Factors Predicting Paediatric Obesity Among Primary School Children in Kuantan

Sinan Mohammed Abdullah Al-Mahmood[1], Ariefah Hanim Shamsuddin[2], Noor Amallina Mohd. Saufi[2], Noratikah Othman[1],Wisam Nabeel Ibrahim[1*]

[1] Department of Basic Medical, Kulliyyah of Nursing, International Islamic University Malaysia, Kuantan Campus, Pahang, Malaysia.
[2] Kulliyyah of Nursing, International Islamic University Malaysia, Kuantan Campus, Pahang, Malaysia.

ABSTRACT

Objective: This study was aimed to investigate the association of parental obesity, food habits, and physical activity levels with body mass index status and sociodemographic factors among children in Kuantan, Pahang. **Method:** A cross-sectional study was conducted on 300 pupils in three primary schools in Kuantan. The three schools were representative of the three major ethnicities in Malaysia, Malays, Chinese, and Indians, and the children were aged 8 to 11 years. Self-developed questionnaires were used to record sociodemographic details and anthropometric measures of both parents and children, and physical activity and food habits were measured using a Children Physical Activity Questionnaire (C-PAQ) and the Harvard Food Frequency Questionnaire (HFFQ), respectively. Data was analysed using IBM SPSS 20.0, with a binary logistic regression model then used to represent the interactions among different factors in terms of predicting childhood obesity. **Results:** Binary logistic regression analysis shows that parental anthropometric measures, children's ages, levels of physical activity, and food habits are significant predictors for paediatric obesity. There is also a significant association between parents' anthropometric measurements and childhood obesity. Significant correlation was found between fast food consumption, fruit and vegetable consumption, and physical activity and body mass index in children (p¤0.05). **Conclusion:** The study provides evidence that parental obesity, fast food consumption, fruit and vegetables intakes, and physical activity levels have significant associations with children's body mass indices.

KEYWORDS: Parental obesity, Food habits, Physical activity, paediatric obesity

INTRODUCTION

Paediatric obesity is an escalating public issue that is associated with increased risks of several physical and psychological consequences (1). Complications previously considered only in adults are now threatening children worldwide, including glucose intolerance, dyslipidaemia, hypertension, fatty liver changes, and gall stones, along with sleep apnoea syndrome and joint problems (2). However, the psychological consequences are more prevalent, and may take the form of social discrimination, poor social quality of life, lack of self-confidence, and depression, which may later evolve into various adult psychological disturbances (3). Based on a report published by the ministry of health in Malaysia (MOH) (4), the prevalence of obesity among adults in Malaysia in 2011 was 15.1%, a 300% increase since 1996. In addition, another report based on a study in east Asian countries revealed that, currently, Malaysia has the highest prevalence of obesity and overweight among Asian countries due to the rapid development and changes of food habits and lifestyles the country has seen in the past 20 years (5). The prevalence of paediatric obesity in Malaysia is escalating in parallel with the general trend of obesity. According to a national survey conducted by the ministry of health in Malaysia in 2016, the prevalence of obesity in children was 11.9%; the same survey conducted in 2011 showed only a 6.1% prevalence of obesity among children. In the recent survey, the paediatric obesity rates were highest in Perak state (14.2%) and the lowest in Sabah (8.0%). In this report, obesity was more frequently reported in urban areas than rural areas, was more frequent in boys than girls, and more frequent among those of Chinese ethnicity, followed by Indians and Malays (4).

Parental obesity is considered to be one of the most important predisposing factors for paediatric obesity, demonstrated by the significant number of studies conducted on a large scale in Asian and European countries (6). Parental BMI may, however, have differing influences on children's BMIs, as demonstrated by some studies which have shown maternal dominance in terms of the association with childhood obesity (7).
The aim of this study is thus to determine the predictive capacity of parents' anthropometric measurements, food habits, and physical activity levels on rates of childhood obesity in the multi-ethnic population of Kuantan, Malaysia.

MATERIALS AND METHODS

Ethical approval

The study was ethically approved by the International Islamic University Malaysia (IIUM) Research Ethics Committee (IREC-467), the Ministry of Education (MOE) Malaysia, and the State Education Department of Pahang.

