

Plateau in obesity and overweight in a cross sectional study of low, middle and high socioeconomic status schoolchildren between 2004 and 2009

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Abstract

Objective To examine cross-sectional trends in obesity and overweight by gender, age and school socioeconomic status (SES) in 1,239 children aged 9–12 years from the same 10 primary schools in 2004 and 2009.

Methods Self report questionnaire with measured height and weight. BMI and international (IOTF) standards were used to classify overweight and obesity. School SES was determined using a combined government measure of family income and parental education.

Results There was no significant change in obesity, overweight or mean BMI between 2004 and 2009. Obesity decreased slightly but not significantly at 7.0% in 2004 and 4.8% in 2009 ($P = 0.42$). The significant predictors of obesity were a low school SES (OR = 2.42, $P = 0.007$) and age ≤ 10 years (OR = 2.33, $P = 0.002$). Male gender was a marginally significant predictor (OR = 1.60, $P = 0.08$). School SES, age and gender were not predictors of overweight.

Conclusions Obesity and overweight remain high, but the increase of earlier years has abated. Children from low SES schools and in younger age groups remained most at risk of obesity. Preventive measures, physical activity and nutrition interventions are needed.

Keywords Children · Obesity · Overweight · Socioeconomic status · Prevalence

Introduction

During the past three decades, the prevalence of overweight and obesity in children and adolescents increased throughout the world (Bundred et al. 2001; WHO 2000). A national study conducted among Australian children and adolescents detected a significant rise in the prevalence of overweight and obesity between the 1980s and the 1990s (Magarey et al. 2001). Recent studies from numerous countries around the Western world suggest that the rising prevalence of childhood obesity that was observed in the 1980s to the mid 1990s has not continued into the most recent decade with an observed stabilization and suggested plateau in the recent studies from the United Kingdom (NHS 2008) and other European countries (Lissner et al. 2009; Péneau et al. 2009; Lazzeri et al. 2008; de Wilde et al. 2009). The most recent childhood obesity prevalence data from the USA (Ogden et al. 2010) reports a stable prevalence with no significant increase from 1999 to 2008.

Recent studies from Australia also suggest a similar stability in prevalence between 1995 and 2007 (Olds et al. 2010) with around 6% of children and adolescents classified as obese and 17% overweight in 2000 (O’Dea and Wilson 2006), 2004 (Booth et al. 2007), 2006 (O’Dea 2008) and 2007 (Commonwealth of Australia 2008).

In studies to date, the role of low socioeconomic status (SES) being associated with an increased prevalence of childhood obesity has been somewhat, but not extensively investigated (Li et al. 2007). In the national study conducted in Australia in 2000 (O’Dea and Wilson 2006), students of both sexes from low socioeconomic (SES)

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schools were significantly more likely than their peers from middle or higher SES schools to be obese (9.0 vs. 5.8%) or overweight (19.0 vs. 16.8%) and low SES predicted the risk of obesity. More recently, in findings from the NHLBI Growth and Health Study from the USA reported that the major factors that best predicted change in BMI percentile among girls was family socio-economic position—namely, income and parent education (Rehkopf 2011).

The primary aim of this study was to examine 5-year trends in the prevalence of overweight and obesity as determined by international standards (Cole et al. 2000) in two cross-sectional samples of Australian schoolchildren selected from the same 10 primary schools in 2004 and 2009. The second aim was to examine whether the influences of gender, age and low school SES on obesity had changed.

Methods

Study population

Participants ($N = 1239$) were drawn from years 4, 5 and 6 from 10 coeducational primary schools in the state of New South Wales (NSW) who participated in cross sectional surveys in 2004 ($N = 590$) and 2009 ($N = 649$). The socioeconomic status (SES) of schools in 2004 and 2009 was defined as low, middle or high SES (O'Dea and Wilson 2006) as determined by the state Department of Education (Commonwealth Department of Education 2005) which assesses school SES using aggregated measures of parental income, education, employment, occupation and measures

of social disadvantage. Low SES represents the lowest quintile of parental income (Commonwealth Department of Education 2005). The status of each school SES did not change between 2004 and 2009.

