
<td></td>
</tr>
</tbody>
</table>

(a) Number of students who answered the question.
(b) At least 137 males in year 8; 121 males in year 10; 132 males in year 11; and 84 males in year 12 answered these questions.
(c) At least 108 females in year 8; 129 females in year 10; 115 females in year 11; and 57 females in year 12 answered these questions.
(d) \( P \) values within gender are results of chi-square tests for trend.
(e) Arrows indicate direction of trend.
(f) \( P \) values between genders are results of chi-square tests.

Students who had attempted weight loss during the previous year had consumed bread (\( P = 0.01 \)), cereal (\( P < 0.001 \)), pasta (\( P = 0.004 \)), milk (\( P < 0.001 \)), ice-cream (\( P < 0.001 \)), eggs (\( P = 0.034 \)), meat (\( P < 0.001 \)), cakes and biscuits (\( P < 0.001 \)), muesli bars (\( P = 0.002 \)), chips and twisties (\( P = 0.003 \)), soft drinks and cordials (\( P < 0.001 \)), fried foods (\( P = 0.002 \)), and other takeaway foods (\( P < 0.001 \)) less often and yellow vegetables (\( P = 0.044 \)) and low fat milk (\( P < 0.001 \)) more often than students who had not tried to lose weight. There was no significant difference in the proportion of those who had consumed all five core foods each day according to whether or not they had tried to lose weight. However, fewer students who had attempted weight loss had eaten dairy foods (\( P < 0.001 \)), and the ‘meat group’ on each of the previous seven days, when compared to students who had not tried to lose weight. Vitamin supplements were taken by 31% of the students during the previous week with no significant difference between genders.

There were significant differences in attitudes for both boys and girls according to whether they had attempted weight loss (WL) or not (non-WL). WL subjects were more likely to report: ‘sometimes eating when bored’ than...
non-WL subjects (males: WL 73%, non-WL 56%, P = 0.001; females: WL 83%, non-WL 73%, P = 0.012); ‘eating more when depressed’ (males: WL 42%, non-WL 20%, P < 0.001; females WL 57%, non-WL 45%; P = 0.014); ‘often eating too much and feeling guilty’ (males: WL 41%, non-WL 13%, P < 0.001; females: WL 70%, non-WL 33%, P < 0.001); and ‘feeling guilty when eating junk food’ (males: WL 40%, non-WL 12%, P < 0.001; females: WL 64%, non-WL 38%, P < 0.001).

WL subjects were more likely than non-WL subjects to report: eating more when depressed; eating from boredom; or associating guilt with eating (males: WL 85%, non-WL 66%, P < 0.001; females: WL 97%, non-WL 88%, P = 0.001).

Concerns about food

Concerns about both nutritive and non-nutritive constituents of food changed little across the school years. An equal proportion of males (56%) were concerned about the fat and pesticides in food, followed closely by sugar (41%), additives (41%) and salt (39%). The males were less concerned about the amount of vitamins in food than about the other constituents (18%). Among females, the greatest concerns were about fat (88%) and sugar (76%), followed by pesticides (70%), salt (67%) and additives (61%). Concern about the additives in food increased for females from 53% in year 8 to 67% in year 12 (P = 0.041). As with the males, fewer females were concerned about the vitamins in food (23%) than about the other specified compounds. Significantly more females than males were concerned about the amount of all the food constituents except vitamins (P < 0.001).

Sources of information about food and nutrition

The major sources of information about food and nutrition for these students were television (males 83%, females 79%; P = 0.076), parents (males 67%, females 80%; P < 0.001), school classes (males 57%, females 74%; P < 0.001), magazines (males 37%, females 72%; P < 0.001) and friends (males 21%, females 56%; P < 0.001). Further information was derived from newspapers (males 22%, females 18%; P = 0.186) and radio (males 18%, females 13%; P = 0.045).

Magazines were a source of such information for an increasing proportion of both males (27% year 8, 39% year 10, 43% year 11, 43% year 12; P = 0.004) and females (67% year 8, 71% year 10, 75% year 11, 81% year 12; P = 0.042), while parents provided such information to a decreasing proportion of students from year 8 to year 12 (males: 78% year 8, 73% year 10, 59% year 11, 51% year 12, P < 0.001; females: 93% year 8, 74% year 10, 77% year 11, 78% year 12, P = 0.002). In contrast, school classes provided information for an increasing proportion of males (49% year 8, 60% year 10, 60% year 11, 62% year 12, P = 0.029) but a decreasing proportion of females (90% year 8, 82% year 10, 62% year 11, 51% year 12, P < 0.001) from year 8 to year 12. Friends provided such information to an increasing proportion of females (37% year 8, 52% year 10, 73% year 11, 66% year 12, P < 0.001) but not males from year 8 to year 12.

Knowledge of minimum food requirement for health

Only 195 of the 460 boys (42%) and 232 of the 411 girls (56%) who answered the question reported that there was a minimum daily food requirement for adolescents. However, of these, only 90 boys (18.48% of all boys) and 142 girls (34.22% of all girls) reported knowing how many serves of core foods were required, with many of them giving incorrect answers (Table 4). Not one student correctly identified the minimum daily requirement of all five core foods, while only 6% of students correctly identified the minimum daily requirement of any four core foods.