Study Population

The sampling method adopted in this study was stratified random sampling, and a total of 300 chil-

*** Corresponding Author**

Email: wisam@iium.edu.my
Tel: +6001129292372
Department of Basic Medical Sciences for Nursing, Kulliyyah of Nursing, International Islamic University Malaysia, Level 2, Interdisciplinary Block, Kulliyyah of Science Building, Indera Mahkota Campus, 25200, Kuantan, Pahang.

dren were randomly approached. The children were aged from 8 to 11 years, and they were given an explanation of the study and recruited only after their approval, and that of their parents, was received in the form of a signed consent form. The participants recruited from the three primary schools were 97, 100, and 103 participants of Malay, Chinese, and Indian ethnicity, respectively. A self-administered questionnaire was distributed to the students, who delivered it to their parents, and this was collected after one week. Children or parents who did not agree to continue with the study or who returned incomplete forms were automatically excluded from the study.

Questionnaire

The questionnaires included information about sociodemographic factors such as age, gender, ethnicity, and household income that were filled in by the parents. In addition, information about the anthropometric measurements of the children and both parents (weight and body height) was obtained to calculate their BMIs, based on ages and percentiles.

The Children Physical Activity Questionnaire (C-PAQ) was used to assess general levels of physical activity among the children. A translated version of this questionnaire was prepared in the Malay language, and this was completed by children with assistance from the parents. The questionnaire consisted of ten items which assessed physical activities done by the children in the previous seven days. Each question was scored using a five-point scale, with higher scores indicating higher levels of physical activity. The mean scores were classified into five categories: very low, low, moderate, high, and very high physical activity.

Food habits were assessed using the Harvard Food Frequency Questionnaire (FFQ). This questionnaire was also translated into Malay language and the form was completed by the children, with assistance from parents. The questionnaire consisted of two categories: fast food intake and fruit and vegetable consumption. A five-point Likert scale with 'Mostly', 'Frequently', 'Sometimes', 'Rarely', and 'Never' was used to rate each item. Based on their total scores, the respondents were categorised into 'Never/Occasional', 'Sometimes', 'Frequent', and 'Always' groups.

Statistical analysis

Statistical analysis was performed using IBM SPSS software version 20.0. Descriptive statistics were used to examine variables such as gender, age, race, body mass index (BMI), physical activity levels, and food habits. A one-way ANOVA test and an independent t-test were used to analyse the associations between the parametric data and categoric data. Finally, correlation analysis and chi-square tests were used to determine the associations between parametric data and categoric data respectively. Here, p-values of <0.05 were considered statically significant.

A Binary Logistic model was used to assess the predictability of different variables based on the 85th percentile for children's BMI. Again, a p-value of <0.05 was considered statically significant.

RESULTS

Descriptive statistics

The mean value of the children's ages was 9.56 (± 0.957 S.D.). The 95th percentile for BMI was 21 Kg/m^2, while the 85th percentile for BMI was 19 Kg/m^2. The mean of BMI for children, fathers, and mothers were 19.52 (± 5.81), 26.38 (± 4.246), and 24.64 (± 4.651), respectively. The other sociodemographic data points are shown in Table 1.

Table 1: Socio-demographic data and anthropometric. Measurements of parents and children

Variable	Frequency (N)	Percentage (%)
Age		
8 years old	38	12.7
9 years old	119	39.7
10 years old	81	27
11 years old	62	20.7
Ethnicity		
Malays	97	32.3
Chinese	103	34.3
Indians	100	33.3
Gender		
Male	141	47
Female	159	53
BMI		
Children		
Underweight	45	15
Normal	111	37
Overweight	33	11
Obese	111	37
Parent (Father)		
Underweight	4	1.3
Normal	115	38.3
Overweight	129	43
Obese	52	17.3
Parent (Mother)		
Underweight	18	6
Normal	144	48
Overweight	100	33.3
Obese	38	12.7

Relationship between parental BMI and children's BMI

Based on the statistical analysis, using a Pearson's correlation, there was a significant association between the Chinese parents' (mother and father) BMIs and children's BMI. As shown in Table 2 and in figure 1, the Chinese mothers' BMIs had a stronger correlation with their children's BMIs than the fathers. However, no such association was found in Malay and Indian families. In addition, obesity in both parents had a significant association with childhood obesity, as shown in figure 2. After stratifying the data according to ethnicity, the analysis demonstrated significant involvement of both parents' BMI values and their child's BMI within those of Chinese ethnicity. However, the difference was insignificant for those of Malay and Indian ethnicities.

