Original Article

Associations between socio-demographic characteristics and pubertal status with disordered eating among primary school children in Selangor, Malaysia

Lin Siew Chong MSc[1], Yit Siew Chin PhD[1,2], Wan Ying Gan PhD[1], Mohd Taib Mohd Nasir PhD[1,2]

[1]*Department of Nutrition and Dietetics, Faculty of Medicine and Health Sciences, Universiti Putra Malaysia, Selangor, Malaysia*
[2]*Research Centre of Excellence, Nutrition and Non Communicable Disease, Faculty of Medicine and Health Sciences, Universiti Putra Malaysia, Selangor, Malaysia*

Background and Objectives: To determine the associations between socio-demographic characteristics and pubertal status with disordered eating among primary school children. **Methods and Study Design:** Using a stratified multi-stage sampling, a total of 816 children (282 boys and 534 girls) aged 10 to 11 years from 12 selected primary schools in the state of Selangor, participated in this study. Data were collected on socio-demographic characteristics, pubertal status and disordered eating behaviors. The Pubertal Development Scale and the Children's Eating Attitudes Test (ChEAT) were used to assess pubertal status and disordered eating, respectively. Logistic regression analysis was conducted to determine the risk factors of disordered eating. **Results:** The prevalence of disordered eating was 30.8% (32.8% in boys and 29.7% in girls). However, the sex difference in the prevalence was not statistically significant. Age, ethnicity and pubertal status were significantly associated with disordered eating in univariate logistic regression analysis. Multivariate logistic regression analysis showed that among boys, being either in an advanced or post-pubertal stage (adjusted OR=8.64) and older age group (adjusted OR=2.03) were risk factors of disordered eating. However, among girls, being a Malay (adjusted OR=3.79) or Indian (adjusted OR=5.04) in an advanced or post-pubertal stage (adjusted OR=2.34) and older age group (adjusted OR=1.53) were risk factors of disordered eating. **Conclusion:** This study found one in three children had disordered eating. Since ethnicity and pubertal status were identified as risk factors, ethnicity-specific intervention programs on the prevention of disordered eating among children should take into consideration their pubertal status.

Key Words: children, disordered eating, ethnicity, pubertal status, Malaysia

INTRODUCTION

Disordered eating can be described as troublesome eating behaviors such as restrictive dieting, bingeing, or purging which occur less frequently or are less severe than those required to meet the full criteria for the diagnosis of an eating disorder.[1] Disordered eating is a recognized predictor of the onset of eating disorders which involve serious disturbances in eating behavior, such as extreme and unhealthy reduction of food intake or severe overeating, as well as feelings of distress or extreme concern about body shape or weight.[2,3] The most common types of eating disorders are anorexia nervosa, bulimia nervosa, binge eating disorder and eating disorder not otherwise specified (EDNOS).[4] One study conducted in 1981 found that 0.05% of a psychiatric patient sample in Malaysia were diagnosed with anorexia nervosa.[5]

Disordered eating has become a serious public health issue due to its harmful consequences, including increased risk for eating disorders, weight gain, obesity, poorer dietary intake, as well as mental health symptoms such as fatigue, anxiety and depression.[6-10] In Western

countries such as Ireland,[11] Canada,[12] United States,[13] and Greece,[14] the prevalence of disordered eating among children and adolescents from 2004 to 2010 ranged from 7.6% to 16.7%.[11-14] However, recent studies (2011-2014) in Middle Eastern countries found the prevalence of disordered eating among adolescents to be relatively high: 15.2% in Algeria,[15] 16.7% in Iran,[16] 22.9% in Syria,[15] 26.7% in Libya,[15] 31.6% in Jordan,[15] 31.7% in Palestine,[15] 33.5% in Sharjah (United Arab Emirates),[15] and 44.7% in Kuwait.[15] Studies in Asian countries including Hong Kong, Singapore, Taiwan and South Korea from 2006 to 2014 reported relatively low prevalence of disordered

eating varying from 5.1% to 10.5%.[17-20] In addition, findings from Hong Kong reported that the youngest case of disordered eating in Hong Kong was only 11 years old among 2382 adolescents (10 to 21 years old).[17] Yang et al also indicated that the prevalence of disordered eating was higher among fourth grade Korean students (aged 9-10 years) compared with the prevalence among seventh graders (aged 12-13 years) indicating that disordered eating has started to emerge earlier in childhood.[20]

There are a number of studies on disordered eating in Malaysia focusing on children (8-9 years) and adolescents (14-17 years). For instance, a study conducted on 107 Malay girls aged 8 to 9 in Selangor reported that 38% of the girls reported disordered eating.[21] Besides, findings from a study by Soo reported that the prevalence of disordered eating was 22.3% in a sample of female adolescents aged between 15 to 17 years in Kelantan.[22] To our knowledge, there are no studies on disordered eating in Malaysia focusing on children of both sexes and from various ethnic groups.