Measurements

The questionnaire had been pilot tested and administered in two previous national studies (O'Dea and Wilson 2006; O'Dea 2008) and was used to collect self report demographic details of the students' gender, age, school grade/year (years 4–6), eating patterns, nutritional quality of breakfast, body image and several other nutrition and physical activity-related variables. Students completed the questionnaire anonymously during regular class times under the supervision of the first author and trained research assistants. Height and weight were measured using standardised anthropometric procedures. Height was measured to the nearest 0.5 cm without shoes or socks using a portable free standing Harpenden stadiometer. Weight was measured to the nearest 0.1 kg using portable Soehnle digital scales. Students were weighed during August–September of 2004 and 2009 in light school uniform, after removing shoes, jackets and emptying their pockets. Participation was high in both survey years with 78% of all the invited students providing signed parental consent to complete the questionnaires and have the anthropometric measurements taken in 2004 and 82% in 2009. BMI was calculated from measured heights and weights as weight (kg)/height (m²), and obesity/overweight were defined using international cut-offs (Cole et al. 2000).

Table 1 Comparison of mean body mass index of schoolchildren in New South Wales, Australia by gender, age and socioeconomic status in 2004 and 2009

	2004		2009		Mean difference (95% CI)	P value
	N	Mean (SD)	N	Mean (SD)		
Total sample	590	19.1 (3.5)	498	18.9 (3.2)	−0.1 (−0.5, 0.3)	0.61
Gender						
Boys	288	19.1 (3.8)	251	19.0 (3.2)	−0.1 (−0.7, 0.5)	0.74
Girls	302	19.0 (3.3)	247	18.9 (3.2)	−0.1 (−0.7, 0.4)	0.67
Age (years)						
9	129	18.4 (3.6)	87	19.0 (3.7)	0.6 (−0.4, 1.6)	0.23
10	214	19.0 (3.6)	168	18.5 (2.7)	−0.5 (−1.2, 0.1)	0.10
11	175	19.3 (3.5)	162	19.4 (3.4)	0.1 (−0.6, 0.9)	0.68
12	72	19.7 (3.1)	81	18.8 (2.9)	−0.9 (−1.8, 0.1)	0.08
SES						
Low	182	19.6 (4.1)	181	19.3 (3.4)	−0.3 (−1.1, 0.5)	0.44
Middle	216	19.1 (3.5)	137	19.3 (3.4)	0.2 (−0.5, 0.9)	0.57
High	192	18.5 (2.9)	180	18.3 (2.6)	−0.2 (−0.7, 0.4)	0.58

Statistical methods

Data were analysed using SPSS version 17.0 [IBM, USA]. Mean BMI was compared between groups using independent samples *t* tests. Results are summarised as the mean and standard deviation (SD), and changes between 2004 and 2009 are summarised as a mean difference and 95% confidence interval (95% CI). The prevalence of overweight and obesity was computed using the international standard 0.5 years BMI cut offs (Cole et al. 2000). The prevalence of overweight and obesity was compared between groups and over time using Pearson’s chi-square tests. The 95% confidence intervals around estimates of prevalence were computed using the normal approximation to a binomial distribution. Where percentages were less than 5%, an exact binomial distribution was used. Binary logistic regression was employed to estimate the independent predictors of overweight and obesity and to compute adjusted odds ratios.

Ethics approval

The study design and protocols were approved by the University of Sydney Human Ethics committee, the local and state Departments of Education. Signed parental consent was obtained for each participant.

Results

Table 1 shows mean BMI values in 2004 and 2009. There were minimal and statistically non-significant changes over time in the total sample with the mean BMI remaining at approximately 19 in both years. There was also no significant change in mean BMI when groups defined according to gender, age and SES were considered. The exception was the mean BMI of 12 year olds which decreased by 0.9 units in 2009 (*P* = 0.08).

Table 2 shows the prevalence of underweight, normal weight, overweight and obesity in 2004 and 2009. Although there was a slight fall in the prevalence of obesity in the total sample from 7.0% in 2004 to 4.8% in 2009 this was not statistically significant. The prevalence of obesity decreased slightly in both the genders and showed a small increase in children aged 9–10 years and a small decrease in older children aged 11–12 years. A post-hoc test showed the decrease in the prevalence of obesity from 6.3% in 2004 to 3.0% in 2009 in children aged 11–12 years was statistically significant (*P* = 0.04). There were small non significant increases in the prevalence of overweight in the total sample and in groups defined by gender, age and SES with the exception of children from low SES schools in whom there was a small decrease in the prevalence of overweight.

