

Short Communication

Prevalence of overweight, obesity and underweight in Western Australian school-aged children; 2008 compared with 2003

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Abstract

Objective: Due to rising rates of obesity globally, the present study aimed to examine differences in overweight and underweight prevalence in Western Australian schoolchildren in 2008 compared with 2003.

Design: Cross-sectional study at two time points; using two-stage stratified sampling, primary and secondary schools in both metropolitan and non-metropolitan Western Australia; sample selected was representative of the State's population figures.

Settings: Seventeen primary and thirteen secondary (2008) and nineteen primary and seventeen secondary (2003) schools. Government and non-government funded schools in metropolitan and non-metropolitan (regional/rural) Western Australia were recruited.

Subjects: Height and weight were measured for 1708 (961 primary and 747 secondary) students in 2008 and 1694 (876 primary and 817 secondary) students in 2003.

Results: Overweight and obesity prevalence in primary students was similar in 2008 (22.9%) to 2003 (23.2%; $P > 0.05$). In secondary girls overweight and obesity prevalence dropped from 23.1% (2003) to 15.9% (2008; $P = 0.002$). Secondary boys showed a slight decrease in overweight and obesity prevalence; however, this was not statistically significant ($P = 0.102$). Higher proportions of underweight in primary girls were observed in 2008 (9.9%) compared with 2003 (4.2%; $P < 0.001$) and in secondary girls in 2008 (9.4%) compared with 2003 (5.5%; $P < 0.001$).

Conclusions: Prevalence of overweight and obesity in Western Australian primary students was stable; however, it declined in secondary students. Both primary and secondary girls showed an increase in underweight prevalence. Public health interventions are needed for the high percentage of youth still overweight, whereas the observed increase in underweight girls warrants attention and further investigation.

Keywords

Adolescents
BMI

Epidemiological studies
Public health

Excess body weight in childhood can lead to negative health conditions such as impaired glucose tolerance, increased CVD risk factor prevalence, asthma, orthopaedic complications and hepatic stenosis (excessively fatty

liver), as well as psychosocial problems⁽¹⁾. Furthermore, an overweight child is more likely to become an overweight adult and thus at increased risk of encountering associated health issues in adulthood⁽¹⁾. The systematic

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monitoring of overweight and obesity prevalence in population-based studies of children and adolescents is important, firstly to assess the effectiveness of current public health interventions in addressing this issue and secondly to forecast the future potential burden on health-care systems. Internationally, recent research has indicated some levelling off in the overweight prevalence in girls⁽²⁾ and boys⁽³⁾. However, a reduction in overweight prevalence has been noted in girls⁽³⁾. A recent review identified that the prevalence of overweight and obesity in Australian children (aged 2–18 years) increased rapidly between 1985 and 1996; however, the rate of increase was not maintained between 1996 and 2007⁽⁴⁾. Rates of change in overweight and obesity prevalence during this time were not significantly different between boys and girls. This levelling off has likewise been noted in Europe, Japan and the USA⁽⁵⁾. The aim of the present study was to examine changes in underweight, overweight and obesity prevalence in Western Australian school-aged boys and girls between 2003 and 2008.

Methods

Study sample and recruitment

The Child and Adolescent Physical Activity and Nutrition Survey (CAPANS) was undertaken on two occasions (2003 and 2008) and included a cross-section of Western Australian school-aged children and adolescents. The protocol and measurement procedures for the 2008 and 2003 surveys were comparable and full details can be found elsewhere^(6,7). The sample was structured to obtain proportional representation according to the State's general population figures. The target CAPANS study sample size (2880 students) was calculated based on: (i) the ability to detect a change of 5% in physical activity level in follow-up surveys, (ii) to accommodate intra-cluster correlations and (iii) consideration of class sizes. The study was conducted according to the guidelines laid down in the Declaration of Helsinki and all procedures involving human subjects were approved by the applicable university ethics committees and the Western Australian Department of Education and Training. Written informed consent was obtained from all subjects.

Stratified random sampling was used to select schools. Western Australian schools were divided into the following categories: primary/secondary, metropolitan/non-metropolitan and government/non-government. Schools were proportionally randomly selected from each stratum. In 2008, thirty-four from seventy-four (45.9%) schools agreed to participate, while in 2003, thirty-six from sixty schools (60.0%) agreed to participate.

Thirty schools in total participated in the project in 2008 and thirty-six in 2003. In primary schools class groups were selected at random from grades 3, 5 and 7. In secondary schools random class recruitment was not possible, thus the

principal or school liaison chose classes to be involved (based on class timetabling) from grades 8, 10 and 11. All students in selected classes were invited to participate in the study with the aim of recruiting approximately twenty-five students from each year group at each school.