Table 2: Correlation between parental obesity and paediatric obesity in different ethnicities

	Race		BMI of Father	BMI of Mother
BMI of Children	Overall N=300	Pearson Correlation	0.189	0.298
		p-value	0.001*	0.000*
	Malay N=97	Pearson Correlation	0.188	0.192
		p-value	0.065	0.059
	Chinese N=103	Pearson Correlation	0.306	0.439
		p-value	0.002*	0.000*
	Indian N= 100	Pearson Correlation	0.025	0.171
		p-value	0.804	0.089

Pearson correlation analysis, * significance of association, Significance of association for p < 0.05, BMI: body mass index.

Figure 1: Relationship between parental obesity and paediatric obesity. A: Significant associations between mean of Chinese mothers' BMI and their children's BMI mean; R^2 linear for Malay, Chinese, and Indian families was 0.037, 0.193 and 0.029 respectively. B: Significant associations between mean of Chinese fathers' BMI and mean of children's BMI; R^2 linear was 0.035, 0.094 and 6.292E-4, respectively.

Figure 2: Relationship between parental obesity and paediatric obesity. A: overall population sample, B: Malay ethnicity, C: Chinese ethnicity and D: Indian ethnicity. *Significant association between mean of children's BMI and dual parental obesity. Significance of association for p< 0.05, BMI: body mass index.

Figure 1

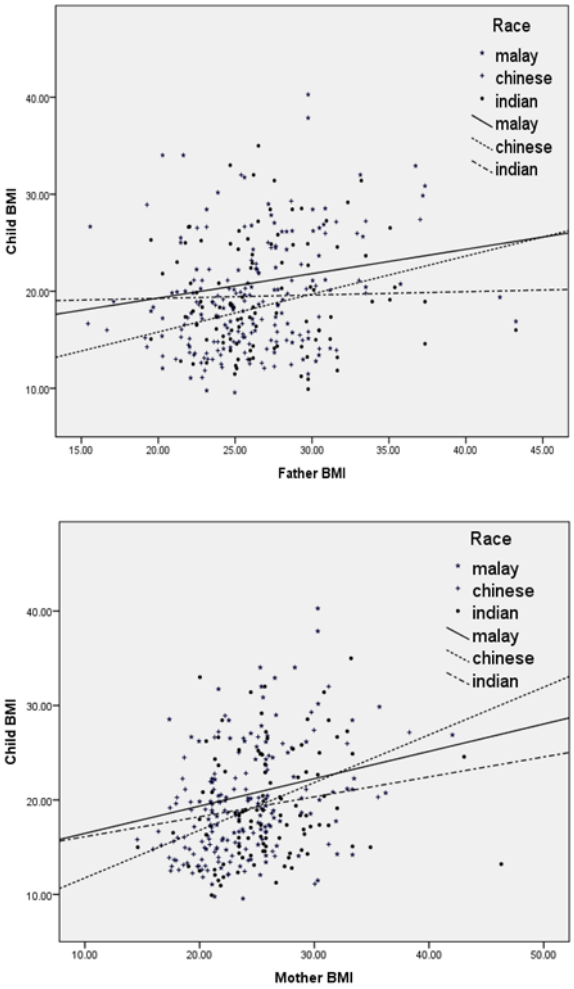
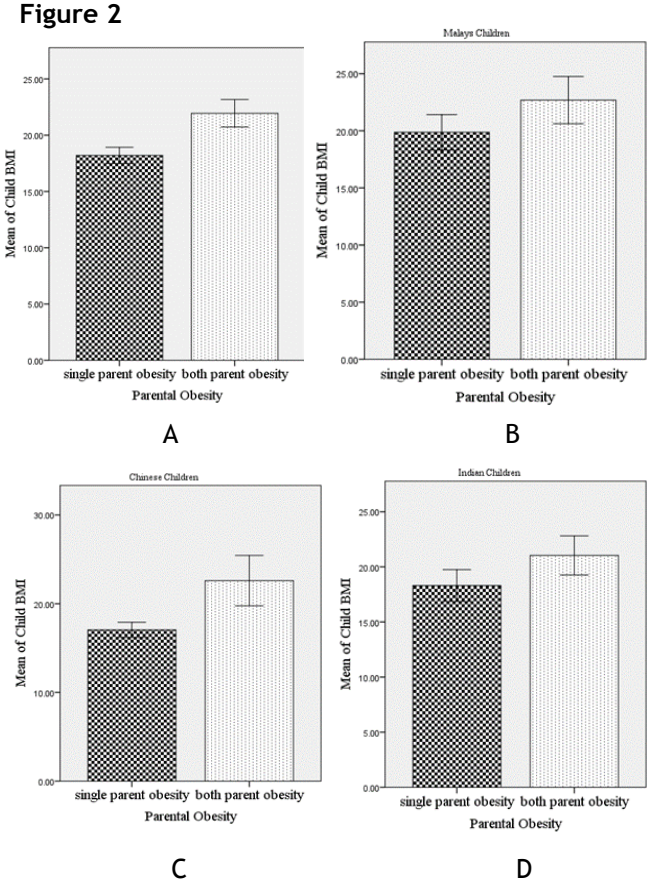


