

Original Article

Food intake patterns among Australian adolescents

Gayle S Savige PhD, Kylie Ball PhD, Anthony Worsley PhD and David Crawford PhD

Centre for Physical Activity and Nutrition Research, School of Exercise and Nutrition Sciences, Deakin University, Australia

Objectives: This study aimed to evaluate the food intake patterns of adolescents with respect to the Australian Guide to Healthy Eating, and to examine variations in food intake patterns by age, gender and region of residence. **Design:** Cross-sectional online food survey administered through schools. **Participants and setting:** In 2004-2005, 3841 secondary students in years seven (12-13 years) and nine (14-15 years) drawn from 37 secondary schools in Victoria, Australia completed an online food intake patterns survey. **Outcome measures:** Food intake was measured by a Food Frequency Questionnaire (FFQ), and categorized according to the five basic food groups (fruit, vegetables, meat, dairy, cereal) and the 'extra' food group as defined by the Australian Guide to Healthy Eating (AGHE). The foods groups were examined in the study population and compared across age, gender and region. **Results:** Many adolescents in this sample reported food intakes that deviated substantially from recommendations of the AGHE. For example, two-thirds of participants failed to consume foods from the five recommended food groups daily; over a third reported eating fruit 'rarely or never'; and 22% reported eating fast foods every day. Food intakes were generally more in line with dietary guidelines among girls than boys. Regional differences were less consistent, and there were few differences by age. **Conclusion:** A significant proportion of adolescents have food intakes that fall short of the recommendations outlined in the Australian Guide to Healthy Eating. This highlights the need for public health initiatives to promote healthier food intake patterns among adolescents.

Key Words: adolescent, diet, food intake, nutrition, rural, urban, Australia

INTRODUCTION

Adolescence is an important growth and development period which has implications for future nutrition status and food consumption habits.¹ During this period an adolescent's body size will grow by 15 per cent.² This brings about increased demand for energy and for a number of micronutrients such as iron and calcium. The increase in energy and nutritional requirements also coincides with the growing autonomy of adolescents to make their own decisions about the foods and beverages they consume.

Whilst there is evidence that food intake patterns are established before adolescence,³ they may also change substantially during adolescence and these modified food patterns, if unhealthy, are likely to influence health and disease risk in later life.⁴ Viner and Barker (2005) have shown that the health outcomes of adults appear to be more strongly associated with adolescent risk factors than those found in childhood. For example, the risk of being obese in adulthood is more likely if obesity was a risk factor in adolescence than if it was a risk factor in childhood.⁵ In Australia, the risk of being obese as an adolescent has increased at a rapid rate in recent years.⁶ Obesity in adolescence may be associated with psychological problems such as poor self-esteem and social isolation⁷ as well as metabolic complications such as hypertension⁸ and insulin resistance.⁶ If obesity tracks into adulthood as previously indicated, the health problems associated with obesity are likely to worsen. For example, insulin resistance in the presence of obesity may develop into type 2 diabetes mellitus.⁶

Limited evidence suggests that the food intake patterns of many adolescents are unhealthy, since their diets often lack nutritious foods like fruit and vegetables and include a disproportionate amount of energy-dense foods (fatty snacks and soft drinks). Results from the Australian National Nutrition Survey (conducted in 1995) found that fruit consumption decreased from childhood to adolescence⁹ and that about 50% of all teenagers had consumed soft drink on the day prior to the survey.¹⁰ Similar findings have been observed among adolescents in the USA¹¹ UK¹² and Europe.¹³

The food intake patterns of adolescents also tend to differ according to gender. In the World Health Organization's HBSC study, girls tended to eat more fruit and vegetables and consume less soft drink than did boys.¹³ In Australia, the 1995 National Nutrition Survey found that adolescent girls had a higher mean daily intake of fruits compared with males of the same age,¹⁴ and that boys tended to consume more soft drink than girls, with older boys (16-18 years) drinking twice as much soft drink as

Corresponding Author: Professor David Crawford, Centre for Physical Activity and Nutrition Research, School of Exercise and Nutrition Sciences, Deakin University, 221 Burwood Highway, Burwood 3125 Australia