Written parental consent was gained for each student to participate, and students were free to withdraw at any time. In 2008, 79.5% of primary (*n* 961) and 46.2% (*n* 747) of secondary students consented to participate in the study and have their anthropometric measures taken; whereas in 2003 consent rates of 58.8% for primary (*n* 876) and 52.1% for secondary (*n* 817) students were achieved.

Data collection

Trained researchers collected data during school visits in school terms 3 and 4 (July to December) in both survey years. Demographic data (sex, birth date, home post-code) and anthropometric measurements were collected from each student. Physical activity and dietary behaviour were also assessed, results are reported elsewhere⁽⁶⁾.

Height and weight measurement adhered to the protocol of the International Society for the Advancement of Kinanthropometry. Students removed their shoes, socks and any other heavy clothing (e.g. jumpers/sweaters/coats). Every measurement was repeated; if the two measures differed by >0.2 kg for weight or >5 mm for height, additional measurements taken until these criteria were met. Weight scales and stadiometers were checked between school visits to ensure that all scales were measuring within $\pm 1.0\%$ of the calibrated weight and $\pm 0.2\%$ of the calibrated height.

BMI (weight in kilograms divided by the square of height in metres), a valid estimate of body fatness in groups of children and adolescents⁽⁸⁾, was calculated for each student. International BMI thresholds specific for sex and age (to 6 months) were used to categorise children as underweight⁽⁹⁾, healthy weight, overweight or obese⁽¹⁰⁾. Each student's home neighbourhood postcode was used to assign a home neighbourhood socio-economic index (Socio-economic Index for Areas – derived from the 2006 Australian Census data) as an estimate of level of social and economic well-being.

Data analysis

Descriptive statistics for 2008 and 2003 were weighted to the Western Australian population standardised age and generalised estimating equation models were created for each sex for both primary and secondary school samples. Each model (adjusted for school clustering as well as age and home neighbourhood socio-economic status) compared 2008 and 2003 proportions of students within BMI categories (overweight/obese *v.* not overweight/obese; underweight *v.* not underweight). Analyses were conducted using the statistical software package SPSS Statistics version 17.0.

Results

Participation rate in the anthropometric component of the study was higher among primary-school students in 2008 than in 2003; whereas these rates for secondary-school students were similar.

The prevalence of overweight and obesity in primary students in Western Australia in 2008 was similar to that in 2003, whereas a smaller proportion of secondary students were overweight or obese in 2008 than in 2003.

Primary-school students

In both 2008 (mean age 10.1 (SD 1.6) years) and 2003 (mean age 10.0 (SD 1.6) years), the majority of primary students surveyed were within the healthy weight category (Table 1). Similar proportions of primary boys and girls in 2003 and in 2008 were classified as overweight or obese (Table 1). A higher proportion of primary girls were underweight in 2008 than in 2003 ($P < 0.001$); primary girls had a 2.20 (95% CI 1.43, 3.37) increased odds of being underweight in 2008 compared with 2003 (Table 1). Home neighbourhood socio-economic status was not associated with being overweight or obese or with being underweight for primary-school boys or girls.

Secondary-school students

In 2008 (mean age 14.1 (SD 1.3) years) and 2003 (mean age 14.2 (SD 1.3) years), the majority of secondary-school students were classified as healthy weight (Table 1). The proportion of secondary-school girls classified as overweight or obese was 7% lower in 2008 than in 2003 ($P = 0.002$; Table 1); secondary girls had a 0.54 odds

(95% CI 0.36, 0.80) of being overweight or obese in 2008 compared with 2003. Secondary girls had a 0.57 odds (95% CI 0.37, 0.89) of being overweight or obese if they resided in a higher socio-economic neighbourhood compared with a middle or low socio-economic neighbourhood. The odds of being overweight or obese for secondary boys in 2008 compared with 2003 was 0.72 (95% CI 0.48, 1.01). Secondary boys had a 0.50 odds (95% CI 0.27, 0.92) of being overweight or obese if they resided in a middle socio-economic neighbourhood compared with a high or low socio-economic neighbourhood.

The proportion of underweight secondary-school girls was significantly higher in 2008 than in 2003 ($P = < 0.001$; Table 1), with a 2.24 (95% CI 1.16, 4.33) increased odds of being underweight in 2008 compared with 2003. Higher odds of being underweight was evident for secondary girls in a high (1.82 odds; 95% CI 1.03, 2.86) and middle socio-economic neighbourhood (1.94 odds; 95% CI 1.31, 2.89) compared with a low socio-economic neighbourhood.

Discussion

Our study results indicate that overweight/obesity prevalence over time has plateaued in Western Australian primary children and reduced in secondary children. Internationally, overweight/obesity prevalence over time has been indicated as stabilising in youth in France⁽¹¹⁾ and reducing in girls in Sweden⁽³⁾.