Figure 2



The association of food habits and physical activity with children's BMI

As shown in Table 3, there was a positive correlation between fast food consumption and body mass index (BMI) in children. Fruit and vegetable consumption and physical activity levels were inversely correlated with children's BMI. In addition, there was a significant association between ethnicity and consumption of fruits and vegetables, as shown in Table 3. The mean score for fruit and vegetable consumption was significantly higher in Indian children than in Chinese and Malay children. As shown in figure 2, the correlation between consumption of fast food and BMI was weakest among children of Chinese ethnicity, while the correlation between consumption of fruits and vegetables and BMI was weakest among children of Indian ethnicity. Physical activity levels had no obvious differences in correlation with BMI in children of different ethnicities (Table 5).

Table 3: Associations between fast food consumption, fruit and vegetable intake, and physical activity levels and body mass index (BMI)

Variables	Child BMI (kg/m^2)	
	R coefficient	p- value
Fast Foods Consumption	0.232	0.001*
Fruits & Vegetables Consumption	-0.302	0.001*
Physical Activities Levels	-0.308	0.001*

Pearson correlation analysis, * significance of association, Significance of association for $p < 0.05$, BMI: body mass index.

Table 4: Association between fast food consumption, fruit and vegetable intake, and physical activity levels and race.

Variables	Race			p-value
	Malays (n=97) Mean (SD)	Chinese (n=103) Mean (SD)	Indians (n=100) Mean (SD)	
Fast Foods Consumption	40.06 (18.06)	36.48 (15.23)	40.28 (19.16)	0.223
Fruits & Vegetables Consumption	36.15 (19.25)	40.84 (16.38)	45.46 (23.32)	0.005*
Physical Activities Levels	2.56 (0.77)	2.42 (0.62)	2.61 (0.74)	0.141

One-way ANOVA test, df = 2, * significance of association, Significance of association for $p < 0.05$

Binary logistic regression analysis

To assess the predictability of paediatric obesity in the multi-ethnic sample, a binary logistic regression model was used to assess the interactions of different variables. The designed model was 75% accurate in predicting obesity in children at the 85th percentile. After controlling for confounding factors in the regression model, the significant predictors for obesity in children were age, parent's anthropometric measures, types of food consumed, and levels of physical activity (Table 5).

