Original Article

Association between overweight or obesity and household income and parental body mass index in Australian youth: analysis of the Australian National Nutrition Survey, 1995

Zaimin Wang[1] BMed, MMed, MPS Food Nutr, Carla M Patterson[1] MSc, PhD and Andrew P Hills[2] BEd, MSc, PhD

[1]*School of Public Health, Queensland University of Technology, Brisbane, Australia*
[2]*School of Human Movement Studies, Queensland University of Technology, Brisbane, Australia*

This study is a secondary data analysis based on the 1995 Australian National Nutrition Survey (NNS). A random subsample of 1581 school children aged 7–15 years old from the NNS was studied. The results show the prevalence of overweight, obesity and combined overweight and obesity was 10.6–20.9%, 3.7–7.2% and 15.6–25.7%, respectively. The odds ratio of overweight or obese boys with highest household income was significantly smaller than those with the lowest household income. The proportion of combined overweight and obesity in children whose parents were overweight or obese was significantly greater compared with those whose parents were not. The trend of increasing prevalence of overweight or obesity among children with increasing parental body mass index (BMI) was significant after adjusting for age except the trend of father's BMI for boys. This study provided baseline data on the recent prevalence of overweight or obesity of Australian school children using new international absolute BMI cut-off points. It indicated that young school girls (7–9 years) were more likely to be overweight or obese compared with boys, the prevalence rates of overweight or obesity in older boys (13–15 year) was significantly greater than in other age groups while in girls it was the opposite. The boys with lowest household income ($0–17 500) were more likely to be overweight or obese compared with those with the highest household income (greater than $67 500). Having parents especially mothers who were overweight or obese may increase the risk of children being overweight or obese.

Key words: Australia, body mass index, nutrition survey, obesity, overweight, school children.

Introduction

The prevalence of overweight or obesity in children and adolescents has increased in recent decades in developed countries.[1–5] Magarey *et al.* revealed that 19.5% of boys and 21.1% of girls aged 2–15 years in Australia in 1995 were overweight while in 1985 these figures were 10.7% of boys and 11.8% of girls among children aged 7–15 years.[6] Booth *et al.* also found that the current prevalence of overweight/obesity combined in Australian children and adolescents was 19–21% of boys and 21–24% of girls.[7] The most significant long-term consequence of childhood obesity is its persistence into adulthood, along with the numerous associated health risks.[8] Overweight or obese children and adolescents are at higher risk for long-term mortality and morbidity and psychological problems.[8,9] Therefore, both effective prevention and treatment for overweight or obese children are essential.

While there have been a number of risk factors identified as contributing to the prevalence of overweight and obesity in children, the studies on which these are based are not consistent. A study in Belgium revealed that children of low socioeconomic status (SES) have the highest risk both of incidence and of permanence of obesity.[10] Among Australian girls, measured height, weight, waist and hip girths were inversely associated with SES, with body fatness tending to be lower in the highest SES tertile.[11] However, Troiano and Flegal found that there was no evidence for a pattern in the relationship between overweight prevalence and race-ethnicity, or social status, and/or education in an American youth population.[4]

Comprehensive data of anthropometric measurements and SES in a representative population sample of Australians are found in the 1995 Australian National Nutrition Survey (NNS) and National Health Survey (NHS).[12,13] However, the individual level SES measurements available for children and adolescents in the NHS and NNS were household income and occupational and educational status of both

Correspondence address: Zaimin Wang, School of Public Health, Queensland University of Technology, Victoria Park Road, Kelvin Grove, Queensland 4059, Australia.
Tel: +61 73864 8298; Fax: +61 73864 5880
Email: z.wang@qut.edu.au
Accepted 17 December 2001

parents. Parental education was unable to be used as an indicator of SES due to small sample sizes, as education data were only collected from half of NNS participants. The variable of parental occupation exists in the NHS dataset while the data of anthropometric measurements were available in the NNS dataset. Matched sample sizes were limited when variables were merged between the NHS and the NNS. However, there is research that reports household income as being a suitable measure of SES.[14,15] Therefore, the aim of this study was to explore the association between overweight or obesity of children and household income. The association of these factors with parental body mass index (BMI) was based on secondary data analysis of the national cross-sectional nutrition survey dataset.

