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Obesity among schoolchildren in Kuala Selangor: A cross-sectional study

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Abstract. Childhood obesity is an established problem in many countries and emerging in others. Epidemiological data on obesity in children is essential in order to plan public health policy and services. A study was conducted to determine the prevalence of obesity in schoolchildren in the fifth grade of elementary school (10-12 years old) in the district of Kuala Selangor. Ten schools of which five are in urban and five in rural areas were selected consisting of 699 eleven year old schoolchildren from the three major ethnic groups. Using international cut-off points for obesity, we report an overall prevalence of obesity of 7.2%. Prevalence of obesity in urban children is 7.2% whereas in rural children it is 7.0 %. Analysed by gender, there were 8.9% obese boys and 5.3% obese girls. Among the 3 major ethnic groups, the Malays had the highest prevalence of obesity at 9.3% followed by the Chinese with 6.6% while among Indians 3.0%. The data obtained from this study suggests that obesity in Kuala Selangor children is a cause for concern in urban and rural areas.

INTRODUCTION

Childhood obesity is a global health problem recognized by the WHO. Prevalence of obesity in school-aged children is estimated to be 10% worldwide (Anonymous, 2005). It is higher in industrialized and developed countries. In the USA, childhood obesity has been considered as an epidemic (Deckelbaum & Williams, 2001). Numerous health problems are associated with childhood obesity including earlier occurrence of type II diabetes mellitus, hypertension and endothelial dysfunction (NHMRC, 2003). These are established cardiovascular risk factors heralding acute coronary insufficiency and stroke. The risk of obesity in adulthood is twice as high for obese schoolchildren and about a third of adult obesity begins in preschool (Serdula *et al.*, 1993). Childhood obesity and overweight are due to multiple factors. Among the risk factors amenable to intervention are behavioural factors such as dietary intake and physical activity (Ells *et al.*, 2005).

There have been few studies on childhood obesity in Malaysia. A study in 2004 reported a prevalence of overweight of 7.3% in a sample of urban adolescents (Moy *et al.*, 2004). In another study, prevalence of childhood obesity was reported to be higher in urban compared to rural areas (Bong & Safurah, 1996).

Kuala Selangor district is one of 9 districts in the state of Selangor. It has a population of 170,200 (Department of Statistics, 2001) and a land area of 117,844 hectares. Kuala Selangor district is more rural than urban but in the past 10 years had undergone rapid industrialization and development and is now one of the fastest growing economies among the districts in Selangor. Urbanization and improved

socioeconomic status have been known to influence changes in lifestyle and eating habits and has been postulated to contribute towards increasing obesity (Noor, 2002). Thus, the purpose of this study is to determine the prevalence of childhood obesity among a sample of schoolchildren in Kuala Selangor district and to explore urban/rural factor, ethnicity and gender associations with childhood obesity.

MATERIALS & METHODS

This was a cross-sectional school-based survey conducted in primary (elementary) schools in Kuala Selangor, a district in the state of Selangor. The study population were students attending the fifth grade (hereafter referred to as Standard Five) in 10 primary schools in the district of Kuala Selangor.

Sampling method

Sample size was determined using Epi Info 6 STATCALC program. Estimating the prevalence of obesity in the population to be 9.0% with confidence level and power of the test set at 95% and 80% respectively, the sample size required was 668. Selection was done by stratified two-stage cluster sampling. A list of all the primary schools (Excluding religious and private schools) in the district of Kuala Selangor was obtained from the Selangor State Education Department. In the list were 69 schools, which are divided into three types: Vernacular (34 schools), Chinese (13 schools) and Tamil (22 schools). Each type of school consists mainly of Malay, Chinese and Indian students respectively. The schools were stratified as urban or rural according to the classification by the Department of Statistics, Malaysia (DOSM). According to DOSM, an area with a population of more than 10,000 is classified as urban. The schools from each stratum (urban and rural) were further stratified by type of school and proportionate-to-size sampling of schools to reflect the ethnic distribution in the population. Thus, five schools comprising of three vernacular schools, one Chinese and one Tamil school were selected from each stratum. Since the total number of students in Standard Five classes in all 10 schools was only 738, it was decided to include them all

Data collection

Letters requesting parents' consent were given to students to take home two weeks before the actual visit and collected on the day of the survey.