Tel: + 61 3 924 46616; Fax: + 61 3 9244-6017

Email: david.crawford@deakin.edu.au

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their female counterparts.¹⁰ Conversely, adolescent boys seem to have healthier food patterns in terms of other food related behaviours. For example, in the HBSC study and in the 1995 National Nutrition Survey of Australians, adolescent boys were more likely to eat breakfast and were less likely to be on a weight loss/special diet.^{13 9} Australian adolescent boys were also found to have a higher daily mean intake of breads and cereals, vegetables, dairy foods and lean meats compared with adolescent girls.⁹

There are few recent data on regional differences in the food intake patterns of adolescents. Adair and Popkin's (2005) longitudinal study examined the food intake patterns of children and adolescents from four different countries (United States, Russia, China and the Philippines). In general, those living in urban areas consumed more fast foods and soft drinks than in rural areas, but this regional difference narrowed over time.¹⁵ Another study that investigated the differences between urban and rural adolescents living in the Jiangsu province in China, found adolescents in urban areas had a higher intake of energy-dense foods and skipped breakfast more frequently than their rural counterparts.¹⁶ In Australia, the health of young people in rural communities is generally poorer than those living in metropolitan areas.¹⁷ The National Health Survey also found that greater rates of overweight people living in rural areas compared to their metropolitan counterparts.¹⁷ This disparity in health and body weight is likely to be due to a number of factors including behavioural risk factors, social and environmental factors.¹⁷ For example, young people living outside major cities may have poorer dietary food behaviours because the price of food in rural area is often more expensive.¹⁸ One study comparing the food intake patterns of adolescents from rural and urban areas in one state of Australia found the food choices of rural dwelling adolescents were less healthy than their urban counterparts.¹⁹ That study was conducted in 1990 and so may not reflect the current situation.

Surprisingly, little else is known about the nature of adolescent food intake patterns or how they vary across population groups. The aim of this study was to describe adolescents' food intakes, and variations in food intakes by gender, age and region of residence (metropolitan and non-metropolitan), and to compare these intakes to the Australian Guide to Healthy Eating.²⁰ The Australian Guide to Healthy Eating (AGHE) encourages the consumption of a variety of foods from the five food groups everyday and suggests 'extra' foods be eaten occasionally or in small amounts. The five food groups consist of: breads/cereals (including rice, pasta and noodles), lean meat and substitutes (including, fish, poultry, eggs, nuts and legumes), vegetables (including legumes), fruit and dairy (including milk, cheese and yoghurt). Foods eaten from these groups are considered essential for a nutritionally adequate diet and have been categorised mainly on the basis of their nutrient profile. The 'extra' foods group contain foods that do not fit into the five food groups and do not contain essential nutrients but often add to the enjoyment of eating. Recommended serves have also been developed for different population groups but were not applied to this study population since requesting this level

of detail was considered too burdensome for this study population. The AGHE guidelines are consistent with the current Dietary Guidelines for Children and Adolescents in Australia.²¹ It was hypothesised that adolescents would generally have food intakes that are inconsistent with those suggested in the AGHE (e.g. lower intakes of recommended foods, such as fruits and vegetables, and higher than recommended intakes of less nutritious energy-dense foods such as fast food). It was also hypothesised that girls; younger adolescents; and metropolitan-dwelling adolescents would report food intakes more closely aligned to recommendations than boys, older adolescents, or non-metropolitan-dwellers.

METHODS

Selection of schools

Every Victorian State Government or Catholic secondary school within each designated region was invited to participate if the school had a student enrolment over 200 and was co-educational (i.e. attended by both boys and girls). Co-educational schools were selected to avoid one gender being over-represented. Schools with student enrolments less than 200 were excluded to lower the risk of students being lost to follow-up since students in smaller schools often transfer out to larger schools in their senior years. Using these criteria, a total of seventy schools (47 metropolitan and 23 non-metropolitan) were invited to participate in the study. The response rate of schools agreeing to participate in the survey was greater in non-metropolitan Victoria (73.9%) compared with Metropolitan Melbourne (42.5%).