Methods

The samples

The Australian NNS and NHS were conducted from January 1995 to January 1996. For the NHS, a base sample size approximating one-third of 1% of the population was initially chosen. Sixteen thousand and four hundred private and non-private dwelling units distributed across all States and Territories were initially selected, bringing the total active sample size to 53 800 people. The study collected comprehensive information about the health status of Australians, their use of health services and facilities, and health-related aspects of their lifestyle as well as a number of demographic characteristics.[13] The NNS was conducted using a subsample of NHS respondents selected from the base NHS sample of private dwellings only. Unlike the NHS, the NNS was conducted by approaching a maximum of two in-scope people per household in urban areas and three in-scope people in rural areas. These people were randomly selected from the household. The NNS collected information about food and nutrient intake, food habits and attitudes and selected physical measurements for people aged 2 years or more.[12] Only the data collected on 1581 respondents aged 7–15 years are present here.

Portable digital scales (Tanita model 1597, Arlington Heights, IL, USA), stadiometer and stretch stature method were used to measure weight and height. Weight was measured with light clothes and without shoes. Height was measured without shoes. The precision of weight and height measurement was nearest 0.1 kg and 0.1 cm, respectively.

The subsets data of BMI (kg/m^2; derived from measured weight and height) of children and parents, gross annual household income were created from the NNS.

Variables

Body mass index in children and adolescents. Recently developed criteria for overweight and obesity among children and adolescents provide BMI values for males and females aged 2–18 years in 6 month age brackets.[16] We applied the new international BMI cut-off points for overweight and obesity in subset data of BMI in the NNS. For each age, the cut-off point at the mid-year value was applied (e.g. for those aged 7 years, we used the cut-off at 7.5 years). Therefore, children and adolescents aged 7–15 years were categorized into the groups of non-overweight, overweight, obesity and combined overweight/obesity.

Parental body mass index. The parental BMI was also derived from measured weight and height in the NNS. It was categorized into non-overweight or obese (BMI $\leq$ 25), overweight (25 < BMI $\leq$ 30) and obese (BMI > 30) according to the recommendations of the National Health and Medical Research Council in Australia.[17] Fathers' and mothers' BMI categories were presented separately.

Gross annual household income. In the original NNS dataset, the variable of gross annual household income was categorized into 19 groups. The categories 'not applicable', 'negative' and 'don't know' were excluded from the analysis as the income levels of these groups were either unknown or nondescriptive. The remaining 16 groups left were then re-coded using the middle point value of income as the best estimate of actual household income. Household income quintiles were calculated from these midpoint estimates and re-coded. The values of these quintiles were: $0–17 500, $17 501–32 500, $32 501–47 500, $47 501–67 500 and >$67 500, respectively. These were used as the measure of SES in this study.

Data management and analysis

The SPSS-9.0 for Windows package (SPSS, Chicago, IL, USA) was used for all NNS data management and statistical analyses.[18] Numbers (n) and prevalence (%) of each overweight or obesity classification by demographic factors were tabulated separately by gender. Chi-squared tests of association between demographic factors, household income, parental BMI and overweight or obesity in children and adolescents were carried out. Odds ratios summarized the association between overweight or obesity of children and adolescents by household income with reference to the lowest quintile. Similarly, the association between overweight or obesity of children and their parent's BMI was summarized with odds ratios using parental non-overweight or obesity as the reference. All models were adjusted for age using multivariable logistic regression models. Statistical significance was defined at the conventional $P < 0.05$ level (two-tailed). Trends in household income and parental BMI were carried out using household income levels and parental BMI categories, respectively. Tests for trends were based on specifying the independent variables as continuous covariates rather than as categorical variables in the logistic regression models.

Results

Respondents

A total 22 562 people aged 2 years or over were selected from the NHS to participate in the NNS. Of these, 17 326 (76.8%) accepted and 13 858 (61.4%) participated in the survey. The response rate among 4–7 years, 8–11 years and 12–15 years was 86.4%, 84.8% and 80.4%, respectively. A total of 1585 children and adolescents aged 7–15 years participated in the NNS. Of those, 1581 had physical measurement

data. The paired data on BMI and annual household income were available for 1354 of the 1581 (87.5%) children and adolescents. The samples of paired data on BMI in children and parents (derived from measured weight and height) were: 428 subjects who had father's BMI, 508 had mother's BMI. There were only 36 matched subjects who had BMI data for both parents.

