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Familial and Socio-environmental Predictors of Overweight and Obesity among Primary School Children in Selangor and Kuala Lumpur

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ABSTRACT

Introduction: A cross-sectional study was conducted to determine the familial and socio-environmental predictors of overweight and obesity among 1430, 9-12 year-old primary school children and their parents in Selangor and Kuala Lumpur. **Methodology:** Body weight and height were measured and body mass index was calculated. Modified Child Feeding (CFQ) and Determinants of Adolescent Social Well-being and Health (DASH) questionnaires were used to measure familial and socio-environmental factors. **Results:** A total of 17.9% of the children were overweight while 16.0% were obese. Positive relationships were found between child's BMI and parent's BMI (r = 0.129, $p \leq 0.01$), concern about child's weight (r = 0.125, $p \leq 0.01$) and restriction (r = 0.057, $p \leq 0.05$) to unhealthy foods. However, negative relationships were found between child's BMI with pressure to eat (r = -0.135, $p \leq 0.01$) and neighbourhood safety perception (r = -0.053, $p \leq 0.05$). The logistic regression analysis showed that being male (Exp (β) = 0.538; 95% CI = 0.421-0.687), higher parent's BMI (Exp (β) = 1.055; 95% CI = 1.028-1.082), higher concern about child's weight (Exp (β) = 1.082; 95% CI = 1.030-1.127), low pressure to eat (Exp (β) = 0.857; 95% CI = 0.801-0.916) and low perception of neighbourhood safety (Exp (β) = 0.951; 95% CI = 0.913-0.990) were significantly associated with increased risk of overweight. **Conclusion:** Parents should be the main target for education to modify children's weight status. Further research should be carried out to understand the mechanism of influence of parents and the socio-environment on child's health.

Keywords: Child feeding practices, childhood obesity, neighbourhood safety, pressure to eat, restrictions

INTRODUCTION

Globally, the rate of childhood obesity is increasing dramatically in both developed countries and developing countries. An estimated 83% or 1.5 billion of the world's children live in developing countries, showing that the increasing trend of childhood overweight and obesity in these countries will affect the majority of the world's children population (Cameron, 2005).

In Malaysia, the prevalence of overweight has increased from 5.36% with

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6.03% for boys and 4.68% for girls (IPH, 2008) to 12% for boys and 13% for girls (Norimah *et al*., 2009). Meanwhile, the prevalence of childhood obesity has increased from 11.7% (Ismail *et al*., 2001-2002) to 13.5% (Norimah *et al*., 2009) in the past 10 years. Although these prevalence rates are relatively lower compared to those of developed countries such as the United States, United Kingdom, Spain, Italy and southern Europe (obesity prevalence rates of between 19 and 35%), the prevalence of obesity in Malaysia is still unfavourable when compared with other advanced Asian countries such as Japan which reported obesity prevalence rates of between 6.1 and 11.1% for males and 7.1 and 10.2% for females (Lobstein & Frelut, 2003; Chu, 2001).

In the past, childhood obesity has been found to be mainly attributed to dietary habits and physical activity of the individuals (Maffeis, 2000; Ravussin & Bogardus, 2000). However, familial and environmental influences could also facilitate the development of childhood obesity (Davison & Birch, 2001). One of the major familial characteristics that predicts highly a child's overweight status is the presence of overweight parents in the family. In addition, recognition of the child's overweight status through a parent's concern for the child's weight has also been found to directly relate to the child's total body fat mass (Sprujit-Metz *et al*., 2003).

Other familial factors includes parental feeding practices such as restriction and pressure to eat, which in the past were found to be associated with the child's weight status (Francis *et al*., 2001). Restrictions of access to energy-dense, high sugar, salt and fat snacks were found to increase the interest and consumption of the restricted foods (Ludwig *et al*., 2001). On the contrary, pressuring the child to finish foods on their plates has an inverse reaction resulting in children being picky with their food (Galloway *et al*., 2005) and to start disliking the food (Ventura & Birch, 2008).