Selection of subjects

The subjects were drawn from year 7 (aged 12-13 years) and year 9 (aged 14-15 years) students in secondary schools located in the Southern metropolitan region of Melbourne and the non-metropolitan region of Gippsland in the State of Victoria to the east of Melbourne. A metropolitan area is defined as the area under the Capital City Statistical Division and all other areas outside this division are as classified as non-metropolitan areas.²² From the schools that agreed to take part in the study, a total of 9,842 students were invited to participate (calculated from the number of students in each target year level during initial school contact). Parental consent was obtained for 46% of students leaving a total of 4,502 students who were eligible to participate in the study. Teachers administered online surveys to 39% of students (during the baseline study period of 2004-2005) making a total of 3,841 year seven (n=2349) and year nine (n=1492) students. The sample included 1,826 boys (1,230 metropolitan, 596 non-metropolitan) and 2,015 girls (1,273 metropolitan, 742 non-metropolitan) students. The demographic characteristics of the sample are shown in Table 1.

The data reported here were obtained from participants in the baseline phase of a larger cohort study investigating influences on changes in dietary habits from early to late adolescence. The study was approved by the Deakin University Ethics Committee, the Victorian Department of Education and Training and the Catholic Education Office. Students required active parental consent to participate in the study.

Table 1. Baseline characteristics
Demographic characteristics of study sample

Demographic characteristics	Total		Male		Female	
	n	%	n	%	n	%
Total sample	3841		1826	47.5	2015	52.5
Age group						
Year 7 (Mean 12.8 ± SD 1.0)	2349	61.2	1131	61.9	1218	60.4
Year 9 (Mean 14.7 ± SD 0.9)	1492	38.8	695	38.1	797	39.6
Area of residence						
Metropolitan	2503	65.2	1230	67.4	1273	63.2
Non-metropolitan	1338	34.8	596	32.6	742	36.8
Family characteristics						
Lives with both parents	2649	69.0	1264	69.3	1385	68.9
Lives with mother only	987	25.7	456	25.0	531	26.4
Lives with father only	150	3.9	86	4.7	64	3.2
Lives with neither parent	55	1.4	20	1.1	35	1.7

Procedure of the study

All eligible schools were initially sent an invitation to participate in the study. A follow-up phone call was made to schools to answer any questions and confirm if the target school was interested. Detailed correspondence outlining the study procedures, parent information packages and consent forms were mailed to all schools agreeing to be involved in the study and school visits were offered to explain the process and/or administer the survey. Almost all schools indicated that the major obstacle in obtaining parental consent would be due to the apathy of adolescents in returning forms. To assist teachers in this process, the researchers made available small gifts to be offered to all adolescents returning consent forms including forms denying consent.

The online survey emulated the layout of a paper based questionnaire. A limited number of simple, quick loading graphics were used to emphasise the context of some questions and to help maintain the interest of the young respondents. The survey covered 13 pages to minimise scrolling and to group questions in the same context. At the end of each page, a text message informed adolescents of their progress (i.e. what proportion of the survey they had completed), an important motivating factor when completing a survey.²³ If adolescents missed a question they were prompted to complete it before moving onto the next page of the survey.

All teachers involved with the project were given detailed instructions explaining how to access the web-based survey including the URL to the survey homepage. The instructions also included answers to frequently asked questions, estimated time to complete survey and trouble shooting tips such as how adolescents could re-enter and continue the survey at a later date if unable to finish in the allocated time. To avoid technical problems and user frustration, factors that increase the likelihood of non-response error,²³ the survey required very little computer memory (less than 500 KB) and was compatible with the browsers used by schools.

Other online activities (quizzes/crossword) were provided for adolescents who did not wish to participate in the online survey or who were not granted consent. These activities did not require parental consent and were located on the survey home page.

Survey instrument

A 37 item food frequency questionnaire (FFQ) was completed online by adolescents in class time under teacher supervision between October (spring) 2004 and August (winter) 2005. The FFQ was based on the 2001 National Food and Nutrition Monitoring and Surveillance Project report on *Monitoring food intake patterns in the Australian population using short questions* which described a number of validated indices of food intake useful in describing the food intake patterns of groups.²⁴ Please refer to the list of food items in the FFQ is shown in Appendix 1.

The food items were associated with seven point frequency response scales relating to recalled food consumption during the previous month. They ranged from 'never or not in the last month' to 'several times a day' (The FFQ is shown in Appendix 1). The FFQ was presented in two parts – the first covering foods and the second part covering beverages. Milk intake was assessed in the beverage section but also included milk consumed in other forms (e.g. with breakfast cereal).