Proportion of overweight or obesity in children and adolescents

The proportion of overweight, obesity and combined overweight and obesity in 1581 children and adolescents aged 7–15 years was determined using new international absolute BMI cut-off points proposed by the International Obesity Task Force (IOTF).[16] The ranges of the prevalence of non-overweight or obesity, overweight, obesity and combined overweight and obesity in boys were 77.5–84.4%, 10.6–16.0%, 3.7–6.5% and 15.6–22.5%, respectively. The ranges of the prevalence of non-overweight or obesity, overweight, obesity and combined overweight and obesity in girls were 74.3–84.4%, 11.0–20.9%, 4.6–7.2% and 15.6–25.7%, respectively (Table 1).

Except for the 7–9 years age group, the proportion of boys and girls who were non-overweight/obese, overweight or obese did not significantly differ when overweight and obesity were included as separated categories, or when overweight and obesity were combined into a single category. The proportion of overweight 7–9 year old girls was significantly greater compared with boys (χ^2 (1) = 6.07, $P < 0.05$), so was the proportion of combined overweight and obesity (χ^2 (1) = 7.72, $P < 0.01$).

Among the boys, the proportion of combined overweight and obesity in the 13–15 year age group was significantly greater compared with that in the 7–9 year age group (χ^2 (1) = 4.50, $P < 0.05$). Among girls, the proportions of overweight and combined overweight and obesity in the 13–15 year age group were significantly smaller than in the 7–9 year age group (χ^2 (1) = 6.42, $P < 0.05$) and 10–12 year age group (χ^2 (1) = 7.42, $P < 0.01$).

The association between body mass index and household income

The paired data on BMI in children and adolescents and gross annual household income were available for 1354 children and adolescents aged 7–15 years, 711 boys and 643 girls. Among boys and girls, the prevalence of overweight, obesity and combined overweight and obesity was lowest in the highest level of household income (> $67 500). But the difference between the proportion of overweight, obesity and combined overweight and obesity and different levels of household income was not significant.

In the logistic regression model, there was no relationship between BMI and household income (adjusted for age) for girls. Among the boys the odds ratio of overweight or obese boys with highest household income was significantly smaller than those with lowest household income. The trend in the prevalence of overweight and obesity with household income was not statistically significant for either boys or girls after adjusting for age (Table 2).

The association between body mass index in children and their parents

The proportion of combined overweight and obesity in children whose parents were overweight or obese was significantly greater compared with those whose parents were not (for father's BMI, χ^2 (1) = 5.04, $P < 0.05$ in boys and χ^2 (1) = 4.99, $P < 0.05$ in girls; for mother's BMI, χ^2 (1) = 6.81, $P < 0.01$ in boys and χ^2 (1) = 8.64, $P < 0.01$ in girls).

In the logistic regression model, the relationship between the BMI of children and adolescents and parental BMI was significant for boys and girls except for the odds ratios for boys and girls whose fathers were obese after adjusting for age. The trend of increasing prevalence of overweight and obesity among children with increasing parental BMI was statistically significant after adjusting for age. The exception was the trend of father's BMI for boys (Tables 3,4). That means parental overweight or obesity especially in the mother may increase the risk of childhood overweight or obesity.

Discussion

The prevalence of overweight or obesity among children and adolescents in Australia was identified as a concern in a recent report *Acting on Australia's Weight* as it is evident that overweight in Australian children is increasing.[17] The results of the current study using the new international cut-off points[16] revealed the ranges of the prevalence of overweight, obesity and combined overweight and obesity were 10.6–20.9%, 3.7–7.2% and 15.6–25.7%, respectively, in children and adolescents aged 7–15 years. Among the young children aged 7–9 years, girls were more likely to be overweight or obese. Compared with other age groups, older boys aged 13–15 years were more likely to be overweight

Table 1. Proportion of boys and girls in each body mass index category

Age (years)	Non-overweight or obese (%)		Overweight (%)		Obese (%)		Overweight + obese (%)	
	Boys (n = 682)	Girls (n = 571)	Boys (n = 119)	Girls (n = 125)	Boys (n = 43)	Girls (n = 41)	Boys (n = 162)	Girls (n = 166)
7–9	84.4	74.9	10.6	17.9*	5.0	7.2	15.6	25.1**
10–12	80.2	74.3	16.0	20.9	3.7	4.9	19.8	25.7
13–15	77.5	84.4	16.0	11.0	6.5	4.6	22.5	15.6

*$P < 0.05$, **$P < 0.01$ (for the comparison of proportion between boys and girls).