While a natural saturation of the proportion of children reaching a high BMI may account for the plateau in the proportion of overweight/obese in Western Australian

Table 1 Overall and sex-specific number, proportions (%) and 95% confidence interval of proportions of primary and secondary students classified as underweight, healthy weight and overweight or obese in 2003 and 2008, Western Australia

Weight status	Primary						Secondary					
	2003 (total n 876)			2008 (total n 961)			2003 (total n 817)			2008 (total n 747)		
	n	%	95% CI	n	%	95% CI	n	%	95% CI	n	%	95% CI
Underweight												
Overall	35	4.0	2.7, 5.3	75	7.8	6.0, 9.4	37	4.5	3.1, 6.0	55	7.4	5.6, 9.3
Boys	17	3.8	2.0, 5.5	29	5.8	3.7, 7.8	15	3.6	1.8, 5.4	18	5.2	2.9, 7.6
Girls	18***†	4.2	2.3, 6.2	46***†	9.9	7.2, 12.3	22***†	5.5	3.2, 7.7	37***†	9.4	6.5, 12.3
Healthy weight												
Overall	638	72.8	69.8, 75.7	666	69.4	66.5, 72.3	585	71.6	68.4, 74.6	573	76.6	73.6, 79.7
Boys	347	75.5	71.5, 79.4	336	67.6	63.4, 71.7	300	71.7	67.4, 76.0	279	78.9	74.6, 83.2
Girls	291	69.8	65.4, 74.2	330	71.4	67.2, 75.5	285	71.4	66.9, 75.8	294	74.6	70.3, 78.9
Overweight or obese												
Overall	203	23.2	20.4, 26.0	220	22.9	20.2, 25.5	195	23.9	21.0, 26.8	119	15.9	13.3, 18.6
Boys	95	20.7	17.0, 24.4	133	26.7	22.8, 30.6	103	24.7	20.5, 28.8	56	15.9	12.1, 19.7
Girls	108	25.9	21.7, 30.2	87	18.7	15.2, 22.3	92**‡	23.1	19.0, 27.3	63**‡	16.0	12.3, 19.6

Descriptive statistics for 2008 and 2003 weighted to the Western Australian population standardised age and home neighbourhood socio-economic index (Socio-economic Index for Areas; derived from the 2006 Australian Census data). Generalised estimating equation models were created for each sex for both primary- and secondary-school samples and each model was adjusted for school clustering as well as age and home neighbourhood socio-economic status. Significant difference: ** $P < 0.005$, *** $P < 0.001$.

†Analysis within school type (primary or secondary) between 2003 and 2008 in the proportion underweight compared with all other weight categories combined in the same gender, after adjustment for school clustering as well as age and home neighbourhood socio-economic status.

‡Analysis within school type (primary or secondary) between 2003 and 2008 in the proportion overweight or obese compared with all other weight categories combined in same gender, after adjustment for school clustering as well as age and home neighbourhood socio-economic status.

primary children, the observed reduction in the proportion of overweight/obese secondary students suggests that recent intensive Western Australian public health interventions promoting increased activity and healthy eating could have impacted adolescent behaviour. Despite these encouraging results, the continuing high proportion of overweight/obese youth indicates the need for continued public health initiatives targeting children and adolescents.

Survey results indicate an increase in the proportion of primary- and secondary-school girls who were underweight. This is cause for concern as youth who are underweight are more likely to encounter adverse health conditions including delayed puberty, negative body image and fatigue, as well as an increased risk of osteoporosis and reduced fertility as an adult⁽¹²⁾. Furthermore, although there is no current evidence that obesity prevention programmes impact on eating disorder rates⁽¹³⁾, body image has been identified as the top concern of Australian youth⁽¹⁴⁾, indicating that an integrated approach to prevention and treatment of weight-related disorders is appropriate⁽¹³⁾.

There are several limitations to be considered when interpreting these study results. Students volunteered to participate in the study and secondary-school classes were not randomly selected. Students or their parents may have self-selected participation based on their weight status. A higher proportion of primary students consented in 2008 compared with 2003. While data analysis controlled for socio-economic status, response rates within the two 'school types' (i.e. government *v.* non-government funding) may have differed between 2003 and 2008 (this could not be determined as these data were not available for 2003). A major strength of our study is that it captured objectively measured data from a representative sample of school-aged students living in metropolitan and non-metropolitan locations at two time points using a consistent methodology.

Conclusion

The current study provides evidence that overweight and obesity prevalence may have plateaued in primary and declined in secondary students in Western Australia; however, rates remain high. The study findings also suggest that the proportion of underweight girls in Western Australia increased significantly between 2003 and 2008. Integrated efforts to address the ongoing environmental conditions and behavioural practices leading to weight-related disorders are needed to optimise the physical and social health of youth and decrease future disease burden.

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