Numerous studies showed that the prevalence of disordered eating was higher in girls than boys.[15,19,22-24] Musaiger et al reported that the risk of disordered eating in female adolescents was about three times higher than their male counterparts in Jordan and Syria.[15] A more recent study conducted in Taiwan found that the prevalence of disordered eating in female adolescents (12.6%) was significantly higher than the prevalence in male adolescents (8.4%).[19] Malaysian studies focused primarily on female adolescents.[21,22] Only one Malaysian study, conducted by Farah, Mohd Nasir and Hazizi among adolescents aged 13 to 14 years old in Pahang, included both sexes.[25] They found that the prevalence of disordered eating in male (28.8%) and female (26.9%) adolescents were almost similar.

Studies have found that pubertal development increased the risk of disordered eating.[26-32] Pubertal status refers to the stage of pubertal development and is often assessed by asking individuals to rate perception on their pubertal development based on secondary sex characteristics such as growth spurt, body hair growth, and skin changes.[27] Early maturing boys and girls had significantly high levels of dietary restraint, more body shape concerns, and more weight concerns as well as a trend towards significantly more eating concerns.[32] In Malaysia, no published study on the association between pubertal status and disordered eating among children had been reported.

In light of the high prevalence and limited studies conducted in Malaysia, there is a need to examine disordered eating among children from the three main ethnic groups in the Malaysian population. To our knowledge, there is no study in Malaysia focusing on children between the ages of 10 to 11 years old. Thus, this study was conducted to determine the associations between socio-demographic characteristics and pubertal status with disordered eating among children of different ethnicities in selected primary schools in Selangor, Malaysia.

MATERIALS AND METHODS
Study setting and subjects
This cross-sectional study was conducted in primary schools in the state of Selangor. A list of primary schools was obtained from the State Education Department of Selangor. There is a total of 646 primary schools in the list and, of these, 430 Malay-medium National Primary Schools, 109 National-type Primary Schools (Chinese), and 97 National-type Primary Schools (Tamil) met the inclusion criteria of being coeducational, non-religious non-residential and government funded schools.

Stratified sampling was then used to select eight schools from Malay-medium National Primary Schools, three schools from National-type Primary Schools (Chinese) and one school from National-type Primary Schools (Tamil). Thus, twelve schools were chosen to participate in this study. In the second stage, the number of respondents aged 10-11 needed in each ethnic group was selected on a proportional basis in order to represent the ethnic proportions of Malay, Chinese and Indian children. By estimating twenty-five respondents in one class, two classes from grade 4 and one class from grade 5 were chosen in this study. Of the selected classes, respondents who participated were predominantly girls. The classes were assigned by the school authority; and hence, random sampling of classes were not possible.

Ethical approval was obtained from the Ethics Committee for Research Involving Humans of Universiti Putra Malaysia (Ethics Approval Number: UPM/TNCPI/RMC/1.4.18.1(JKEUPM)/F2). Permission to conduct the study in primary schools were obtained from the Ministry of Education Malaysia and the Department of Education Selangor. Information sheets about the study and consent forms were distributed to the students for them to bring back to their parents. Signed consent forms were obtained from both the students and their parents prior to data collection. This self-administered questionnaire was completed by the respondents in their classrooms with the assistance of trained researchers.

Socio-demographic characteristics
Respondents were required to fill in information on their sex, ethnicity, date of birth, parents' educational level and parental monthly income in a self-administered questionnaire.