Table 2. Results of logistic regression analysis: the prevalence and odds ratios of overweight/obesity for different levels of household income

Household income (A$)	Prevalence (%)	Unadjusted OR	95% CI	OR adjusted by age	95% CI
Boys					
0–17 500	20.8	1.00		1.00	
17 501–32 500	21.6	0.64	0.35–1.16	0.64	0.35–1.16
32 501–47 500	20.8	0.83	0.45–1.52	0.81	0.44–1.50
47 501–67 500	23.2	0.81	0.45–1.46	0.83	0.45–1.50
>67 500	13.6	0.54	0.27–1.05	0.50	0.26–0.99*
Household income trend (*P*-value)		0.236		0.128	
Girls					
0–17500	19.5	1.00		1.00	
17 501–32 500	21.5	0.87	0.49–1.55	0.87	0.49–1.56
32 501–47 500	20.1	0.84	0.47–1.51	0.86	0.47–1.55
47 501–67 500	22.8	0.86	0.49–1.53	0.88	0.50–1.57
>67 500	16.1	0.67	0.36–1.24	0.70	0.38–1.31
Household income trends (*P*-value)		0.260		0.332	

*$P < 0.05$. OR, odds ratio.

Table 3. Results of logistic regression analysis: the prevalence and odds ratios of overweight/obesity for categories of father's BMI

Father's BMI	Prevalence (%)	Unadjusted OR	95% CI	OR adjusted by age	95% CI
Boys					
Non-overweight or obese	9.1	1.00		1.00	
Overweight	22.5	2.90	1.14–7.34**	2.91	1.14–7.42**
Obese	18.4	2.26	0.70–7.30	2.22	0.68–7.26
Overweight + obese	21.6	2.75	1.11–6.86**	2.76	1.10–6.92**
Father's BMI trends (*P*-value)		0.058		0.106	
Girls					
Non-overweight or obese	12.3	1.00		1.00	
Overweight	26.6	2.59	1.04–6.45**	2.70	1.07–0.82**
Obese	28.6	2.86	0.97–8.40*	2.95	0.99–8.84*
Overweight + obese	27.1	2.66	1.10–6.42**	2.77	1.13–6.76 **
Father's BMI trends (*P*-value)		0.032		0.044	

*$P = 0.053$–0.056, **$P < 0.05$. BMI, body mass index; OR, odds ratio.

Table 4. Results of logistic regression analysis: the prevalence and odds ratios of overweight/obesity for categories of mother's BMI

Mother's BMI	Prevalence (%)	Unadjusted OR	95% CI	OR adjusted by age	95% CI
Boys					
Non-overweight or obese	13.6	1.00		1.00	
Overweight	23.2	1.92	0.95–3.89	2.03	0.99–4.15*
Obese	30.8	2.83	1.32–6.07***	3.14	1.44–6.85***
Overweight + obese	26.1	2.25	1.21–4.18***	2.42	1.29–4.54***
Mother's BMI trends (*P*-value)		0.006		0.012	
Girls					
Non-overweight or obese	14.6	1.00		1.00	
Overweight	27.9	2.26	1.09–4.68**	2.35	1.13–4.90**
Obese	34.9	3.12	1.40–6.97**	3.36	1.49–7.59***
Overweight + obese	30.6	2.58	1.35–4.90***	2.71	1.41–5.19***
Mother's BMI trends (*P*-value)		0.003		0.001	

*$P = 0.053$, **$P < 0.05$, ***$P < 0.01$. BMI, body mass index; OR, odds ratio.

or obese while girls aged 13–15 years were the least likely to be overweight or obese in all age groups. These findings generally provide baseline data based on a large, relatively recent national survey of nutritional status in Australian school children.

A number of studies have considered the risk factors contributing to the prevalence of overweight in children and adolescents. The literature reports on a range of different indicators (e.g. income, education levels and occupation) as being suitable measures of SES.[14] Unlike adults, the children and adolescents reported were not in the workforce, did not earn an income and had not finished their education. Therefore, parental or family-based measurements of socio-economic position were used in examining the influence on their health status. Unfortunately, this study was unable to select more SES indicators for further analysis due to the limitation of the datasets. The current study used household income as the measure of SES and found that although the prevalence of overweight, obesity and combined overweight and obesity among boys and girls was the lowest in the highest level of household income, only among the boys was the odds ratio of overweight or obese boys with the highest household income significantly smaller compared with those with the lowest household income.