A 31-item questionnaire in the Malay language was developed for the study. The questionnaire contained multiple-choice, close-ended questions that elicit demographic, physical activity and dietary information. A pre-test of the instrument was conducted on 36 Standard Five students in a vernacular school in Puchong, Selangor. Slight modifications were made to the questionnaire based on results of the pre-test in which a few questions were rephrased to enhance clarity. The revised questionnaire was used in the actual survey.

During the survey, the selected children were gathered in a hall or classroom and the questionnaires were distributed for the children to complete. Each question was read aloud and explained by a member of the research team. Teachers and researchers assisted students who had problems understanding any of the questions.

Height and weight were measured to calculate BMI by members of the research team. Height was measured to the nearest one-tenth of a centimetre with a portable Seca 208 height measure suspended upright against a straight wall. Weight was measured with clothes on, without shoes to the nearest half kilogram with a bathroom scale which was calibrated with standard weights before each session.

Definition of obesity

Body mass index (BMI) was used as the anthropometric indicator for obesity (BMI=weight/height^2). Body mass status classification was according to international reference values developed by Cole *et al.* (2000) and adopted by the International Obesity Task Force (IOTF). To determine body mass status, the age of each child at the time of the survey was rounded off to

Table 1. Participation rates by urban rural strata and type of school

Type of school	No. of schoolchildren/total (%)		
	Urban	Rural	Total
Vernacular	296/305 (97.0)	165/175 (94.3)	461/480 (96.0)
Chinese	45/47 (95.7)	44/45 (97.8)	89/92 (96.7)
Tamil	130/142 (91.5)	19/24 (79.2)	149/166 (89.8)
Total	471/494 (95.3)	228/244 (93.4)	699/738 (94.7)

the nearest half year and the individual child's status is classified (underweight or normal, overweight and obese) based on the cut-off BMI values for the corresponding age and sex.

Data Analysis

Data were entered and analysed in SPSS version 11.5. Chi-square tests for statistical significance of associations were computed along with the respective odds ratios for overweight and obesity with their 95% confidence intervals (CIs).

RESULTS

A total of 738 students from 10 schools were eligible for the survey. 699 responded giving a participation rate of 94.7% (Table 1). The number of urban schoolchildren was 471 (67.4%) and rural schoolchildren 228 (32.6%). Male and female pupils were approximately equal in number (360 vs. 339). Distribution by ethnicity was 60.2% Malay, 10.9% Chinese and 28.9% Indian. The age of the children ranged from 10.6 to 12.2 years, with a mean of 11.1 years.

Mean BMI±SD was 18.1±3.9, range 22.1 (11.4-33.5). The overall prevalence of obesity was 7.2%. A total of 21.8% (152 of 699) were overweight or obese (Table 2).

Table 3 shows the prevalence of overweight and obesity and association with demographic factors. Only ethnicity was significantly associated with obesity. There was no association between urban-rural strata and obesity, prevalence of obesity between urban and rural children was not significantly different (7.2 vs.7.0%).

Difference in obesity rates between genders was not significant (8.9% vs. 5.3%). However, among girls, there was a weakly significant difference in urban-rural obesity rates (Table 4). Urban girls were less likely to be overweight or obese compared to their rural counterparts (OR=0.57 and OR=0.35 for overweight/obese and obese respectively). This difference is not observed between urban and rural boys.

Malay schoolchildren were more than three times more likely to be obese compared to Indians, but not when compared to the Chinese (Table 5). The Chinese are three times more likely to be overweight compared to the Indians but are not more significantly likely to be obese.