In terms of socio-environmental factors, neighbourhood safety perception of the parents and different types of facilities available were also found to be associated with the physical activity level of a child. Parental perception of neighbourhood safety such as road safety was found to be strongly related to the child's walking and cycling behaviour (Timperio *et al*., 2004). Despite such findings in the past on family and the socio-environmental influences on the child weight status, there is still a lack of published studies on these influences in Malaysia. Hence, the current study could fill the gap in the existing research by exploring associations between familial and socio-environmental factors with childhood obesity among children in Selangor and Kuala Lumpur (Klang Valley).

METHODS

Study background

This is a cross-sectional study applying a stratified sampling method to select a sufficient number of each type of school to represent the ethnic proportions of Malay, Chinese and Indian children. All National, Chinese, Tamil, non-religious and non-single sex public primary schools in the state of Selangor and Federal Territory of Kuala Lumpur were included in the sampling frame of the study. Out of 790 schools which met the inclusion criteria, 65 schools were randomly selected for the study. One class from each grade (primary 4, 5 & 6) was randomly selected from a list of classes in each school. All students from the selected classes were invited to participate. Teachers distributed parental consent forms to parents via the students. Parents who agreed to participate completed a self-administered parent's questionnaire together with the consent form at home while the children completed a self-administered child's questionnaire in school. Data collection was conducted between July 2008 and February 2009 and was approved by the Medical

Research Ethics Committee, Faculty of Medicine and Health Sciences, Universiti Putra Malaysia and by the Ministry of Education, Malaysia. Permission was also obtained from the respective school principals before the study was carried out.

Sampling method

The minimum sample size required for the study was calculated using the formula by Daniel (1999) as follows:

$n = Z^2 p (1-p) / d^2$

where

- n = sample size
- Z = area under normal curve corresponding to the desired confidence interval (1.96)
- p = prevalence of obese children in the population (13.7%)
- d = precision (difference between sample mean and population mean) (±2%)

Based on a study conducted in 2008 on primary school children by Muhammad *et al.* (2008), the prevalence of obesity for school children aged 9-12 years was 13.7%.

Thus,

$n = 1.96^2(0.137)(0.863) / (0.02)^2 = 1135$

Taking into consideration only a 25% response rate from parents during a pre-test of the questionnaire, 6500 questionnaires were distributed to the selected 65 schools. A total of 1640 (response rate = 25.2%) parent-child pairs responded with consents, but 210 participants were excluded from the data analysis owing to incomplete questionnaires. The final sample consisted of 1430 of parent-child pairs.

Questionnaires

Data were collected using a self-administered questionnaire which consisted of two parts: parent's questionnaire and the child's questionnaire. Both the parent's and the child's questionnaires were constructed and modified using parts of the Child Feeding Questionnaire (CFQ) which assess parental feeding strategies and ideas about child feeding (Birch *et al*., 2001) and also parts of the Determinants of Adolescents' Social Well-being and Health (DASH) questionnaire (Harding *et al*., 2007) which was designed to examine the influence of social conditions influencing the health of young people from different ethnic backgrounds. The initial questionnaires were pretested on 354 parent and child pairs to test the readability, understanding and the construct validity of the items. The final questionnaires used for this study were derived after carrying out a construct validity test using Principle Component Analysis (PCA) which was performed on the pre-test data. The construct validity of the items was determined by examining the correlations of items to each other through factor analysis with varimax rotations. Items that cross-loaded on several factors (i.e. items that had a loading of >0.4 on more than 1 factor) and items that had a loading of <0.4 on all factors were eliminated.

Parent's questionnaire

The parent's questionnaire consisted of 6 sections which were socio-demographic background, parental feeding practices, food availability, parent's diet, parent's physical activity and neighbourhood environment. The reliability of the parent's questionnaire was high (Cronbach's alpha = 0.74).

The section on socio-demographic background consisted of five questions in relation to background information of the parents. Socio-demographic information collected consisted of age, gender, ethnicity, highest educational level and income status.