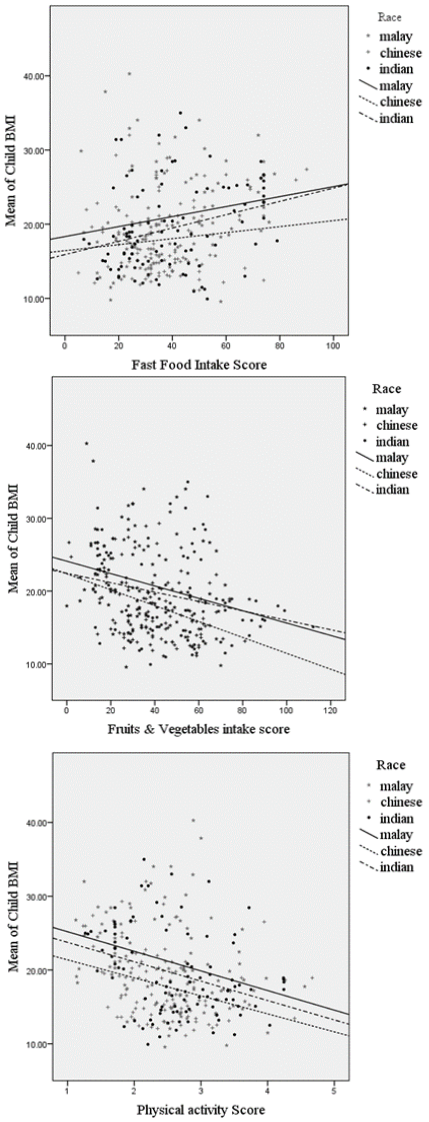


Figure 3: Correlation between types of food scores, physical activity levels, and children's BMIs.
BMI: body mass index.

Table 5: Binary logistic regression analysis of obesity in children

Variables	*p*-value	OR	95% C.I.
Chinese race	0.153	0.573	0.266-1.231
Indian race	0.126	0.550	0.256-1.183
Age	0.000*	2.048	1.455-2.882
Boys	0.660	1.142	0.631-2.066
Consumption of vegetables and fruits	0.002*	0.971	0.953-0.989
Consumption of Fast Foods	0.009*	1.028	1.007-1.050
Level of Physical activity	0.000*	0.262	0.148-0.464
Father BMI	0.007*	1.112	1.029-1.201
Mother BMI	0.003*	1.119	1.040-1.204

Regression model Accuracy=75%, *significant association, $p < 0.05$ is taken as statistically significant at 95% confidence interval, BMI: body mass index.

DISCUSSION

The study population was comprised of roughly equivalent numbers from both genders and all ethnic groups, as shown in Table 1. The prevalence of obesity within the three selected schools in Kuantan was 40% among male students, and 34.4% among female students. This contradicts the report of the Malaysian national survey, which reported a higher prevalence of childhood obesity in females due to biological and social predisposing factors. However, despite these differences in prevalence, the study found no significant association between gender and childhood obesity ($p>0.05$), which might be due to the social and biological similarity of both genders before sexual maturation and its accompanying developmental changes

Ethnicity did not have any significant relationship with obesity in children ($p>0.05$). This is in contradiction with the study conducted by Balkish and the results of the national survey, which stated that children of Chinese ethnicity had the highest prevalence of overweight in comparison with other ethnicities (8).Child's age was significantly associated with obesity, which is in agreement with the study conducted by Balkish (8). Children in older age groups tend to have more independent lifestyles in terms of their food habits, which may then largely rely on fast food and unhealthy food options.

The study showed that there was significant association between parental anthropometric measures and childhood obesity ($p<0.05$). According to the study conducted by McLoone et al (9), parental obesity is one of the commonest predisposing factors for paediatric obesity, mainly due to influences in food habits and unhealthy lifestyles (9). The association was more significant in mothers and in those of Chinese ethnicity compared to fathers and other ethnic groups, which might indicate the greater influence of a mother's food choices and lifestyle on their children's food and lifestyle, which later determine their risk of developing obesity. This finding is in agreement with the study conducted by Lazzeri (10, 11), which reported a 70% chance of childhood obesity if both parent were obese and a 50% chance if one parent was obese. Other studies have stated similar findings (11). In both studies, the suggested influence of parental obesity was formed from a combination of genetics and family environmental influences.