An inverse relationship has been documented between SES and obesity in youth,[10,11] and income had been used as an indicator to define SES in some studies.[14,15] It would be interesting in a further study to explore whether the relationships found here using household income as an indicator remain the same if other indicators (i.e. education or occupation) were used.

Both bivariate and multivariate statistical analyses were used to explore the independent association between the prevalence of overweight or obesity in children and parental BMI. Results showed that the prevalence of overweight or obesity in children and adolescents increases with the increasing prevalence of parental overweight or obesity except the trend of father's BMI for boys. That is, having parents especially mothers who were overweight or obese may increase the risk of children being overweight or obese. This finding is consistent with the results of previous studies.[19,20] These results also suggested that the parental risk of overweight or obesity was an independent risk factor for childhood obesity. Genetic predisposition, family eating habits and lifestyle may also manifest an influence. For example, parents have the opportunity to influence their children's activity and diet positively.[21] However, as NNS does not provide any long-term data on food and energy intake, the selected highlights from the NNS[22] revealed that the average energy intake of adults classified as overweight or obese was lower than that recorded for adults whose weight was in the acceptable range. Further study on the influence of parental diet and physical activity is required. In addition, the influence of having two overweight or obese parents could not be examined in this study due to the very small matched sample size of those children for whom both parents had BMI data reported.

There are also several important covariates contributing to the risk of children being overweight or obese. More importantly, the increased prevalence of overweight and obesity in youth may be attributed to decreasing activity, increasing inactivity and increasing food energy intake. A comparison of the dietary intakes of children aged 10–15 years from the Australian national surveys of 1985 and 1995 suggested that mean daily energy intake has increased by 0.5–2.0 MJ in the 10 year interval.[23,24] However, based on the secondary data analysis of the NNS, Wang *et al.* also found that the mean intake of energy in non-overweight Australian boys aged 7–15 years was significantly higher than that in their overweight counterparts (ZM Wang, CM Patterson, AP Hills, pers. comm. 2001). This may suggest that those who were overweight are restricting their dietary energy intake or are underreporting their intakes. Many also suggest that increasing levels of obesity in children are the direct results of declining levels of physical activity and there is accumulating evidence that physical activity among youth has declined during the past decades.[25] Ethnicity is also an important factor contributing to the prevalence of overweight in children.[26] Unfortunately, there were no data involving physical activity for Australian youth under 15 years in the 1995 NNS. The samples of minority groups in both the NNS and NHS were not sufficient to assess the association between ethnicity and childhood overweight or obesity.

There are further limitations with respect to the data and criteria for determining overweight or obesity in children and adolescents in this study. For example, the respondents are a subsample of the NHS and were selected by approaching a maximum of two in-scope people per household in urban areas and three in-scope people in rural areas. Thus, when merging the subsets SES and parental BMI data created from the NNS, some of the respondents did not have paired data. For example, among the 1581 children and adolescents aged 7–15 years in the NNS dataset, 12.5% did not have household income data, the rate of non-paired data for parental BMI derived from measured weight and height was 73% and 68%, respectively. Besides the sample selection errors, it is still possible that there is a non-response bias in the data because the children and adolescents who are significantly over or underweight might be more likely to avoid an anthropometric assessment.

In addition, the data of new international cut-off points were actually derived from six pooled reference populations in the world.[14] The suitability of those cut-off points to identify the degree of overweight or obesity among Australian youth still needs to be evaluated.

In conclusion, this study provided baseline data on the recent prevalence of overweight or obesity of Australian school children using new international absolute BMI cut-off points. It revealed that compared with young boys aged 7–9 years, the girls of the same age were more likely to be overweight or obese. Among both boys and girls, the prevalence rates in the 13–15 year age group significantly differed from other age groups (e.g. 13–15 year-old boys were more

likely to be overweight or obese while 13–15 year-old girls were the opposite). The odds ratio of overweight or obese boys with the highest household income was significantly smaller compared with those with the lowest household income. Having parents, particularly mothers, who were overweight or obese may increase the risk of children being overweight or obese.

Due to the limitations in this study, more research is required to examine the influence of risk factors contributing to overweight or obesity in children and adolescents.

Acknowledgements. The authors would like to thank Dr Diana Battistutta, statistician in the Faculty of Health, Queensland University of Technology, for her very helpful comments.