Parental feeding practices section consisted of five factors on parental feeding strategies and ideas. The factors were 'perceived parent weight', 'perceived child

weight' and 'perceived responsibility' which were scored on a 4-point Likert scale from never to always; 'concern about child's weight' was scored on a 4-point Likert scale from unconcerned to very concerned; and 'restriction' and 'pressure to eat' were scored on a 5-point Likert scale from disagree to agree. A higher mean score on each scale reflected greater use of / agreement with the control practice.

The food availability section consisted of questions on the availability of sugar-dense foods, fruits and vegetables at home such as 'stocked sugar-dense food' and 'stocked fruits and vegetables'. These were scored on a 4-point Likert scale from never to everyday. 'Stocked sugar-dense foods' were reverse coded. A higher mean score on each scale reflected a higher availability of stocked foods at home.

The parent's diet section measured the consumption of 'fruits and vegetables', 'meats', 'fast foods', 'snacks' and 'sweet drinks' of the parents. These were scored on a 4-point Likert scale from never to everyday. 'Fast foods', 'snacks' and 'sweet drinks' were reverse scored. A higher mean score on each scale reflected a higher frequency of consumption of the types of foods.

The parent's physical activity section measured 8 types of moderate-vigorous sports involvement such as jogging, dancing, aerobics, cycling, swimming, team sports, racket sports and martial arts. These were scored on a 4-point Likert scale from never to everyday. A higher mean score reflected a higher frequency of physical activity.

The neighbourhood environment section measured the 'neighbourhood safety' and 'available facilities'. The response items for 'neighbourhood safety' were coded on a 5-point Likert scale from disagree to agree while 'available facilities' were coded on a 2-point scale from no to yes. A higher mean score indicates a higher agreement with neighbourhood safety or use of available facilities in the neighbourhood.

Child's questionnaire

The child's questionnaire consisted of four sections which were socio-demographic background, parental encouragement in healthy eating and physical activity, child's physical activity and child's diet. The reliability of the child's questionnaire (Cronbach's alpha 0.63) was deemed acceptable (Sim & Wright, 2000).

The section on the child's socio-demographic backgrounds consisted of 3 questions. The information gathered included the child's date of birth, gender and ethnicity.

Parental encouragement in healthy eating and physical activity measured the verbal encouragement of parents to the child's eating and physical activity. The types of encouragement were 'sports participation', 'breakfast', 'fruits' and 'vegetables' and these were coded on a 2-point scale of either yes or no.

The child's physical activity section measured 8 types of moderate-vigorous sports involvement such as jogging, dancing, aerobics, cycling, swimming, team sports, racket sports and martial arts similar to the parent's physical activity section. These were scored on a 4-point Likert scale from never to everyday. A higher mean score on each scale reflected a higher frequency of physical activity.

Child's diet section measured the consumption of 'fruits and vegetables', 'meats', 'fast foods', 'snacks' and 'sweet drinks' of the child. These were scored on a 4-point Likert scale from never to everyday. 'Fast foods', 'snacks' and 'sweet drinks' were reverse scored. A higher mean score on each scale reflected higher frequency of consumption of the types of foods.

Anthropometric measurements

Weight and height of the children were measured using a TANITA digital scale Model TBF-300 (Tanita Corporation, Japan) and a SECA Bodymeter 208 (SECA,

Germany) respectively. Each measurement was obtained twice with weight recorded to the nearest 0.1kg and height to the nearest 0.1cm. Body Mass Index (BMI) in kg / m^2 was calculated and subjects were categorised according to the WHO (2007) growth reference for children aged 5-19 years of age.

Statistical analysis

Statistical analysis was performed using SPSS version 17.0 (SPSS Inc., Chicago, IL, USA). Descriptive statistics were used to describe features of the sample. In order to examine the relationship between variables, Chi-square test (χ^2) and Pearson's correlation (r) were used to determine if significant relationships exist between the variables. Logistic regression was used to determine the contribution of familial and socio-environmental factors to childhood overweight. The Wald χ^2 test was used to determine significance of each model as a whole as well as to determine the significance of individual β coefficients while the Hosmer and Lemeshow test was used to test goodness of fit. Exponential of regression coefficients, Exp (β) which represents the ratio-change in the odds of the event of interest for a one-unit change in the predictor, are presented together with their 95% Confidence Interval (CI). The level of significance was set at $p<0.05$ when the 95% CI did not overlap.

