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# The Dietary, Physical Activity and Sedentary Behaviours of Victorian Regional Secondary School Students

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*The aim of this study was to investigate the dietary, physical activity and sedentary behaviours of adolescents from four secondary schools in Warrnambool, regional Victoria. In 2004, a random sample of students (n=712), stratified by school year level, was generated from school enrolment databases and 443 students completed a lifestyle questionnaire. Twenty per cent of students were physically active for 60 minutes or more per day; 28 per cent used electronic media in free time for a maximum of two hours per day. Only seven per cent of students met these two Australian physical activity recommendations. Fruit, vegetables and dairy products were consumed every day by 39 per cent, 40 per cent and 71 per cent of students respectively; three serves per day of each of these foods are recommended for Australian adolescents. Compared with boys, girls were less physically active ( $p<0.001$ ), consumed more fruit ( $p=0.011$ ) and vegetables ( $p<0.001$ ), but fewer dairy products ( $p<0.024$ ). Seventeen per cent of students were overweight or obese; these students were less physically active than normal weight peers ( $p<0.018$ ). The dietary, physical and sedentary behaviours of regional Victorian secondary school students in this study were inadequate when compared with Australian recommendations. Dietary and physical activity habits are still evolving in adolescence and unhealthy habits can still be changed.*

**Key words:** Dietary habits, Physical activity, Sedentary behaviour, Health behaviour, Adolescent, Obesity

Australia is experiencing an obesity epidemic. Over 60 per cent of adults and 20–25 per cent of children and adolescents are overweight or obese (Batch & Baur, 2005; Cameron et al., 2003). From 1985 to 1995 the prevalence of overweight in children and adolescents doubled and obesity trebled (Magarey, Daniels, & Boulton, 2001a). These trends are not confined to Australia. The prevalence of overweight has dramatically increased in the last decade in many countries (World Health Organization [WHO], 2002) and globally there are more than one billion overweight adults, at least 300 million of them clinically obese (WHO, 2003).

Obesity and related co-morbidities present enormous challenges for primary health care both in terms of human suffering and economics (Access Economics, 2006). Obesity treatment programs to date have had limited success (Swinburn, Gill, & Kumanyika, 2005; WHO, 2000); therefore all opportunities for primary prevention must be explored. Overweight in childhood and adolescence increases the risk of adult overweight and obesity (Parsons, Power, Logan, & Summerbell,

1999). The increasing obesity prevalence in Australian young people means that greater health problems are predicted in the next generation of adults. There is strong scientific evidence that healthy eating and participation in regular physical activity is associated with decreased risk of obesity (Department of Health and Ageing [DoHA], 2003; WHO, 2000, 2003); therefore population-based strategies that keep young Australians healthy are required.

Limited data relating to diet and physical activity behaviours of adolescents are available in Australia, especially from non-metropolitan areas. The aim of this study is to further the understanding of these behaviours in boys and girls, and draw comparisons to Australian physical activity and dietary recommendations. These recommendations are to do 60 minutes or more per day of moderate-to-vigorous physical activity (MVPA) and limit use of electronic media in free time to a maximum of two hours per day (DoHA, 2004). Three serves per day of fruit, vegetables and dairy foods and the limit of 1–3 serves per day of “extra” foods (such

as crisps, confectionary and soft drink) depending upon body size and activity level (National Health and Medical Research Council [NHMRC], 2003), are the Australian dietary recommendations relevant to this study.

The findings from this research will be used in the design of school-based obesity prevention interventions and to monitor behaviour change.

### Methods

The study included students from all four secondary schools (2 government, 1 Catholic and 1 Independent) in the regional city of Warrnambool, southwest Victoria, in May 2004. A random sample of 712 students stratified by year level (Year 7 to Year 11) was generated from school enrolment databases. Students in the sample were invited to complete a questionnaire on their dietary, physical activity and sedentary behaviours. Key questions were modelled on those used in the WHO Health Behaviour in School-Aged Children (HBSC) 2001-2002 survey (WHO, 2004).