Table 2 Prevalence of underweight, normal weight, overweight and obesity in schoolchildren from NSW, Australia in 2004 and 2009 by gender, age group and socioeconomic status

	2004		2009		Under-weight		Normal		Obesity		Overweight		P value
	N	% (95% CI)	N	% (95% CI)	2004	2009	2004	2009	2004	2009	2004	2009	
Total	583	4.3 (2.8, 6.3)	498	4.4 (2.8, 6.6)	72.0 (68.4, 75.7)	72.1 (68.1, 76.0)	7.0 (5.1, 9.4)	4.8 (3.1, 7.1)	16.6 (13.6, 19.7)	18.7 (15.3, 22.1)	0.42		
Gender													
Boys	286	3.5 (1.7, 6.3)	251	4.0 (1.9, 7.2)	73.1 (67.9, 78.2)	71.7 (66.1, 77.3)	8.4 (5.5, 12.2)	5.6 (3.1, 9.2)	15.0 (10.9, 19.2)	18.7 (13.9, 23.6)	0.44		
Girls	297	5.1 (2.9, 8.2)	247	4.9 (2.5, 8.3)	71.0 (65.9, 76.2)	72.5 (66.9, 78.0)	5.7 (3.4, 9.0)	4.0 (2.0, 7.3)	18.2 (13.8, 22.6)	18.6 (13.8, 23.5)	0.84		
Age (years)													
9–10	139	4.3 (1.6, 9.2)	98	6.1 (2.3, 12.9)	71.9 (63.7, 79.2)	63.3 (52.9, 72.8)	9.4 (5.1, 15.5)	12.2 (6.5, 20.4)	14.4 (9.0, 21.3)	18.4 (11.3, 27.5)	0.57		
11–12	444	4.3 (2.6, 6.6)	400	4.0 (2.3, 6.4)	72.1 (67.9, 76.2)	74.3 (66.3, 82.0)	6.3 (4.2, 9.0)	3.0 (1.6, 5.2)	17.3 (13.8, 20.9)	18.8 (14.9, 22.6)	0.15		
SES													
Low	182	3.3 (1.2, 7.0)	181	2.8 (0.9, 6.3)	65.9 (58.6, 72.8)	72.4 (65.3, 78.7)	10.4 (6.4, 15.8)	6.6 (3.5, 11.3)	20.3 (14.7, 26.9)	18.2 (12.9, 24.6)	0.50		
Middle	216	3.7 (1.6, 7.2)	137	5.8 (2.6, 11.2)	74.5 (68.7, 80.3)	66.4 (57.9, 74.3)	6.0 (3.2, 10.1)	4.4 (1.6, 9.3)	15.7 (10.9, 20.6)	23.4 (16.6, 31.3)	0.20		
High	185	5.9 (3.0, 10.4)	180	5.0 (2.3, 9.3)	75.1 (68.3, 81.2)	76.1 (69.2, 82.1)	4.9 (2.3, 9.0)	3.3 (1.2, 7.1)	14.1 (9.4, 19.9)	15.6 (10.6, 21.7)	0.85		

Table 3 Independent effects of age, gender and socioeconomic status on obesity and overweight in schoolchildren in New South Wales, Australia: comparison of 2004 data with 2009

Factor	Obesity adjusted odds ratio (95% CI)	<i>P</i> value	Overweight adjusted odds ratio (95% CI)	<i>P</i> value
Year 2009	0.68 (0.40, 1.17)	0.16	1.13 (0.82, 1.55)	0.46
Male	1.60 (0.95, 2.69)	0.08	0.93 (0.67, 1.27)	0.63
Age 9–10 years	2.33 (1.37, 3.98)	0.002	0.94 (0.63, 1.39)	0.75
Low SES	2.42 (1.27, 4.62)	0.007	1.37 (0.92, 2.03)	0.12
Middle SES	1.38 (0.68, 2.79)	0.37	1.46 (0.98, 2.16)	0.06
High SES	1		1	

Table 3 shows the relative contributions of year, gender, age and SES to the prevalence of obesity and overweight. The most significant risk factor for obesity was a low SES with an odds ratio of 2.42 followed by being younger with an odds ratio of 2.33. Gender was marginally significant in the model but year was not a significant predictor. There were no significant predictors for overweight except being from a middle SES school which was a marginally significant predictor with a small odds ratio of 1.46.