RESULTS

Parent and child's socio-demographic characteristics

Table 1 shows the socio-demographic characteristics of the parent-child respondents. Of the 1640 respondents, the majority of the children were female, Malay and with mean age of 10.3±0.8 years. A majority of the parents were mothers, Malay, with SPM (Malaysian Certificate of Education) qualification, and earned less than RM1500 income per month. The mean age for parents was 41.30±5.2 years.

Children's body weight status

Table 2 shows the body weight status of children. The majority of the children were normal in weight status (42.6%) with more girls (44.8%) than boys (39.5%) in this category. This was followed by the prevalence of thinness (23.5%) with more girls (26.0%) than boys (20.0%) being thin. The prevalence of overweight was found to be 17.9% while the prevalence of obesity was 16.0%. Conversely, the prevalence of overweight was higher among boys (18.9%) compared to girls (17.1%). Similarly, the prevalence of obesity was higher among boys (21.6%) compared to girls (12.1%).

Parents' perception of child's body weight status

As shown in Table 3, 18.4% parents rated 'not sure' for their child's weight status and they were categorised as non-estimators. Only a total of 11.5% of the children were perceived as 'heavy' by their parents when in fact 33.9% of the children were actually overweight and obese. Similarly for perception of children as being 'light', 8.4% of the children were perceived to be 'light' when in fact 23.5% of children were actually thin. A total of 29.3% of the parents perceived their children to be 'balance' while in fact 42.6% children were normal weight. Nevertheless, a total of 49.2% of the parents correctly perceived their children's weight (correct estimators). In other words, a total of 50.8% of the parents had an incorrect perception of their child's weight status with 12.8% of them being over-estimators, 19.6% under-estimators and 18.4% being non-estimators.

Relationship between familial and socio-environmental factors with child's BMI

As shown in Table 4, parent's BMI (r=0.129, $p<0.01$), concern about child weight (r=0.125, $p<0.01$) and restrictions (r=0.057, $p<0.05$) were positively correlated with the child's BMI while pressure to eat (r= -0.135, $p<0.01$)

Table 1. Distribution of children and parents according to demographic characteristics (n=1640)

Variables	*Children* *n %*	*Parents* *n %*
Gender		
Male	681(41.5)	775 (47.3)
Female	959 (58.5)	865 (52.7)
Ethnicity		
Malay	924 (56.3)	929 (56.6)
Chinese	420 (25.6)	414 (25.2)
Indian	273 (16.6)	272 (16.6)
Others	23 (1.4)	25 (1.5)
Educational Level		
No formal education		20 (1.2)
UPSR, PMR		200 (12.2)
SPM		642 (39.1)
STPM / Matriculation / A-Level		190 (11.6)
Diploma		256 (15.6)
Degree		256 (15.6)
Masters or PhD		76 (4.6)
Income		
<RM1500 (Low)		570 (34.8)
RM1500-RM3500 (Moderate)		522 (31.8)
>RM3500 (High)		548 (33.4)
Age		
Mean±SD	10.3±0.8 years	41.30±5.2 years

Note: Income status:- Low- < RM 1500, Moderate – RM1500 –RM3500, High - > RM3500 (Malaysian Economic Planning Unit Classification)
UPSR – Primary School Evaluation Examination
PMR - Lower Secondary Evaluation Examination
SPM - Malaysian Certificate of Education
STPM - Malaysian Certificate of Higher Education

Table 2. Body weight status of children, (n=1640)

	Thinness *n (%)*	*Normal* *n (%)*	*Overweight* *n (%)*	*Obese* *n (%)*
Male	136 (20.0)	269 (39.5)	129 (18.9)	147 (21.6)
Female	249 (26.0)	430 (44.8)	164 (17.1)	116 (12.1)
Total	385 (23.5)	699 (42.6)	293 (17.9)	263 (16.0)