To determine physical activity behaviour patterns, students were asked to report how many days they did 60 minutes or more of MVPA in a typical week and in the past seven days; responses were combined and reported as mean days per week. This method of measuring physical activity was designed by Prochaska, Sallis et al. (2001) and was used in the HBSC study (WHO, 2004). Students were also asked to report on their frequency of use of television, video/DVD, electronic games and computers (hours/day) in their free time on school days and weekend days (WHO, 2004). The responses were combined and the mean usage of electronic media in free time was used to measure sedentary behaviour.

Dietary intake was measured using a food frequency questionnaire (22 items) as in the WHO HBSC survey (WHO, 2004). Seven response options were provided, with responses combined into three categories for analysis. Low intake included the options of *never* and *less than once a week*, moderate was 1–6 times a week and high was *once a day - every day* and *every day - more than once*. Questions were also asked on preferred milk and type of spread for bread, as well as the frequency of having breakfast on school and weekend days.

Body Mass Index (BMI) was calculated from self-reported height and weight measures. Students had access to scales and a tape measure if they wished to check their measurements. Age- and gender-specific BMI international cut-off points were used to calculate the prevalence of overweight and obesity (Cole, Bellizzi, Flegal, & Dietz, 2000). Overweight and obesity categories were combined for analysis and reporting, with remaining data analysed and reported as normal weight.

Written informed consent was obtained from participating students and their parents. Ethics approval was gained from Flinders University Social and Behavioural Research Ethics Committee, The Victorian Department of Education and Training and the Catholic Education Office – Diocese of Ballarat.

To test whether there were gender differences in physical, sedentary and dietary behaviour the  $\chi^2$  test was used for categorical variables and the Wilcoxon-Mann Whitney test for continuous variables. The same tests were used to analyse the difference between BMI category and physical and sedentary behaviour and fruit and vegetable intake. The numbers of people in categories for other types of dietary intake was not sufficient to analyse the association with BMI. Statistical analyses were performed using SPSS for Windows version 12.

### Results

A total of 443 students (response rate 62 per cent; boys 55%, girls 69%) participated in the study (Table 1). The mean age of participants was 14.1 years, (*SD* 1.4, range 11-18 years), with Year 7 and 8 students being the largest group. The mean BMI for participants was 20.6 kg/m<sup>2</sup> (*SD* 3.18, range 14.2 - 33.7 kg/m<sup>2</sup>), and 75 participants, (17%) were overweight or obese.

**Table 1: Characteristics of study population**

	Boys n=189		Girls n=254	
	Mean	SD	Mean	SD
Age (years)	14.17	(1.47)	13.94	(1.42)
Weight (kg)	60.5	(14.33)	54.54	(9.52)
Height (cm)	168.90	(10.64)	163.29	(7.29)
BMI(kg/m <sup>2</sup> )	20.91	(3.47)	20.45	(3.02)

On average, participants reported taking part in MVPA for at least 60 minutes per day on 4.5 days or more per week. Boys reported greater physical activity levels compared with girls (4.9 vs. 4.2 days/week, *p*<0.001). Only 20 per cent of participants met the recommendation of at least 60 minutes or

**Table 2: Proportion of students who met Australian physical activity recommendations by gender**

	Boys n=189		Girls n=254		p-value *
	n	%	n	%	
Recommendation 1 At least 60 minutes physical activity/day	61	(32.3%)	35	(13.9%)	<0.001
Recommendation 2 Maximum 2 hrs of electronic media in free time/day	40	(21.2%)	85	(34.1%)	0.007
Recommendations 1 & 2	15	(8.4%)	14	(5.6%)	0.268

\* p-values for gender difference - from  $\chi^2$  test

more of MVPA every day, with more boys doing so than girls (Table 2). Fifty-six per cent of students (boys 64%, girls 50%) participated in 60 minutes or more of MVPA on most days of the week.