Foods and beverage responses from the FFQ were converted into scores based on the five AGHE food groups. The frequency of consumption for each food or beverage in the past month was converted into a daily equivalence as follows: not in the last month (0.00 per day), several times per month (0.01 per day), once a week (0.14 per day), a few times a week (0.36 per day), most days (0.71 per day), once per day (1.00 per day), several times per day (2.50 per day). The daily equivalence for food and beverage items in each food group was summed to obtain a daily intake for each of the five food groups and the 'extra' food group.

The estimated daily intake of the dairy group included the summed daily equivalence of three items: milk, yoghurt and cheese, but excluded ice-cream. The fruit group included whole fruit as one item (fresh, canned, frozen and dried fruits) and, the 'fruit plus juice group' included the summed equivalence of two items; whole fruit as well as fruit juice. The breads and cereals group included the summed equivalence of three items: bread, pasta/rice/noodles and breakfast cereal. The meat group included the summed equivalence of seven items: red meat, poultry, pork, fish, eggs, legumes and nuts and excluded fatty

processed meats like sausages. The vegetable group included the summed equivalence of three items: salad vegetables, potatoes (excluding fried potato) and other cooked vegetables. Legumes were not included in the vegetable group since consumption of this food would have been overestimated with it classified in the meat group. Foods that did not fit into the five food groups were classified as "extra foods". Extra foods included the summed equivalence of four energy-dense snacks (confectionery, cakes, sweet biscuits and crisps), four sugar-sweetened beverages (regular soft-drink, cordial, energy drinks, sports drinks) and five fast foods items (from fast food chains as well as fish and chips, hot chips, pizzas and pastry goods like pies).

The summed daily equivalence of each food group was then further collapsed into four frequency cut-points (1 = <0.3599 times per day, 2 = 0.35991 to 0.7099 times per day, 3 = 0.70991 to 0.999 times per day, 4 = 0.991 or more times per day) and recoded into the following categories: never/rarely (=1), a few days per week (=2), most days (=3) and daily (=4).

Statistical analysis

Data were analysed using SPSS statistical software (SPSS Inc, Chicago, SPSS for Windows, version 12.0.1 2003). Descriptive statistics were used to describe the food intakes of the sample as a whole (e.g. proportions of adolescents reporting various consumption frequencies of food groups defined by the AGHE). Variations in food group consumption frequencies by gender, age and region of residence were analysed using the chi-squared statistic. In order to examine the independence of the socio-demographic variables, pair wise associations between gender, age (year 7 or year 9), and region of residence (metropolitan and non-metropolitan) were examined using the chi-squared statistic. For all chi-squared analyses, a *p*-value of <0.05 was used as the cut point for statistical

significance. However, since chi-squared is sensitive to sample size, the phi coefficient was also inspected to evaluate the strength of associations where the significance of the chi-squared statistic was between $p < 0.01$ and $p < 0.05$.

RESULTS

Table 2 shows the proportion of adolescents consuming at least two or more of the five basic food groups everyday or at least most days during the previous month. Just over one third of the adolescents (34.6%) reported eating at least one food from each of the five food groups everyday and 55.4% reported eating from each of the five food groups 'most days'; and approximately one in four consumed from four of the five food groups daily or most days.

Chi-squared analyses showed that there was no significant association between gender and year level and, although there was an association between gender and region of residence ($p = .007$), the phi coefficient (0.04) suggested this was very weak. There was also no significant association between year level and region. These findings suggest that the socio-demographic variables were not strongly associated, and subsequent analyses compared

Table 2. Proportion of adolescents consuming foods from five or fewer food groups daily or on most days.

No. of food groups consumed	Frequency of consumption	
	Daily <i>n</i> (%)	Most days <i>n</i> (%)
5 food groups	1,330 (34.6)	2,126 (55.4)*
4 food groups	1,028 (26.8)	907 (23.6)
3 food groups	671 (17.5)	443 (11.5)
< 3 food groups	812 (21.1)	365 (9.5)
Total	3,841 (100)	3,841 (100)

* $p < 0.0001$ for non-metropolitan and metropolitan adolescents

Table 3. The proportion of adolescents who consumed food from each of the five food groups and the 'extra' group as well as water (including non-sugar beverages) according to frequency of consumption.