Pubertal status
Pubertal status was assessed using the Pubertal Development Scale (PDS).[33] Five items on a four-point scale (1=no development to 4=development completed), were used to rate the growth spurt, body hair growth, and skin changes in both boys and girls. Additionally, boys rated their development of facial hair and voice change, and girls rated their breast development and whether they had reached menarche. Menarche was coded dichotomously and rated as present (4) or absent (1). Items were summed separately for boys and girls (including menarche for girls). Possible scores range from 5–20. Pubertal status was classified into 5 categories: (1) Pre-Pubertal, (2) Beginning-Pubertal, (3) Mid-Pubertal, (4) Advanced-Pubertal, and (5) Post-Pubertal.[33]

Disordered eating
Disordered eating was assessed using the Children's Eating Attitudes Test (ChEAT).[34] The ChEAT is a 26-item questionnaire which has been widely used to measure

levels of disordered eating attitudes and behaviors in children aged 8 to 13 years. Items are rated on a 6-point Likert scale from '6' (always) to '1' (never). The three most incrementally symptomatic responses for each item were scored 1, 2, and 3, whilst the remaining three choices were scored zero. Total scores are derived from the sum of the composite items, and possible total scores ranged from 0 to 78. ChEAT scores that were 20 or more were categorized as disordered eating. The internal consistency of ChEAT was previously reported to be high (Cronbach's alpha=0.76).[34] In the current study, the internal consistency of the ChEAT was also found to be high (Cronbach's alpha=0.80).

Statistical analysis

Data were analyzed using IBM SPSS Statistics 21. Sampling weights were incorporated into the analyses to produce representative estimates of the prevalence of disordered eating for both boys and girls from the three main ethnic groups attending primary schools in Selangor. The sampling weight is based on the reciprocal of its probability of selection into the sample in order to account for the complex sampling design and non-response rate. Weighting was calculated based on the following formula:[35]

Final weight = W1 x W2 x f1
W1 = the inverse of the probability of selecting the school
W2 = the inverse of the probability of selecting the classroom within the school
f1 = a student-level non-response adjustment factor

Descriptive statistics were used to determine the prevalence of disordered eating. Univariate logistic regression analysis was performed to determine the potential risk factors of disordered eating. Those variables which were found to be significantly associated with disordered eating in the univariate logistic regression were included in a multivariate logistic regression analysis which was used to determine the risk factors of disordered eating. The analysis was performed separately for boys and girls. In this analysis, independent variables included socio-demographic factors (age, ethnicity, education level of parents, and socio-economic status) and pubertal status. Results were presented as crude and adjusted odds ratios (OR) with 95% confidence intervals (CI). A p value of <0.05 was considered statistically significant.

RESULTS

Socio-demographic characteristics

Of a total of 950 consent forms distributed, 849 (response rate =89.4%) were returned with consents. A total of 33 respondents were excluded in the study due to incomplete questionnaires and missing anthropometric measurements. This yielded a total of 816 respondents for data analysis. Table 1 shows the socio-demographic characteristics of the respondents. A total of 816 children (boys=35.1%, girls=64.9%), with a mean age of 10.6 years (95% CI: 10.6, 10.6) participated in this study. Overall, 67.6% of these children were Malay (67.6%), 21.3% were Chinese and 11.1% Indian. About 2 in 5 of the parents had an upper secondary school education (fathers=37.6%, mothers=43.1%). The mean parental monthly income was RM 4485 (95% CI: 4199, 4770), which is equivalent to US 1372. With respect to socio-economic status, a majority of their families had monthly income above the poverty level (96.4%), with a minority of them classified as poor (1.2%) and hardcore poor (2.4%). There were no significant differences in age, ethnicity, parents' educational level, parental monthly income and socio-economic status between boys and girls (p>0.05).

Table 1. Socio-demographic characteristics of respondents (n=816)

	Boys (n=282)	Girls (n=534)	Total (n=816)
Age (years), mean (95% CI)	10.6 (10.5, 10.7)	10.6 (10.6, 10.7)	10.6 (10.6, 10.6)
Ethnicity, n (%)	282	534	816
Malay	183 (64.1)	374 (69.6)	557 (67.6)
Chinese	66 (23.2)	112 (20.2)	178 (21.3)
Indian	33 (12.8)	48 (10.2)	81 (11.1)
Father's educational level, n (%)	245	488	733
No formal	3 (1.6)	8 (2.2)	11 (2.0)
Primary	9 (3.7)	20 (4.3)	29 (4.1)
Lower secondary (PMR)	27 (10.2)	74 (15.8)	101 (13.9)
Upper secondary (SPM)	86 (36.0)	193 (38.5)	279 (37.6)
Pre-university	45 (18.6)	62 (13.4)	107 (15.2)
University	75 (29.9)	131 (25.7)	206 (27.2)
Mother's educational level, n (%)	247	486	733
No formal	4 (2.0)	6 (1.4)	10 (1.6)
Primary	11 (4.6)	19 (4.4)	30 (4.5)
Lower secondary (PMR)	24 (9.0)	68 (13.5)	92 (12.0)
Upper secondary (SPM)	96 (39.5)	217 (45.0)	313 (43.1)
Pre-U	46 (18.4)	68 (14.6)	114 (15.9)
University	66 (26.6)	108 (21.1)	174 (23.0)
Parental monthly income (RM), n	206	434	640
mean (95% CI)	4592 (4080, 5105)	4431 (4086, 4776)	4485 (4199, 4770)
Socio-economic status, n (%)	206	434	640
<RM520 (hardcore poor)	7 (2.9)	9 (2.1)	16 (2.4)
RM521- RM830 (poor)	2 (0.8)	6 (1.3)	8 (1.2)
>RM831 (above poor)	197 (96.3)	419 (96.5)	616 (96.4)