On average, participants spent approximately 3.5 hours per day using electronic media in free time, with boys spending more time than girls (3.8 vs. 3.4 hours/day,  $p = 0.016$ ). Twenty-eight per cent of the participants used electronic media for a maximum of two hours per day in free time, as recommended. Only seven per cent of students (boys 8%, girls 6%) met both physical activity recommendations. Fifteen per cent of students (boys 24%, girls 8%) met the recommendation of 60 minutes per day of MVPA, but had high level use of electronic media (>2 hours/day).

Thirty-nine per cent of participants ate fruit daily and 40 per cent ate vegetables daily. Fewer boys than girls consumed fruit (32% vs. 47%,  $p = 0.011$ ) and vegetables daily (32% vs. 52%,  $p < 0.001$ ; Table 3). Approximately half of the participants consumed bread daily; preferring white over wholegrain bread. Twenty-eight per cent of the participants ate breakfast cereal every day, with a preference for unrefined over refined cereal evident. Only nine per cent of participants had daily consumption of fruit, vegetables and either wholegrain bread or unrefined cereal.

Analysis of the less healthy food alternatives in the questionnaire revealed that packaged snacks were the most popular item, with 21 per cent of participants consuming them every day. This was followed by biscuits and cakes, confectionary and soft drink (15%, 14% and 11% respectively). Boys consumed significantly more packaged snacks, soft drinks and fast food than girls (Table 3).

Approximately 70 per cent of participants consumed dairy products daily, with more boys

**Table 3: Dietary intake by gender [%]**

	Boys n=189			Girls n=254			p-value*
	Low	Moderate	High	Low	Moderate	High	
Fruit	8.0	58.8	33.2	4.3	49.2	46.5	0.011
Vegetables	4.3	64.0	31.7	4.3	43.9	51.8	<0.001
Dairy products	3.2	20.6	76.2	2.4	32.3	65.4	0.024
Meat	1.6	69.1	29.3	6.7	61.9	31.3	0.026
Fish	58.5	39.4	2.1	67.7	31.9	0.4	0.049
Rice & pasta	18.1	79.3	2.7	14.7	80.6	4.8	0.363
Wholegrain bread	48.9	40.3	10.8	52.4	36.2	11.4	0.681
White bread	3.2	48.9	47.9	8.3	51.6	40.2	0.045
Unrefined cereals	31.6	43.9	24.6	39.5	41.1	19.4	0.178
Refined cereals	41.1	41.6	17.3	54.9	37.9	7.1	0.001
Fast food	33.7	64.2	2.1	45.4	52.6	2.0	0.046
Soft drink	23.9	59.0	17.0	47.0	46.6	6.3	<0.001
Packaged snacks	27.9	56.9	27.7	29.6	54.2	16.2	<0.001
Biscuits & cakes	11.7	70.7	17.6	18.6	69.2	12.3	0.068
Confectionary	14.9	70.2	14.9	17.4	69.2	13.4	0.744

\* p-values for gender difference - from  $\chi^2$  test

Unrefined cereals = plain weetbix, natural muesli/ porridge

Refined cereals = coco pops, cornflakes, toasted muesli etc. with added sugar and/or salt

Fast food = hot chips, pies, pizza, sausage rolls, hot dogs, hamburgers, dim sims, deep fried foods

Packaged snacks = chips, twisties, burger rings

doing so than girls (76% vs. 65%,  $p = 0.024$ ). Participants preferred whole milk compared with reduced fat milk (61% vs. 29%), and margarine compared with butter (46% vs. 37%, Table 4). More boys than girls preferred whole milk over low fat milk ( $p = 0.006$ ), but there was no significant gender difference in spread preference.

Breakfast was consumed daily by two-thirds of participants, with more boys doing so compared with girls (75% vs. 60%,  $p = 0.004$ , Table 4). Participants were more inclined to skip breakfast on a school day than on the weekend (31% vs. 15%).