Food Groups/Water	Total Sample (n)	Daily %	Most days %	Few days/week %	Rarely/Never %
Five (essential) food groups					
Bread/cereals	3766	85.2	6.9	4.8	3.1
Fruit	3766	36.5	24.5	0.0	39.0
<i>Fruit (+ juice)</i>	3739	66.7	14.7	7.4	11.1
Vegetables	3766	73.0	10.3	9.7	7.0
Dairy	3739	72.5	11.0	9.3	7.1
Meat/legume/eggs	3766	71.4	14.7	10.2	3.6
Extra food group					
"Extra" food group (overall)	3739	89.8	5.4	3.2	1.7
Fast Foods	3766	22.1	13.1	41.9	22.9
Energy-dense snacks	3766	49.3	14.8	25.3	10.6
Sugar-sweetened drinks	3739	39.4	13.5	16.4	30.6
Water					
Water (including tea/coffee/milo* and other non-sugar beverages).	3739	86.7	6.1	4.1	3.2

* Milo is a drink made from a dry mixture of chocolate and malt that mixed into either hot or cold milk

TABLE 4. Food Groups and Extra Foods (fast foods, energy-dense snacks and sugar- sweetened drinks)
The proportion of adolescents who consume food from each of the five food groups and 'extra' foods according to the frequency of consumption by gender and region.

	Gender (%)			Region (%)		<i>p</i>
	<i>n</i>	Male 1,786	Female 1,980	<i>p</i>	Metro 2,459	
Bread				<0.05		<0.05
Daily		86.5	83.9		84.2	87.0
Most days		5.6	8.1		7.3	6.2
Few days/wk		4.8	4.8		4.9	4.7
Rarely/Never		3.1	3.1		3.7	2.1
Fruit (only)				<0.001		NS
Daily		32.6	40.1		36.4	36.8
Most days		22.5	26.2		23.7	25.9
Few days/wk		0.0	0.0		0.0	0.0
Rarely/Never		44.9	33.7		39.9	37.3
Fruit (+ juice)				<0.01		<0.001
Daily		61.7	71.2		65.3	69.3
Most days		16.0	13.6		14.6	15.1
Few days/wk		7.8	7.1		7.9	6.5
Rarely/Never		14.5	8.1		12.2	9.1
Vegetables				<0.001		<0.001
Daily		70.0	75.7		69.9	78.7
Most days		10.5	10.1		10.5	10.0
Few days/wk		10.9	8.6		11.0	7.3
Rarely/Never		8.6	5.6		8.6	4.0
Dairy				<0.01		<0.05
Daily		74.8	70.4		71.3	74.7
Most days		9.8	12.2		11.1	11.0
Few days/wk		8.1	10.5		9.7	8.6
Rarely/Never		7.3	7.0		7.9	5.7
Meat/legumes				<0.001		<0.05
Daily		76.1	67.3		71.7	70.0
Most days		12.3	16.9		13.6	16.7
Few days/wk		8.6	11.7		10.8	9.1
Rarely/Never		3.0	4.2		3.8	3.3
Extra foods				<0.001		NS
Daily		92.0	87.7		90.5	88.4
Most days		4.5	6.2		5.2	5.8
Few days/wk		2.0	4.2		2.9	3.8
Rarely/Never		1.4	1.9		1.5	2.0
Fast foods				<0.001		<0.001
Daily		26.3	18.3		25.5	10.0
Most days		14.8	11.5		13.4	12.5
Few days/wk		40.6	43.0		40.3	44.9
Rarely/Never		18.2	27.1		20.9	26.7
ED† Snacks						<0.01
Daily		49.5	49.0		50.4	47.1
Most days		14.8	14.8		19.3	16.7
Few days/wk		25.5	21.1		25.2	25.6
Rarely/Never		10.1	11.5		10.5	10.7
SS† Drinks				<0.001		<0.01
Daily		47.6	32.0		41.2	36.1
Most days		13.5	13.4		13.5	13.5
Few days/wk		15.3	17.4		16.4	16.4
Rarely/Never		23.5	37.1		28.9	34.0

ED† = Energy-dense; ED† = Sugar-sweetened

food intakes across each of the three socio-demographic variables separately.