Within each ethnic group there were no statistically significant differences in overweight and obesity rates either between

Table 2. Body mass status distribution of Standard Five schoolchildren in Kuala Selangor

	n (%)
Normal or underweight	547 (78.2%)
Overweight	102 (14.6%)
Obese	50 (7.2%)
Total	699 (100%)

Table 3. Demographic factors and prevalence of overweight and obesity in Standard Five schoolchildren in Kuala Selangor

Variable		Overweight or obese			Obese		
		% (n)	p value	Odds Ratio (95% CI)	% (n)	p value	Odds Ratio (95% CI)
Strata							
Urban	(n=471)	20.8 (98)	0.39	0.85 (0.58-1.24)	7.2 (34)	0.92	1.03 (0.56-1.91)
Rural	(n=228)	23.7 (54)			7.0 (16)		
Gender							
Male	(n=360)	24.4 (88)	0.07	1.39 (0.97-1.99)	8.9 (32)	0.07	1.74 (0.96-3.16)
Female	(n=339)	18.9 (64)			5.3 (18)		
Ethnicity							
Malay	(n=421)	24.2 (102)			9.3 (39)		
Chinese	(n=76)	31.6 (24)	0.001	–	6.6 (5)	0.02	–
Indian	(n=202)	12.9 (26)			3.0 (6)		

Table 4. Prevalence of obesity among male and female Standard Five schoolchildren in Kuala Selangor by urban-rural strata

	Overweight or obese (Combined)			Obese		
	% (n)	p value	Odds Ratio (CI)	% (n)	p value	Odds Ratio (CI)
Male						
Urban (n=240)	25.4 (61)	0.54	1.17 (0.69-1.97)	10.8 (26)	0.07	2.31 (0.92-5.77)
Rural (n=120)	22.5 (27)			5.0 (6)		
Female						
Urban (n=231)	16.0 (37)	0.049	0.57 (0.33-1.00)	3.5 (8)	0.03	0.35 (0.14-0.92)
Rural (n=108)	25.0 (27)			9.3 (10)		

Table 5. Comparison of prevalences of overweight and obesity by ethnicity

Variable	Overweight or obese (Combined)		Obese	
	p value*	Odds Ratio (CI)	p value*	Odds Ratio (CI)
Malay vs. Chinese	0.17	0.69 (0.41-1.18)	0.45	1.45 (0.55-3.81)
Malay vs. Indian	0.001	2.16 (1.36-3.46)	0.005	3.34 (1.39-8.01)
Chinese vs. Indian	<0.001	3.12 (1.66-5.90)	0.18**	2.30 (0.68-7.77)

* Pearson's Chi Square Test
** Fisher's Exact Test

Table 6. Comparison of prevalence of overweight and obesity between urban and rural children within ethnic groups

	Overweight or obese (Combined)			Obese		
	% (n)	p value	Odds Ratio (CI)	% (n)	p value	Odds Ratio (CI)
Malay						
Urban (n=263)	24.7 (65)	0.76	1.07 (0.68-1.71)	10.3 (27)	0.36	1.39 (0.68-2.83)
Rural (n=158)	23.4 (37)			7.6 (12)		
Chinese						
Urban (n=34)	26.5 (9)	0.39	0.648 (0.24-1.74)	2.9 (1)	0.25	0.288 (0.03-2.71)
Rural (n=42)	35.7 (15)			9.5 (4)		
Indian					0.32	***
Urban (n=174)	13.8 (24)	0.33	2.08 (0.46-9.33)	3.4 (6)		
Rural (n=28)	7.1 (2)			0 (0)		

*** Odds Ratio cannot be computed as one cell has no value

Table 7. Comparison of prevalence of overweight and obesity between male and female children within ethnic groups