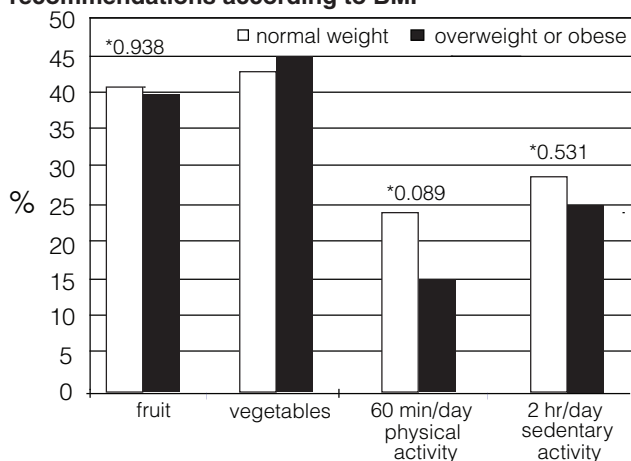
Seventeen per cent of students in the present study were overweight or obese, based on international reference curves (Cole et al., 2000). Participants who were overweight or obese were less physically active than normal weight peers (mean number of days/week 4.1 vs 4.6,  $p = 0.018$ ). The association between overweight and obesity and whether participants met the recommendation

**Table 4: Selected dietary habits by gender [n and (%)]**

	Boys n=189	Girls n=254	p-value *
Preferred milk			
Whole	133 (70.7)	141 (55.5)	0.006
Reduced fat	42 (22.3)	87 (34.3)	
Other	3 (1.6)	2 (0.8)	
Don't drink milk	10 (5.3)	24 (9.4)	
Preferred spread			
Butter	64 (34.2)	104 (40.9)	0.326
Margarine	88 (47.1)	114 (44.9)	
Other	17 (9.1)	14 (5.5)	
Don't use spread	18 (9.6)	22 (8.7)	
Breakfast			
Every day	137 (74.9)	150 (59.7)	0.004
Sometimes (1-6 days)	43 (23.5)	92 (36.7)	
Never	3 (1.6)	9 (3.6)	

\* p-values for gender difference - from  $\chi^2$  test

**Figure 1: Percentage of students with high fruit and vegetable intake and who met the physical activity recommendations according to BMI**



\* p-values for difference between BMI category and lifestyle variables - from  $\chi^2$  test

of 60 minutes or more of MVPA per day was not statistically significant although there was a tendency towards a negative association (Figure 1). There was no significant difference in BMI category and other lifestyle variables such as time spent using electronic media in free time, or fruit and vegetable intake (Figure 1).

### Discussion

The majority of secondary school students in this study were not sufficiently physically active, spent too much time engaging in sedentary behaviours and did not consume enough fruit, vegetables, wholegrain and dairy products. These results are a cause for concern because the behaviour patterns contribute to poor health outcomes, with positive energy balance and excess weight gain being a particular concern.

Accumulating 60 minutes or more of MVPA in a day is recommended for good health for

adolescents (DoHA, 2004), but there is variation internationally regarding whether this should take place most days in a week, or daily. In the HBSC study (WHO, 2004), 34 per cent of the students participated in 60 minutes or more of MVPA on most days of the week. This compared to 56 per cent in the present study, which used the same screening measure. Only one in five participants in the present study met the current Australian recommendation for daily MVPA.

Participation in physical activity is a result of the interplay of physical, social and psychological factors, such as opportunity, encouragement, cultural norms and perceived competence (Sallis, Prochaska, & Taylor, 1999). Negative forms of these factors erode self-concept and poor body image is a likely consequence (Bond et al., 2004; WHO, 2004). Poor body image is a barrier to starting physical activity and contributes to poor physical activity adherence when unrealistic body shape changes are not achieved (Wigg, 2004). The relationship between self-concept and body image is stronger in girls than in boys (Bond et al.); therefore it may explain why girls had a slightly lower level of physical activity compared with boys in the present study. The gender difference is more strongly identified in several other studies (Hands, Parker, Glasson, Brinkman, & Read, 2004; Myers, Strikmiller, Webber, & Berenson, 1996; NSWHD, 2004; WHO, 2004).