The number of food groups consumed daily or on most days did not differ significantly by age or gender, but more non-metropolitan adolescents (60.1%) ate from the five food groups most days compared with their metropolitan counterparts (52.8%). Table 3 shows the proportions of adolescents consuming from each of the five food groups, the 'extra' food group and water (including low energy-dense beverages) according to frequency of consumption. From the five food groups (defined as essential foods for a healthy diet), bread and cereals were the most commonly consumed food group. After this group in decreasing order of daily intake were vegetables, dairy foods, meat/eggs/nuts/legumes and fruit if fruit juice excluded (66.7% if included). 'Extra' foods (defined as non-essential foods including fast foods, energy-dense snacks and sugar-sweetened drinks) were consumed by 89.8% of adolescents on a daily basis. Energy-dense snacks comprised the greatest proportion of the 'extra' foods. Water (including low energy-dense beverages) was consumed by 86.7% of adolescents every day.

Table 4 shows the proportions of adolescents reporting various consumption frequencies of the five recommended food groups, and of 'extra' foods, by gender and region. The proportions of adolescents who consumed food from each food group (or the 'extra' food groups) did not differ significantly in terms of year level except for a very small proportion of adolescents (<5%) who rarely or never ate meat (data not shown).

There were gender differences in certain frequencies of consumption for all five food groups and the 'extra' food groups excluding energy-dense snacks (Table 4). On a daily basis a significantly greater proportion of males consumed meat/meat alternatives, fast foods and sugar-sweetened drinks compared to their female counterparts ($p < 0.001$), whilst a greater proportion of females consumed fruit everyday compared with males ($p < 0.001$). There were no gender differences in the consumption of vegetable or dairy foods on a daily basis, though a higher proportion of males (8.6%) compared with females (5.6%) rarely or never ate vegetables ($p < 0.001$).

Table 4 shows the regional differences that were found in the consumption of each food group (except for fruit and energy-dense snacks). A significantly greater proportion of non-metropolitan adolescents (78.7%) consumed vegetables on a daily basis compared with their metropolitan counterparts (69.9%) ($p < 0.001$). One in four adolescents from metropolitan Melbourne ate fast food everyday compared with 10% of adolescents from non-metropolitan Victoria ($p < 0.001$). The proportion of metropolitan adolescents who rarely or never consumed fruit (including juice) was also significantly greater than adolescents from non-metropolitan Victoria ($p < 0.001$).

DISCUSSION

This study sought to evaluate the food intake patterns of adolescents with respect to the Australian Guide to Healthy Eating, and to examine variations in intake by age, gender and region of residence. Almost two thirds of the students failed to consume foods from each of the five food groups on a daily basis as recommended, although at

least half of them consumed foods from each of these groups most days. The food intake patterns which are of most health concern include the relatively high proportion of students who never or rarely eat fruit and the proportion of students who consume fast foods every day. With the exception of meat/meat alternatives, a higher proportion of females followed a healthier pattern of eating (on a daily basis) than their male counterparts. Adolescents from the non-metropolitan area tended to consume vegetables more frequently and to eat fast foods less frequently than adolescents living in the metropolitan region. Finally, this study found minor variations only in food intake patterns between the different year (age) levels. This differed from our hypothesis that younger adolescents would have healthier food intake patterns. The lack of difference may be due to the sensitivity of the survey instrument since it measured frequency only (and not amounts) and/or the reasonably narrow age range (12-15 years). Results from the National Nutrition Survey showed the food intake patterns of younger adolescent (12-15 years) were more likely to be influenced by the home environment than their older counterparts.⁹

The findings of the present study differ from those of the 1995 National Nutrition Survey (NNS). The NNS showed a higher proportion of children 12-15 years consumed foods from each of the five food groups compared with the adolescents in the current study.¹⁷ Those data, however, are not strictly comparable since the dietary methodology for the NNS involved a 24 hour recall. Furthermore, the items making up each of the food groups in the present study and the NNS differ in some instances. In the European Health Behaviour in School-aged Children study,¹³ the proportion of students who ate fruit everyday was similar to that found in the current study. The Health Behaviour in School-aged Children study also found a high proportion (more than 25%) of students in 16 countries and regions who seldom ate fruit (once a week or less). Whilst we do not know the upper limit, almost 40% of the students in the current study rarely or never ate fruit. Interestingly, when fruit juice was included in the fruit group, fruit consumption on a daily basis almost doubled and the proportion who never or rarely consumed fruit dropped to 11%. A study of New Zealand adolescents showed that whilst these adolescents perceived fruit to be a convenient snack it often bruised (on the way to school), was not always convenient to purchase, attractively presented or easy to share with friends unlike chocolate bars and potato crisps.²⁵ In contrast, fruit juice does not bruise, is convenient to purchase and attractively packaged which may partly explain its high rate of consumption.