Discussion

The prevalence of obesity and overweight in 2004 and 2009 were not significantly different with 7.0% of children obese in 2004 and 4.8% in 2009 and 16.6 and 18.6% overweight. These prevalence figures are similar to those reported in the other studies (Olds et al. 2010; O'Dea and Wilson 2006; Booth et al. 2007; O'Dea 2008; Commonwealth of Australia 2008; Li et al. 2007) of Australian schoolchildren, suggesting that childhood obesity and overweight has reached a plateau. The prevalence figures are also similar to an early study of Australian students (Magarey et al. 2001) from 1995, suggesting that the overall prevalence remains high but has not increased since the 1990s. This finding is also consistent with the most recent trends from several other Westernised countries (NHS 2008; Lissner et al. 2009; Péneau et al. 2009; Lazzeri et al. 2008; Ogden et al. 2010), which suggest a leveling of childhood obesity after increases in the 1990s.

In agreement with other recent studies of Australian schoolchildren (O'Dea and Wilson 2006; Li et al. 2007) and studies from other countries (Rehkopf et al. 2011; Mikolajczyk and Richter 2008; Wardle et al. 2006), we found a higher prevalence of obesity and overweight in children from low SES schools compared with their higher SES peers and also in younger primary school children.

This is the second study to suggest a protective effect of higher SES on the weight status of children (O'Dea and Dibley 2009) and, as such, it represents a replication of these earlier findings. A likely explanation for these socio-demographic findings is the social determination of health

status concept, which states that a wide range of socio-cultural factors influence the risk of childhood obesity, including the typical social determinants of health (Marmot 2001), such as family income, parental education, geographic access to nutritious food, access to and affordability of local sporting facilities, general health literacy, outdoor environment, and cultural norms of eating, exercising and ideal weight (Reidpath et al. 2002). As such, the ongoing prevention of childhood obesity is most likely to succeed if these socio-cultural determinants are addressed in interventions targeting schools, communities and other areas of low SES. Health literacy may be the factor which explains many of the persistent social class differences in obesity and health status worldwide.

During the period between 2000 and 2009, many nutrition and physical activity promotion activities were systematically targeted towards school-aged children in Australia, their parents and their school communities. National government programs included Eat Well Australia: 2000–2010 (<http://www.health.gov.au/internet/main/publishing.nsf/Content/health-publth-strateg-food-nphp.htm>); Healthy Active Australia (<http://www.healthyactive.gov.au/>); Crunch'n'sip (<http://www.crunchandsip.com.au/default.aspx>); Active After Schools program (<http://www.health.gov.au/internet/healthyactive/Publishing.nsf/Content/initiatives-a>) and Active Australia (<http://www.healthyactive.gov.au/>) and these programs are still currently operating on a national scale. These health promotion initiatives may go part way in explaining the leveling trends in childhood obesity that we appear to be observing at present.

It was interesting to note that the trend for low SES children to be more obese or overweight was consistent in 2004 and 2009. This finding suggests that whilst the SES differences in weight status are still likely to exist among Australian schoolchildren, the extent of the difference between the three SES groups of children may be lessening. This trend should be further examined in longitudinal studies of children and adolescents from various social classes and ethnic backgrounds, as several studies to date (O'Dea and Wilson 2006; O'Dea 2008; Li et al. 2007) have been unable to clearly determine whether the observed differences are most influenced by the children's social class, ethnicity or a combination of both.

The strengths of the current study include large sample sizes and a high response rate in both of the study years; consistent sampling from the same 10 schools in 2004 and 2009 and standardised measurement of height and weight. Limitations include the use of a cross sectional rather than a longitudinal study design and the use of convenience sampling rather than random sampling. These factors limit the generalisability of the findings as it was not possible to know whether the decreasing trend that was found is due to random differences of the sampling of children recruited in 2004 and 2009.

The current study results suggest that childhood obesity and overweight may be stabilizing in Australia, but that obesity still remains a significant problem in developed countries worldwide and that obesity related disease prevention, such as type 2 diabetes prevention, should remain important objectives for the health status of the nation. Implementation of culturally appropriate physical activity and nutrition promotion interventions which ought to 'First, do no harm' (O'Dea 2004) should be particularly targeted at lower middle and low SES schools and ethnically diverse areas. Health professionals should monitor the ongoing clinical screening of obese children and adolescents for type 2 diabetes risks, particularly those who are inactive, ethnically at risk and those who have a family history of the disease.

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