The second physical activity recommendation limit the amount of time adolescents use electronic media in free time to a maximum of two hours per day. Australia is one of the first countries to make this type of restricting recommendation and only one in four participants in this study met it. The HBSC study (WHO, 2004) reported a less favourable result—one in four students watched television four or more hours on a school day and computer use was in addition to this.

Physical inactivity is widespread in western cultures (Lobstein, Baur, & Uauy, 2004; WHO, 2003) and it is not surprising that very few participants in the present study met both Australian physical activity recommendations. It is interesting to note that 15 per cent of participants in this study met the recommendation of 60 minutes per day of MVPA and exceeded the two hours per day of electronic media in free time recommendation. This finding is in line with another study (Marshall, Biddle, Sallis,

McKenzie, & Conway, 2002), which reported that many young people are both highly active and highly sedentary.

Our study indicates that patterns of dietary intake for the majority of students are not meeting current dietary guidelines. Three serves of fruit and vegetables are recommended for daily consumption (NHMRC, 2003) and yet few students in the present study did so; this is consistent with findings from other recent studies (Hands et al., 2004; NSWDH, 2004; Vereecken, De Henauw, & Maes, 2005). Unfortunately in the last 10 years there has not been a marked improvement in fruit and vegetable consumption if we compare the results of the current study with the National Nutrition Survey of 1995 (Magarey, Daniels, & Smith, 2001b).

The majority of students in the present study ate bread every day, preferring white bread over wholegrain bread. The CAPANS study (Hands et al., 2004) also identified higher consumption of white bread over wholegrain bread, suggesting that this may be an Australian preference. Few consumed breakfast cereal daily and interestingly those who did preferred unrefined cereal over refined varieties. There is a lack of data on breakfast cereal preference that is comparable to our results.

Three serves per day of dairy foods are recommended for Australian adolescents, with reduced fat options encouraged (NHMRC, 2003). Over one quarter of participants—more girls than boys—do not consume dairy products daily, which is consistent with findings from the CAPANS study (Hands et al., 2004). This has health implications, especially for bone strength. Given that whole milk is a proxy indicator for total fat and saturated fat in a diet (McLennan & Podger, 1998) and a high fat diet is associated with increased risk of overweight (Swinburn, Caterson, Seidell, & James, 2004; WHO, 2003) it is a concern that participants preferred whole milk to reduced fat options. The location of the schools in a dairy farming region is expected to contribute to the maintenance of this more traditional habit.

One-third of students in the present study skipped breakfast. Once again this was consistent with findings from other studies (NSWDH, 2004; WHO, 2004). Those who skip breakfast are more likely to consume snacks as a substitute, and these tend to be high-sugar, high-fat foods that have lower dietary fibre (Ruxton & Kirk, 1997). The small numbers of students with daily consumption of

high energy snacks or soft drink or categorised as overweight or obese prevented us from determining associations with skipping breakfast.

Consumption of “extra foods” (NHMRC, 2003) such as packaged snacks, confectionary, fast food, soft drink, biscuits and cakes, plays a role in the development of obesity (Lobstein et al., 2004; Swinburn et al., 2004). While few students in the present study reported consuming these items daily, the situation is expected to be considerably worse than the data shows because several extra foods may be consumed by students in a day and these data have not been reported here. The recommendation of 1–3 serves per day of extra food is ineffective as a population message when the serves suggested are considerably smaller than the portion sizes readily and cheaply available.