The females in the current study had food patterns that were more closely aligned with the AGHE than their male counterparts. Similar gender differences have been found in other studies.^{26 27 28 29} Female adolescents may adopt healthier food intake patterns than their male counterparts for several reasons. First, they usually demonstrate a greater concern for their body image and weight control.³⁰ Indeed, in the present study, significantly more females reported they were less satisfied with their body image than males and significantly more females reported trying to lose weight in the last month compared with

males (data not presented). Females also tend to be more health-conscious than males.³² However, whilst a greater proportion of female adolescents ate fruit everyday and consumed fast food and soft drink less frequently than their male counterparts, a significantly smaller proportion consume eat meat or meat alternatives on a daily basis. This is consistent with recent reports of iron deficiency anaemia (with its potential adverse health consequences) among adolescent girls in Australia.³³

Just over one in five adolescents in the current study consumed fast foods every day. Several studies show these foods are popular among adolescents for a variety of reasons. Fast foods are convenient (no preparation), easy to obtain^{34 25 35} and are sold in venues where adolescents can easily socialise.²⁵ Taste is also a very important factor in the food choices of adolescents^{34 25 35} and fast foods are usually high in fat and salt, nutrients that greatly enhance the taste of a food. The study supports the need for preventive measures aimed at decreasing the consumption of fast foods in adolescents. For example, if school environments are found to be an important source of fast foods for adolescents then school policies and programs need to be implemented where students have access to a range of healthy food choices and limited access to fast foods. Other studies have shown that changing the school environment can favourably influence the food choices of secondary students.^{36 37}

In the current study, adolescents living in the non-metropolitan area appeared to have healthier food intake patterns (consumed more vegetables and less fast food on a daily basis) compared with adolescents living in metropolitan Melbourne. In contrast, students living in rural areas of Tasmania consumed more fast foods (pies and hot chips) compared to their urban counterparts.¹⁹ There are several possible explanations for this discrepancy that include the differences that may be associated with location of the study, number of fast food items being examined, and the classification of urban and rural schools. The latter did not match with the current study's classification of metropolitan and non-metropolitan schools. The difference in metropolitan and non-metropolitan fast food intake patterns in the current study may be due, in part, to the accessibility and availability of these foods. A significantly higher proportion of adolescents living in the metropolitan area (data not shown) reported living near a fast food outlet compared to those living in the non-metropolitan area. Whilst evidence about the effect of availability and accessibility on the consumption of fast foods is scarce, there is limited evidence that one or both of these factors may influence the intake of high fat snacks,³⁸ soft drinks³⁹ and fruit and vegetable consumption among adolescents.^{40 41}

The findings of the current study need to be treated with some caution since the self-reported FFQ was limited to 37 food and drink items and so does not represent all foods eaten. The FFQ is a qualitative measure of foods and beverages consumed and so does not measure the amounts consumed. However, the FFQ was a short, easily administered and inexpensive instrument that can be used to 'rank' adolescents by intake in a broad range of adolescent sub-populations. The FFQ instrument was adapted from the 2001 National Food and Nutrition

Monitoring and Surveillance Project report which evaluated the short dietary questions used in the National Nutrition Survey. This report provides the best available evaluation of questions that can be used to measure the intake of specific food groups that were used in this study. Validity and test-retest reliability data for the FFQ are not available.

The findings from this study indicate a significant proportion of adolescents have eating habits that deviate from the Australian Guide to Healthy Eating and as a consequence are at greater risk of consuming diets that are not only inadequate in terms of their nutritional needs but also are incompatible with their long term health. The daily inclusion of fast foods and the omission of a variety of healthy foods recommended by the Australian Guide to Healthy Eating (and consistent with national dietary guidelines) by a large proportion of adolescents may contribute to the growing problem of obesity among adolescents and the psychosocial and other health-related consequences associated with this condition such as insulin resistance. The regional differences in food patterns warrant further investigation to determine the factors that influence or predict these differences.