Table 2. Pubertal status of respondents (n=816)

	Pubertal status, % (95% CI)			
	Pre-pubertal	Beginning pubertal	Mid-pubertal	Advanced or post-pubertal
Age	10.5 (10.4, 10.6)	10.6 (10.5, 10.6)	10.6 (10.6, 10.7)	10.9 (10.7, 11.0)
Sex				
Boys	33.9 (28.4, 40.0)	40.6 (34.7, 46.8)	22.8 (18.1, 28.4)	2.6 (1.2, 5.6)
Girls	17.2 (14.1, 20.9)	20.0 (16.6, 23.8)	51.5 (47.0, 55.9)	11.4 (8.9, 14.4)
Ethnicity				
Malay	24.7 (21.1, 28.6)	21.6 (18.2, 25.3)	45.6 (41.3, 49.9)	8.2 (6.2, 10.8)
Chinese	23.2 (17.2, 30.5)	42.4 (34.8, 50.4)	24.9 (18.6, 32.6)	9.5 (5.9, 14.8)
Indian	13.1 (6.8, 23.7)	32.4 (22.6, 44.0)	47.7 (36.4, 59.2)	6.8 (3.0, 14.9)
Total	23.1 (20.1, 26.3)	27.2 (24.1, 30.6)	41.4 (37.9, 45.0)	8.3 (6.6, 10.4)

Pubertal status

Table 2 shows the pubertal status of respondents in this study. Children with higher age were more advanced in their pubertal status. Girls were generally more advanced in their pubertal status than boys. Most of the girls were in their mid-pubertal stage (51.5%; 95% CI: 47.0, 55.9) while boys were in the category of beginning pubertal stage (40.6%; 95% CI: 34.7, 46.8). The same distribution was found between ethnic groups. Malay and Indian respondents were generally more advanced in their pubertal status than Chinese respondents. About half of the Malay (45.6%; 95% CI: 41.3, 49.9) and Indian respondents (47.7%; 95% CI: 36.4, 59.2) were classified as mid-pubertal, while a high proportion of Chinese respondents were in the category of beginning pubertal (42.4%; 95% CI: 34.8, 50.4%). On account of only one student who was categorized in the post-pubertal category, the categories for advanced and post-pubertal were grouped together to form the "advanced or post-pubertal" category corresponding to 8.3% (95% CI: 6.6, 10.4) of the total respondents.

Prevalence of disordered eating and associated factors

The overall prevalence of disordered eating was 30.8% with a mean ChEAT score of 15.4 (95% CI: 14.8, 16.1). The prevalence of disordered eating in boys (32.8%; 95% CI: 27.3, 38.8) was higher than that of the girls (29.7%; 95% CI: 25.8, 33.9) although the difference was not significant (p=0.385). Table 3 presents the associations between socio-demographic characteristics and pubertal status with disordered eating. Age was associated with disordered eating among boys. Those at an older age reported a significantly higher prevalence of disordered eating compared with those at a younger age (p=0.005). Among boys, there were no significant differences in ethnicity, parents' educational level, parental monthly income and socio-economic status between those with disordered eating and those without disordered eating. In terms of pubertal status, boys who were in an advanced or post-pubertal stage had the highest prevalence of disordered eating (76.7%; 95% CI: 36.8, 94.9), (p=0.007). The same distribution was found between pubertal status and disordered eating among girls. Girls who were in an advanced or post-pubertal stage reported the highest prevalence of disordered eating (41.6%; 95% CI: 29.7, 54.5), (p=0.001). Girls with older age reported significantly higher prevalence than those without disordered eating (p=0.001). Among girls, ethnicity was significantly asso-

ciated with disordered eating with Indian (38.5%; 95% CI: 25.1, 53.9) reporting to have the highest prevalence of disordered eating followed by Malay (34.1%; 95% CI: 29.2, 39.2) and Chinese (10.3%; 95% CI: 6.2, 16.7), (p=0.005). There were no significant differences in parents' educational level, parental monthly income and socio-economic status between those with disordered eating and those without disordered eating among girls.