Table 3. Distribution of subjects by parent's perception of child's weight and actual child's body weight status (n=1640)

Parent's perception of children's body weight status	*Actual child's body weight status*			*Total n (%)*
	Thinness n (%)	*Normal n (%)*	*Overweight and obese n (%)*	
Light	137 (8.4)[a]	67 (4.1)[b]	13 (0.7)[b]	217 (13.2)
Balance	179 (10.9)[c]	480 (29.3)[a]	242 (14.8)[b]	901 (55.0)
Heavy	10 (0.6)[c]	22 (1.3)[c]	188 (11.5)[a]	220 (13.4)
Not sure	59 (3.6)[d]	130 (7.9)[d]	113 (6.4)[d]	302 (18.4)
Total	385 (23.5)	699 (42.6)	556 (33.9)	1640 (100.0)

Body weight perception: [a] correct-estimator, [b] under-estimator, [c] over-estimator, [d] non-estimator

Table 4. Correlation between familial and socio-environmental factors and child's BMI

Familial & Socio-environmental factors	*Child's BMI*
Parent's BMI	0.129**
Perceived parent weight	-0.032
Perceived child weight	0.035
Perceived responsibility	0.022
Concern about child weight	0.125**
Restriction	0.057*
Pressure to eat	-0.135**
Parental encouragement to healthy eating & physical activity	-0.037
Stocked sugar dense foods	0.051
Stocked fruits and vegetables	-0.044
Parent fruits & vegetables	0.004
Parent meat	-0.019
Parent snack	0.022
Parent fast food	-0.041
Parent sweet drinks	0.025
Child fruits & vegetables	0.047
Child meat	-0.018
Child snack	0.029
Child fast food	0.021
Child sweet drinks	0.018
Parent physical activities	0.006
Child physical activities	0.013
Ethnicity	-0.260
Educational level	0.007
Income status	0.032
Neighbourhood safety perception	-0.053*
Facilities	0.019

*$p < 0.05$, ** $p < 0.01$

and parent's perception of neighbourhood safety (r= -0.053, $p<0.05$) were found to be negatively correlated with the child's BMI. No correlation was found for the rest of the familial and socio-environmental factors with child's BMI.

Associations between familial and socio-environmental factors with childhood overweight and obesity

A logistic regression analysis was performed with children's weight status as the outcome variable and familial and socio-environmental factors as independent variables. A test of the full model with all the predictors as a constant-only model was statistically significant, with $\chi^2 = 114.825$, $p<0.0001$ (df =29, n = 1430), indicating that the predictors, as a set reliably distinguished overweight children and non-overweight children. The probability (p) value of 0.218 was computed from the χ^2 distribution in the Hosmer and Lemeshow test, implying the model's estimates fit the data at an acceptable level showing that the logistic model was a well-fitting model. However, the variance in children's weight status was found to be moderate, with Nagelkerke $R^2 = 0.111$. Prediction success was moderate, with 93.7% of the non-overweight and 16.2% of the overweight correctly predicted. The overall success rate was 70.4%.

As shown in Table 5, the risk of overweight in children was found to be significantly higher among male children compared to female children (Exp (β) = 0.538; 95% CI = 0.421-0.687). It was also shown that children with parents of higher BMI were found to have a significantly higher risk of being overweight and obese (Exp (β) = 1.055; 95% CI = 1.028-1.082). Parent's concern about child's weight (Exp (β) = 1.082; 95% CI = 1.030-1.127) was also found to significantly contribute to a higher risk of overweight and obesity among children. However, pressure to eat demonstrated a significant inverse association with child's risk of overweight and obesity (Exp (β) = 0.857; 95% CI = 0.801-0.916) where the higher the practice of pressure to eat, the lower the risk of overweight among children. Lastly, parents with a low perception of neighbourhood safety (Exp (β) = 0.951; 95% CI = 0.913-0.990) were found to have children with a significantly higher risk of being overweight and obese. All other parameters were found not to have a significant contribution to increased risk of overweight and obesity among children.