There was an increase across school years in the proportion of boys, but not girls who reported that there was a minimum food requirement. Nevertheless, by year 12, only 61% of the students (54% of males, 71% of females) provided this information. There was also an increase across school years in the proportion of males, but not females, who reported knowing the quantities of core foods required for health. By year 12, only a third of the students (25% males, 43% females) reported they had this knowledge. However, there were no significant trends

| Table 4. Students’ knowledge of the minimum daily requirements of core foods: presented as number (percentage) of those who reported that there was a minimum daily food requirement$^{(a)}$ and correctly identified the minimum number of serves of core foods required$^{(b)}$ |
|---------------------------------|---------------|----------------|---------------|----------------|
| **Food group**                  | **Sex**       | **n$^{(c)}$**  | **Total (%)** | **Pgender$^{(d)}$** |
| Cereal foods                    | M             | 76             | 34 (44.7)     | 0.009          | 0.456          |
|                                 | F             | 133            | 36 (27.1)     |                | 0.095          |
| Fruit                           | M             | 80             | 41 (51.3)     | 0.008          | 0.557          |
|                                 | F             | 137            | 95 (69.3)     |                | 0.375          |
| Vegetables                      | M             | 79             | 3 (3.8)       | 0.366          | 0.135          |
|                                 | F             | 133            | 9 (6.8)       |                | 0.658          |
| Dairy products                  | M             | 81             | 22 (27.2)     | 0.009          | 0.549          |
|                                 | F             | 138            | 62 (44.9)     |                | 0.230          |
| Meat group                      | M             | 79             | 54 (68.4)     | 0.975          | 0.661          |
|                                 | F             | 135            | 92 (68.2)     |                | 0.738          |

(a) 195 of 460 boys (42%) and 232 of 411 girls (56%) who answered the question, considered there was a minimum daily food requirement for adolescents. Of these, 90 boys and 142 girls reported knowing the number of serves of core foods required.

(b) No students provided the correct minimum daily requirements for teenagers for all five food groups.

(c) Number of students who answered the question (of the 90 boys and 142 girls who could have answered these questions).

(d) P values within gender are results of chi-square tests for trend.

(e) P values between genders are results of chi-square tests.
across school years in the knowledge of core food requirements among either girls or boys.

Discussion

This study examined the food and nutrition-related beliefs, attitudes, concerns, knowledge and behaviours of Townsville adolescents. The food intake of the majority of these students did not meet Australian dietary recommendations (16). Less than half (45%) of these adolescents had eaten food from all five core food groups (cereals, fruit, vegetables, dairy products and the meat group) on every day in the previous week, and the proportion was much lower (22%) if fruit juice was excluded. However, many of them had consumed non-core foods frequently. Such eating habits may increase the future risk of a number of diseases including osteoporosis, heart disease, some cancers, obesity and the associated non-insulin dependent diabetes, constipation, and diverticular disease (27). In contrast to the boys, where more in higher than lower school years ate food from all the core food groups daily, fewer girls in higher than lower school years did so. This may reflect both the gender difference in age of growth spurts and growth, and the tendency for girls to become concerned about their weight as they mature.

The frequency of consumption of dairy products may be underestimated in this study as custard was not included in the questionnaire, however, the overall intake of dairy products among girls is of concern with only 75% consuming them daily. Furthermore, there was a steady decrease in the proportion consuming this food group daily from year 8 to year 12. These are foods the public (7,36,37) and adolescents (38) often believe to be fattening and students who had attempted weight loss during the previous year had consumed dairy foods less often than students who had not tried to lose weight. It is possible to achieve the RDI for calcium (15) without consuming dairy products, but this is unlikely in the Australian food context. Hence many of these adolescent girls are unlikely to achieve their peak bone mass thus increasing their risk of future osteoporosis (41). While 28% of these students did not consume the fruit group daily during the previous week, the proportion rose to 68% for fruit, when juice was excluded. The tendency for these students to consume fruit juice rather than fruit, will maintain their carbohydrate and vitamin intake, but may compromise their fibre intake and result in an increase in energy intake.

Studies in Queensland and Tasmania have found that the food adolescents eat is influenced by: liking and taste; smell; mood especially among girls; convenience especially among boys (26,31); what their peers (26) and the adults in their household (26,31) are eating; media advertising (14,26); and the desire to manipulate their body shape (26,32,33). Two recent overseas studies have examined influences on food intake (34,35), however, further studies are needed to explore the reasons why such a small proportion of adolescents regularly eat core foods.

These data support the results of earlier studies showing that adolescents who try to lose weight consume fewer dairy products (32,39) and bread (32,40) and that those striving for slimmness have a lower calcium intake (33) than those who do not. The promotion of core foods as ‘diet foods’, may be advantageous to both the manufacturers and the population. Alternatively, health authorities could promote ‘eating well’ as the most effective ‘diet’ for weight loss.