Food habits and physical activity were also shown to contribute to children's obesity, as shown in figure 3 and table 3. Children with high consumption levels of fast food, low consumption levels of fruits and vegetables, and lower levels of physical activity had significant associations with obesity. Ethnic groups did not have any specific associations with these factors except that the daily intake of fruits and vegetables was higher among children of Indian ethnicity. In previous studies, fast food had significant associations with BMI, as fast food and eating out can affect children's BMIs (12).

The binary logistic regression model showed that ethnicity and gender were not significant predictors for childhood obesity in primary schools in Kuantan, while age, parental obesity, food habits, and physical activity levels were strong predictors for children obesity. This indicates a dependant relationship among these factors and with parental obesity in terms of determining the risk of children obesity. Thus, parents are considered important targets in the prevention of obesity in children in terms of persuading them to change their food habits and lifestyles.

CONCLUSION

This study showed that parental obesity, along with the food habits and physical activity level of children may contribute to the body mass index of children. Thus, future intervention studies are encouraged to find ways to change the food habits and lifestyles of parents to achieve better results in targeting childhood obesity. Limitations in sample size and methods of acquiring data that affect this study should be considered in order to minimise these in future studies.

ACKNOWLEDGEMENT

This work was sponsored by International Islamic University Malaysia (RIGS 16-286-0450).

CONFLICT OF INTEREST

The authors have no conflict of interest to declare with regard to this work.

REFERENCES

1. Wafa SW, Talib RA, Hamzaid NH, McColl JH, Rajikan R, Ng LO, et al. Randomized controlled trial of a good practice approach to treatment of childhood obesity in Malaysia: Malaysian Childhood Obesity Treatment Trial (MASCOT). Pediatric Obesity. 2011;6(2Part2).
2. Lee YS. Consequences of childhood obesity. Ann Acad Med Singapore. 2009;38(1):75-7.
3. Kelsey MM, Zaepfel A, Bjornstad P, Nadeau KJ. Age-related consequences of childhood obesity. Gerontology. 2014;60(3):222-8.
4. National Health & Morbidity Survey [Internet]. 2016. Available from: www.iku.gov.my/index.php/research-eng/list-of-research-eng/iku.../nhms-.
5. Ismail M, Chee S, Nawawi H, Yusoff K, Lim T, James W. Obesity in Malaysia. Obesity reviews. 2002;3(3):203-8.
6. Whitaker KL, Jarvis MJ, Beeken RJ, Boniface D, Wardle J. Comparing maternal and paternal intergenerational transmission of obesity risk in a large population-based sample. The American journal of clinical nutrition. 2010;91(6):1560-7.
7. Whitaker RC. Predicting preschooler obesity at birth: the role of maternal obesity in early pregnancy. Pediatrics. 2004;114(1):e29-e36.
8. Naidu BM, Mahmud SZ, Ambak R, Sallehuddin SM, Mutalip HA, Sahril N. Overweight among primary school-age children in Malaysia. Asia Pacific journal of clinical nutrition. 2013;22 (3):408-15.
9. McLoone P, Morrison DS. Risk of child obesity from parental obesity: analysis of repeat national cross-sectional surveys. The European Journal of Public Health. 2012;24(2):186-90.
10. Lazzeri G, Pammolli A, Pilato V, Giacchi MV. Relationship between 8/9-yr-old school children BMI, parents' BMI and educational level: a cross sectional survey. Nutrition journal. 2011;10(1):76.
11. Sylvetsky-Meni AC, Gillepsie SE, Hardy T, Welsh JA. The impact of parents' categorization of their own weight and their child's weight on healthy lifestyle promoting beliefs and practices. Journal of obesity. 2015;2015.
12. Poh BK, Ng BK, Haslinda MDS, Shanita SN, Wong JE, Budin SB, et al. Nutritional status and dietary intakes of children aged 6 months to 12 years: findings of the Nutrition Survey of Malaysian Children (SEANUTS Malaysia). British Journal of Nutrition. 2013;110(S3):S21-S35.