References

1. Allan J. New directions for the study of overweight. West J Nurs Res 1998; 20: 7–13.
2. Hill J, Trowbridge F. Childhood obesity: future directions and research priorities. (The causes and health consequences of obesity in children and adolescents). Pediatrics 1998; 101: 570–574.
3. Rosner B, Prineas R, Loggie L, Daniels SR. Percentiles for body mass index in U.S. children 5–17 years of age. J Pediatr 1998; 132: 211–222.
4. Troiano R, Flegal K. Overweight children and adolescents: description, epidemiology, and demographics. (The causes and health consequences of obesity in children and adolescents). Pediatrics 1998; 101: 497–504.
5. Flegal K. The obesity epidemic in children and adults: current evidence and research issues. Med Sci Sports Exerc 1999; 31: S509–S514.
6. Magarey AM, Daniels LA, Boulton TJC. Prevalence of overweight and obesity in Australian children and adolescents: reassessment of 1985 and 1995 data against new standard international definitions. Med J Aust 2001; 174: 561–564.
7. Booth ML, Wake M, Armstrong T, Chey T, Hesketh K, Mathur S. The epidemiology of overweight and obesity among Australian children and adolescents, 1995–97. Aust NZ J Public Health 2001; 25: 162–169.
8. World Health Organization. Obesity: preventing and managing the global epidemic. Geneva: WHO, 1997.
9. Cashel K, Gibbons KL, Inge KE, Booth ML, Farpour-Lambert N, Baur LA, Steinbeck KS, Hills AJ, Bass SL, Kerr DA. Recommendations for nutrition and physical activity for Australian children. Med J Aust 2000; 173: s1–s16.
10. De Spiegelaere M, Dramaix M, Hennart P. The influence of socioeconomic status on the incidence and evolution of obesity during early adolescence. Int J Obes 1998; 22: 268–274.
11. Booth M, Macaskill P, Lazarus R, Baur LA. Sociodemographic distribution of measures of body fatness among children and adolescents in New South Wales. Aust Int J Obes 1999; 23: 456–462.
12. Australian Bureau of Statistics. National Nutrition Survey Users' Guide 1995. Canberra: Commonwealth of Australia, 1998.
13. Australian Bureau of Statistics. National Health Survey Users' Guide 1995. Canberra: Commonwealth of Australia, 1996.
14. Turrell G, Western JS, Najman JM. The measurement of social class in health research: problems and prospects. In: Waddell C, Petersen AR, eds. Just health: inequality in illness, care and prevention. Melbourne: Churchill Livingstone, 1994; 87–103.
15. Gortmaker S, Must A, Perrin JM, Sobol AM, Dietz WH. Social and economic consequences of overweight in adolescence and young adulthood. N Engl J Med 1993; 329: 1008–1012.
16. Cole T, Bellizzi MC, Flegal KM, Dietz WH. Establishing a standard definition for child overweight and obesity worldwide: international survey. BMJ 2000; 320: 1–6.
17. National Health and Medical Research Council. Acting on Australia's weight: a strategic plan for the prevention of overweight and obesity. Canberra: Australian Government Publishing Service, 1997.
18. SPSS Inc. SPSS for Windows Manuals. Chicago: SPSS, 1999.
19. Whitaker R, Wright JA, Pape MS, Seidel KD, Dietz WH. Predicting obesity in young adulthood from childhood and parental obesity. N Engl J Med 1997; 337: 869–873.
20. Maffeis C, Talamini G, Tato L. Influence of diet, physical activity and parents' obesity on children's adiposity: a four-year longitudinal study. Int J Obes 1998; 22: 758–764.
21. Epstein LH, Valoski A, Wing RR, McCurley J. Ten-year follow-up of behavioural, family-based treatment for obese children. JAMA 1990; 264: 2519–2523.
22. Australian Bureau of Statistics. National nutrition survey selected highlights, Australia, 1995. Canberra: Commonwealth of Australia, 1997.
23. Department of Community Services and Health. National dietary survey of school children (aged 10–15 years), 1985; No 2 – nutrients. Canberra: Australian Government Publishing Service, 1989.
24. Mclennan W, Podger A. National nutrition survey, 1995. Nutrient intakes and physical measurements. Canberra: Australian Government Publishing Service, 1998.
25. Luepker R. How physically active are American children and what can we do about it? Int J Obes 1999; 23: S12–S17.
26. Popkin BM, Udry JR. Adolescent obesity increases significantly in second and third generation US immigrants: The national longitudinal study of adolescent health. J Nutr 1998; 128: 701–706.