Students who ate three main meals on all seven days prior to the survey were more likely to eat all five core foods daily than students who did not. Skipping meals and frequent snacking are acknowledged to be common teenage behaviour (28,29), and many Australian adolescents have been shown to regularly skip breakfast (30). Nevertheless, these data suggest that continuing to encourage adolescents to eat three main meals per day may improve their intake of core foods. The food industry could also be encouraged to promote core foods as desirable snacks.

While about half of these adolescents reported that there is a minimum food intake required for health, only about a quarter (18% males, 34% females) reported knowing the quantities of core foods required. However, many of these did not correctly identify core food requirements and not one student correctly identified the minimum intake for all five core foods. While it is well known that knowledge about personal behaviour required for health, especially long-term health, does not necessarily lead to the desired behaviour (42), health promoting behaviour is unlikely to occur by chance in a society in which it is not the norm. Knowledge of core food requirements is specialised knowledge, and cannot be acquired by accident or by superficial teaching. A deeper understanding or internalisation of information is required to not only acquire the information, but to also act on it (43). The education system is ideally positioned to provide such knowledge and understanding which should target the lack of knowledge of required food intake, and discussions of food-related beliefs and common myths about food and nutrition.

More than three quarters of these adolescents associated food with negative emotions confirming the previous reports of associations between eating and guilt, depression and boredom among year 8 school children from North Queensland (20,32) and extending the data to older adolescents. The proportion of students reporting such associations was higher among girls than boys (at every age) and appeared to increase with age, particularly among girls.

An association between eating and depression or negative emotions is recognised in the clinical literature in obese individuals (44), especially binge eaters (45), and those with eating disorders (46). The emotional turbulence of adolescence may result in adolescents having a lower tolerance to these negative emotions than adults. Nevertheless, they do report eating more in association with these feelings. As stress and anxiety levels rise (47) in affluent societies which have ready access to food, it may become increasingly difficult to moderate the food intake in a population which turns to food for comfort and nurturing. These are important issues which should be addressed early in the high school years in an attempt to prevent such associations becoming lifelong habits. Furthermore, in the clinical setting, adolescence may be a time when dealing with negative emotions is a more appropriate method of weight control than an emphasis on food restriction.

Television, parents, schools and magazines were the major sources of nutrition information for these adolescents, with television providing such information to the
largest proportion of the students overall. Together with the increasing influence of magazines from year 8 to year 12, this suggests an important role for the media in nutrition education for adolescents. Television and magazines have been shown to affect the nutritional knowledge of adolescents (48); their food choices (14) and their body image (49). For example, a Western Australian study found a negative correlation between hours spent watching television and nutrition knowledge (48). This may reflect the quality of nutrition information presented on television, such as advertisements for non-core foods (11,50). Nutrition information in the media is usually as advertisements, news, articles on weight loss or gain and documentaries. Such information is not always appropriate (11,51), and may be confusing or difficult to interpret because it is new, controversial or over-simplified. There is the potential for a major role for the media in disseminating accurate nutrition information which will reach a wide adolescent audience. A substantial effort should be made to ensure that such information is correct, and that core foods, rather than non-core foods, are promoted. Thus, partnerships between the health and education sectors and the media could have a positive effect on the long-term health of the population.

The results of this study cannot be extrapolated to all Australian adolescents. The population sample included only students from private schools in a regional area and was conducted in the early 1990s. Although a Tasmanian study in the 1980s showed substantial differences between the food intake of adolescents from private and public schools (50), we did not find many differences in the frequency of consumption of core foods among year 8 students from public and private schools in the local region (unpublished data). A further limitation of this study was that the dietary intake questions used were based on an instrument designed to measure changes in dietary intake following a nutrition education program and not to quantify dietary intake (26). Furthermore, some subjects may not have included all vegetables in their responses (such as eggplant and tomatoes), and there were no questions on custard for inclusion in the dairy group or legumes for inclusion in the group of meat and meat alternatives. Nevertheless, these food intake questions provide a reasonable estimate of the frequency of intake of the foods and food groups assessed, although not of the quantity consumed. The instrument used was not validated and the socioeconomic data collected could not be used because many of the answers were ambiguous.

Conclusion

Fewer than half of these adolescents consumed all five core foods daily during the period of the study and their knowledge about the minimum requirements for these foods was poor. Future research should examine why so many adolescents do not eat core foods regularly and why associating negative emotions with eating is so prevalent. Mechanisms should be developed to increase the intake of core foods. These students were also confused about many of the nutrition myths which pervade our society. A deeper understanding of nutritional issues and thorough exploration of common myths could be undertaken during school nutrition classes to educate students, and in the media to educate their parents who are also a major source of their nutrition information. Television, parents, schools and magazines are the major sources of nutrition information for these students thus providing an opportunity for the media and schools to contribute substantially to the health of the nation. This partnership for health must also include the food industries which can help by effectively promoting core foods to young people.

Acknowledgments

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References

Adolescents’ food-related beliefs and behaviours