	Overweight or obese (Combined)			Obese		
	% (n)	p value	Odds Ratio (CI)	% (n)	p value	Odds Ratio (CI)
Malay						
Male (n=233)	27.8 (62)	0.069	1.521 (0.97-2.39)	10.8 (24)	0.260	1.47 (0.75-2.89)
Female (n=198)	20.2 (40)			7.6 (15)		
Chinese						
Male (n=39)	35.9 (14)	0.406	1.512 (0.57-4.02)	10.3 (4)	0.184	4.11 (0.44-38.65)
Female (n=37)	27.0 (10)			2.7 (1)		
Indian						
Male (n=98)	12.2 (12)	0.796	0.897 (0.39-2.05)	4.1 (4)	0.366	2.17 (0.39-12.12)
Female (n=104)	13.5 (14)			1.9 (2)		

male and female (Table 6) or between urban and rural children (Table 7).

DISCUSSION

In this study, the overall prevalence of overweight and obesity (14.6% and 7.2% respectively) are slightly lower than the rates from two previously conducted Malaysian studies using various definitions of obesity and in various age groups. Bong & Safurah (1996) conducted a study among children of different age groups in Selangor and found the overall prevalence of obesity for the district of Kuala Selangor to be 8.7% based on the 1983 WHO weight-for-height criteria. Kasmini *et al.* (1997) reported an overall prevalence of obesity of 9.6% in children and adolescents aged 7 to 16 years old in schools in urban Kuala Lumpur based on weight-for height cut-off points from the 1976 NCHS growth charts. A more recent study by Moy *et al.* (2004) is probably the most comparable

as they included similar aged schoolchildren in Kuala Lumpur but used BMI-for-age cut-off points recommended by the 1995 WHO report and reported prevalence of overweight (10.1%) among schoolchildren of the same grade of school, which is lower than the prevalence of overweight combined with obesity or overweight alone found in this study.

This is the first study in Malaysian children known to us, to use the IOTF classification for childhood obesity. We chose the IOTF definition for the reasons that it is accepted in the national clinical practice guidelines for management of obesity of this country as a measure of obesity in children. Secondly, it appears to be increasingly used by researchers around the world and thus enables cross-national and possibly other future local comparisons.

One such cross-national comparison was conducted by Wang *et al.* (2002) who reported the combined prevalence of overweight and obesity in adolescents 10 to 18-years of age in 1997 of between 6.2% in China, to 27.3% in the United States of America. Our study showed a combined prevalence of 21.8% and this is a cause for concern. China, Russia and Brazil reported lower figures.

There was no discernible difference between urban and rural obesity rates, in contrast with an earlier study (Bong & Safurah, 1996) in which urban obesity was reported to be higher. The relationship between urbanization and obesity is said to vary across countries. Obesity is more prevalent in urban areas in China but in rural areas in Russia (Wang, 2001). In recent years urban centres have been made more accessible to rural residents by more road access and improved public transportation, especially in this particular state which has seen among the fastest urban growth in this country. Improved accessibility may have resulted in the encroachment of urban influences in rural areas and a nutritional transition in these areas, bridging the urban/rural gap (Ng *et al.*, 1995).

Similarly, prevalence of obesity was not significantly varied by gender. It should be noted however that the prevalence in girls may be an underestimation as the sensitivity of the IOTF criteria was reported to be very low for this group (Neovius *et al.*, 2004). In previous studies overweight and obesity were higher among boys (Bong & Safurah, 1996; Kasmini *et al.*, 1997).

There are conflicting findings with regards to association of obesity with ethnicity. Indian children have the lowest overweight and obesity prevalences compared to the Malay and the Chinese in the current study and also in the study by Moy *et al.* (2004), whereas the opposite was reported by Kasmini *et al.* (1997).

Methodological variation between local studies limits meaningful comparison and thus assessment of trends. However, comparison with studies in other countries using similar criteria are feasible and suggest that overweight and obesity is as much a problem in this country as in other more developed parts of the world. To stem this problem, the current intervention programmes may need to be reviewed and improved.

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