DISCUSSION

A previous study conducted in the state of Selangor reported the prevalence of childhood overweight and obesity at 16.3% and 6.3% respectively (Anuar Zaini *et al*., 2005). As for the Federal Territory of Kuala Lumpur, the prevalence of overweight and obesity was reported at 13.7% and 13.7% respectively (Muhammad *et al*., 2008). In our study, the prevalence of childhood overweight and obesity are 17.9% and 16.0% respectively, both of which are higher than the prevalence in the previous studies.

Parent's weight status was found to be positively correlated with child's weight status in this study. Other studies have also found the same results whereby the presence of overweight parents in the family was associated with obesity in the child (Lee *et al*., 2006). The influence of parental weight status on children can be either genetic (Maes *et al*., 1997) or environmental such as the presence of a obesigenic environment (Davison & Birch, 2002).

It is important to evaluate the parent's perception of child's weight to understand parent's nutrition and obesity knowledge (Muhammad *et al*., 2008) and to understand its influence on parental feeding practices (Francis *et al*., 2001). In our study, half of the parents were found to have an incorrect perception of their child's weight (50.8%) and most of these parents had children who were overweight or underweight. This finding is similar to a previous study in which half of the parents were found not to

Table 5. Logistic regression of overweight and obese children as a function of familial and socio-environmental factors (n=1430)

Variable	*Overweight & obese (n=427)*						
	B	*Wald Statistic*	*Exp (B)*	*95% C.I. for EXP (B)*		*-2Log Likelihood*	*Nagelkerke R^2*
				Lower	*Upper*		
						1614.052	0.111
Age	-0.077	0.935	0.926	0.793	1.082		
Gender (Male)	-0.621	24.828	0.538***	0.421	0.686		
Ethnicity (Malay)	0.002	0.001	1.002	0.834	1.205		
Educational level (No formal education)	-0.003	0.003	0.997	0.903	1.102		
Income status (<RM1500)	0.109	1.470	1.115	0.935	1.329		
Parent's BMI	0.053	16.413	1.055***	1.028	1.082		
Perceived parent weight	-0.060	1.066	0.942	0.841	1.055		
Perceived child weight	-0.027	0.235	0.973	0.873	1.085		
Perceived responsibility	0.038	1.627	1.039	0.980	1.102		
Concern about child weight	0.079	9.787	1.082**	1.030	1.137		
Restriction	0.058	3.692	1.059	0.999	1.124		
Pressure to eat	-0.155	20.134	0.857***	0.801	0.917		
Stocked sugar-dense food	0.033	1.266	1.034	0.976	1.095		
Stocked fruits and vegetables	-0.061	1.542	0.941	0.854	1.036		
Parental encouragement in healthy eating & physical activity	-0.042	0.614	0.959	0.863	1.065		
Parent fruits and vegetables	-0.010	0.156	0.990	0.944	1.039		
Parent meat	0.014	0.073	1.014	0.914	1.126		
Parent snack	-0.021	0.171	0.979	0.886	1.082		
Parent fast food	-0.245	8.510	0.783	0.664	0.923		
Parent sweet drinks	0.066	1.056	1.068	0.942	1.211		
Children fruits and vegetables	0.034	3.147	1.035	0.996	1.075		
Children meat	-0.125	7.027	0.882	0.804	0.968		
Children fast food	-0.006	0.018	0.994	0.914	1.081		
Children snack	0.064	0.853	1.067	0.930	1.223		
Children sweet drinks	-0.038	0.394	0.963	0.856	1.083		
Parent's physical activity	0.021	1.335	1.021	0.986	1.058		
Children's physical activity	0.005	0.083	1.005	0.969	1.043		
Neighbourhood safety	-0.050	5.893	0.951*	0.913	0.990		
Facilities	-0.016	0.046	0.984	0.848	1.141		

* $p<0.05$; ** $p<0.01$; *** $p<0.001$

have an accurate perception of their children's weight status (Muhammad *et al*., 2008). However, parental perception on child's weight was not found to be associated with child's weight status. Although inaccuracy of parent's perception was observed, the reasons why parents were unable to accurately perceive their child's weight were not examined in this study.