While the boys in the present study tended to have poorer dietary habits than girls, increasing concerns about body shape and weight might explain girls skipping breakfast more often, and having higher consumption of fruit and vegetables, and lower consumption of dairy products, soft drink and packaged snacks. The higher physical activity levels of boys and their rapid physical growth during adolescence may allow boys to get away with poor dietary habits without obvious consequences such as weight gain. Regardless of this, if poor dietary habits continue into adulthood health problems manifest later in life.

In Australia the overweight and obesity prevalence according to measured studies is 20–25 per cent (Batch & Baur, 2005), compared with 17 per cent in this study. There is evidence to support the fact that absolute BMI values of young people may be under-estimated when based upon self-reported height and weight (Strauss, 1999; Wang, Patterson, & Hills, 2002), but the vast majority are correctly classified as normal weight, overweight or obese (Strauss). Strauss also reported that the association between lifestyle habits (eating habits and participation in physical activity) and BMI based upon self-reported height and weight did not differ from that based upon measured values. This information supports our decision to use self-reported height and weight to investigate lifestyle behaviours in young people. Also the self-reported data collection method is less threatening than physical measurement, and therefore it was considered appropriate in order to obtain the lifestyle behaviour data of as many participants in

the sample as possible.

The HBSC survey (WHO, 2004) also used self-reported height and weight and calculated BMI using the Cole et al. reference curves (Cole et al., 2000). The prevalence of overweight and obesity varied enormously across countries and regions; (3–34% [WHO, 2004]). Lower physical activity participation and higher television viewing were associated with greater likelihood of overweight in the HBSC survey (Janssen et al., 2005). The present study also found an association between overweight and low physical activity participation but not between overweight and the use of electronic media. There were no consistent patterns to associate overweight with intake of fruit and vegetables either in the HBSC survey or the present study.

An important strength of our study is that it provides data on the dietary, physical activity and sedentary behaviours of adolescents—a segment of society often overlooked in favour of studies that target adults with greater lifestyle-related disease burdens or children who are a higher priority for early intervention studies. Key questions were selected from a validated questionnaire (WHO, 2004) and there was little data missing in the questionnaires that were completed. The questionnaire relied upon self-report measures that could pose a limitation because participants may give socially desirable responses. The fact that so many students have reported lifestyle behaviours below the Australian recommendations for a range of variables suggests that the actual situation may be worse than that reported. The generalisability of the results of this study to other regions is somewhat limited because it was conducted in one city in regional Victoria.

Interestingly, of the 712 students in the sample, 618 students (87%) attended the sessions to complete the questionnaire and provided their own written consent, but only 443 (62%) were eligible to participate because they had written parental consent. The authors speculate that students or

parents were not actively opposed to participation in the study, but rather many students simply had a casual attitude to obtaining their parent's signature in advance. Of the 175 students who did not obtain parent permission, 43 per cent were girls and 57 per cent were boys.

The present results indicate that the Australian physical activity and dietary recommendations (DoHA, 2004; NHMRC, 2003) are not widely followed, and thus need to be more effectively promoted. Despite improved cognitive abilities in adolescence, simply increasing the awareness of the recommendations among young people is unlikely to result in increased levels of physical activity (Jensen & Simovska, 2005). Through being better informed, community organisations such as schools can modify their environments and service delivery to become more positive influences on the lifestyle behaviours of adolescents (DoHA, 2003; Vartiainen, Tossavainen, Viri, & Niskanen, 1991). Interventions designed to improve lifestyle habits of adolescents should consider the developmental changes that occur in this stage of life and the associated gender differences. The physical changes associated with puberty and the development of more sophisticated psychological capacity and broader social interaction (Erikson, 1968), makes adolescence a unique window of opportunity to change unhealthy lifestyle habits.

## Conclusions

The dietary, physical and sedentary behaviours of regional Victorian secondary school students in this study were inadequate when compared with Australian recommendations. Gender differences existed in these behaviours; more boys had unhealthy dietary habits and more girls were insufficiently physically active. By being better informed about the behaviour patterns of this age group it is possible to target interventions to improve these behaviours and monitor change.

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