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AUTHOR DISCLOSURES

Gayle S Savige, Kylie Ball, Anthony Worsley and David Crawford, no conflicts of interest.

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Appendix 1 – FFQ

To respond to the FFQ, students were asked the following:

In the past MONTH, about how often have you had the following? (select one for each food/drink listed, even if you never have it).

Each type of food/drink listed in the FFQ was followed by seven frequency options (not in the last month, several times per month, once a week, a few times a week, most days, once per day, several times per day). A radio button preceded each frequency option requiring students to select the appropriate frequency by clicking on the button)

The list of foods in the FFQ were presented in the following order.

1. Hot chips, French fries, wedges, fried potato
2. Potatoes (not including chips, French fries wedges, fried potato).
3. Salad (salad includes mixed green salad and other mixtures of raw vegetables).
4. Cooked vegetables (not counting potatoes)
5. Fruit (includes fresh, canned, frozen, dried)
6. Bread, toast, bread rolls
7. Pasta, rice, noodles
8. Breakfast cereal
9. Red meat (such as chops, steaks, roasts, stir fries, casseroles, rissoles, mince)
10. Chicken (not counting crumbed fast foods like KFC)
11. Pork (not including ham or bacon)
12. Meat products (e.g. sausages, frankfurter, salami, bacon or ham)
13. Fish/seafood (home prepared including frozen or tinned)
14. Fish/seafood (from a fish and chip shop)
15. Cheese
16. Yoghurt
17. Ice-cream
18. Eggs
19. Nuts (including peanut butter)
20. Dried beans/peas (e.g. baked beans, lentils)
21. Chocolate or lollies
22. Fast foods (e.g. McDonalds, KFCs)
23. Pizza
24. Pies/pasties/sausage rolls
25. Cakes/donuts
26. Potato crisps or other salty snack foods
27. Sweet biscuits (e.g. Tim Tams, cream biscuits, choc chip cookies)
28. Tea/Coffee
29. Milk (including flavoured milk, milk on cereal)
30. Plain water (tap or bottled)
31. Milo/Nesquik/hot chocolate
32. Fruit Juice
33. DIET cordial or DIET soft drink
34. REGULAR (not DIET) cordial
35. REGULAR (not DIET) soft drink
36. Energy Drinks (e.g. V, Red Bull)
37. Sports Drinks (e.g. Gatorade, Powerade)
38. Alcohol

Original Article

Food intake patterns among Australian adolescents

Gayle S Savige PhD, Kylie Ball PhD, Anthony Worsley PhD and David Crawford PhD

*Centre for Physical Activity and Nutrition Research, School of Exercise and Nutrition Sciences, Deakin University, Australia***澳洲青少年的食物攝取型態**

目的：本研究目的在於評估青少年食物攝取與澳洲健康飲食指南的關聯，並且調查食物攝取型態隨年齡、性別和居住地區的變異。**設計：**透過學校執行的橫斷性線上飲食調查。**參與者及裝置：**2004-2005年，3841位來自澳洲維多利亞37所中學7年級（12-13歲）和9年級（14-15歲）的中學生完成線上食物攝取型態調查。**出象測量：**由飲食頻率問卷測得食物攝取並依五大類（水果、蔬菜、肉類、奶類、穀類）和澳洲健康飲食指南(AGHE)定義的「額外」食物類作分類。在這個研究族群中分析這些食物類別，並作跨年齡、性別和地區的比較。**結果：**這個樣本中，有許多青少年報告的食物攝取與AGHE的建議有極大的偏離。例如，三分之二的參與者無法每天吃到建議的五大類食物；超過三分之一「很少或從來不」吃水果；22%每天吃速食。一般來說，女孩的食物攝取與飲食指標的一致性上較男孩好。地區性的差異較不一致，而在年齡上有些許的差異。**結論：**顯著比例的青少年的食物攝取低於澳洲健康飲食指南的建議。這個結果強調了需要公共衛生的行動來促進青少年更健康的飲食型態。

關鍵字：青少年、飲食、食物攝取、營養、鄉村、城市、澳洲。