The familial and socio-environmental factors found to be associated with child's weight status in our study were concern about child's weight, restrictions and pressure to eat and parent's perception of neighbourhood safety. A previous study also found that a mother's concern for her child's weight was directly related to the child's total fat mass (Sprujit-Metz *et al*., 2003).

Parents were also reported to restrict their child's access to 'unhealthy foods' (Francis *et al*., 2001) such as high energy-dense snack foods and exert pressure on the child to eat what parents perceived to be healthy foods such as fruits and vegetables (Galloway *et al*., 2005). Restrictions were found to be positively associated with weight status of children in this study but pressure to eat was found to be negatively associated. Similar findings were reported in a previous study where parental restrictions and pressure to eat were correlated with child's BMI (Francis *et al*., 2001).

The relationship found between restrictions and pressure to eat with child's BMI may be due to the parent's concern for child's weight. In the past, mothers were found to use restrictions when they perceived their daughters as heavy (Francis *et al*., 2001). In our study, no relationship was found between parent's perception on child's weight with restrictions. However, a negative relationship was found with pressure to eat showing a consistent finding with past literature where mothers were reported to pressure their daughters to eat when they were perceived as being thin (Francis *et al*., 2001).

Another reason for the relationship between restrictions and pressure to eat with the child's BMI may be due to the counter effects of parental feeding practices on the child as it was not in response to the child's hunger or satiety, leading to a reduction in child's regulatory ability (Davison & Birch, 2001). Children may be more interested in the restricted food, so when such foods were made available, they were more prone to consume large amounts of it (Fisher & Birch, 1999), leading to unhealthy dietary intake and facilitation of weight gain. Meanwhile pressuring a child to eat and to finish foods on his or her plate may even cause dislikes (Ventura & Birch, 2008), hence leading to a decrease in the child's weight status.

Parent's perception of neighbourhood safety was found to be negatively associated with child's weight status in this study. This may be due to the fact that parents did not perceive their neighbourhood to be safe leading to a lack of physical activity opportunities for the children. Another study also reported the same; when there is a higher crime rate or lower road safety, the child's physical activity involvement was reported to be lower. This was because parents were found to restrict their children's use of recreational facilities available in the neighbourhood (Sallis *et al*., 1997).

Several limitations in the present study should be taken into consideration. First, the findings may not be generalised to the whole population of primary school children in Malaysia. The findings are limited by the sampling location as the participants were selected only from schools in the state of Selangor and Federal Territory of Kuala Lumpur. It is suggested that the scope of future studies should include children in every state throughout the country.

Secondly, the results are based on self-reported measures, and hence social desirability and recall bias are possible. Parents are more prone to give desired answers rather than the actual answers especially when the questions are parenting

related. It is suggested that in the future, face-to-face interviews be conducted instead in order for a more accurate result from parents. A similar limitation applies to the child's questionnaire.

Finally, this is a cross-sectional study, where the relationships between child's weight status and the different family and social influences cannot be determined as the risk factors for the increase in weight status of the children even if the relationship was significant. To be able to better understand the association, a longitudinal research design should be undertaken through follow-up on the children involved in this study.

CONCLUSIONS AND RECOMMENDATIONS

In conclusion, the prevalence of childhood obesity in this study was found to be higher compared to its prevalence in previous studies. The major findings found to predict childhood obesity were child's gender, parent's weight status, concern about child's weight, restriction, pressure to eat and parent's perception of neighbourhood safety. Parents should be the main target for education to modify children's weight status by educating them with correct knowledge on diets and physical activity, both for themselves and their children. Parents should also be encouraged to bring their children to sports clubs or recreational facilities so as not to worry about their children's safety. Serious consideration should be given to the environment by the local authorities so that it promotes a healthy lifestyle and facilitates physical activity involvement. Further research should be carried out to understand the mechanism of influence by both parents and the socio-environment on children's health.

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