The multivariate logistic regression analysis suggests that among boys, those who were older and in an advanced or post-pubertal stage were 2.03 times (adjusted OR=2.03; 95% CI: 1.26, 3.28) and 8.64 times (adjusted OR=8.64; 95% CI: 1.55, 48.03) more likely to report disordered eating. Among girls, those who were Malay or Indian in an advanced or post-pubertal stage and in an older age group were 3.79 times (adjusted OR=3.79; 95% CI: 2.01, 7.11), 5.04 times (adjusted OR=5.04; 95% CI: 2.12, 11.97), 2.21 times (adjusted OR=2.34; 95% CI: 1.08, 5.06) and 1.53 times (adjusted OR=1.53; 95% CI: 1.06, 2.21) more likely to have disordered eating, respectively.

DISCUSSION

The prevalence of disordered eating among children (aged 10 to 11 years) in the present study was 30.8% which is much higher than the prevalence reported previously in local studies conducted among adolescents.[25,36] Dan, Mohd Nasir and Zalilah reported a prevalence of 14.3% among adolescents aged 13 years in Kuantan, Pahang.[36] Meanwhile, Farah, Mohd Nasir and Hazizi stated that 27.8% of early adolescents aged 13-14 years reported disordered eating.[25] This high prevalence might be due to the rapid introduction of Western culture into Malaysia, which has led to various changes in dietary habits and dietary patterns. These changes support the possibility for the high prevalence of disordered eating in Malaysia.

Findings of this study showed that age and pubertal status were risk factors of disordered eating which are consistent with other studies.[26,27,31,32] This study highlights that both boys and girls of older age who were in advanced or post-pubertal stage were more likely to develop disordered eating. As adolescence approaches and puberty begins, girls may become more aware of their bodies because of exposure to the thin ideal which may lead to increased disordered eating and weight-control attempts.[27] On the other hand, a study reported that late-maturing boys scored higher in bulimic symptoms and were more dissatisfied with their bodies. Body dissatisfaction is well-known risk factor of disordered eating among ado-

Table 3. Associations between socio-demographic characteristics and pubertal status with disordered eating

	Boys (n=282)			Girls (n=534)		
	Prevalence % (CI)	Crude OR (95% CI)	Adjusted OR (95% CI)	Prevalence % (CI)	Crude OR (95% CI)	Adjusted OR (95% CI)
Age, mean (95% CI)	10.7 (10.6, 10.9)	1.96 (1.23, 3.12)[*]	2.03 (1.26, 3.28)[*]	10.7 (10.6, 10.8)	1.83 (1.29, 2.61)[*]	1.53 (1.06, 2.21)[*]
Ethnicity						
Chinese	32.8 (26.2, 40.2)	-	-	10.3 (6.2, 16.7)	1.00 (ref)	1.00 (ref)
Malay	27.8 (17.3, 41.6)	-		34.1 (29.2, 39.2)	4.50 (2.47, 8.19)[*]	3.79 (2.01, 7.11)[*]
Indian	41.9 (26.1, 59.6)	-	-	38.5 (25.1, 53.9)	5.46 (2.37, 12.58)[*]	5.04 (2.12, 11.97)[*]
Father's educational level (n=733)						
No formal	58.6 (10.7, 94.4)	-	-	46.2 (16.6, 78.8)	-	-
Primary	53.8 (22.8, 82.2)	-	-	19.5 (6.8, 44.7)	-	-
Lower secondary (PMR)	34.7 (18.2, 55.9)	-	-	29.5 (20.0, 41.3)	-	-
Upper secondary (SPM)	28.2 (19.4, 39.1)	-	-	27.6 (21.6, 34.5)	-	-
Pre-U	35.6 (22.5, 51.2)	-	-	36.4 (24.6, 50.0)	-	-
University	33.3 (23.1, 45.4)	-	-	32.6 (25.0, 41.3)	-	-
Mother's educational level (n=733)						
No formal	40.4 (8.5, 83.1)	-	-	20.5 (2.9, 69.3)	-	-
Primary	44.8 (18.8, 74.1)	-	-	12.0 (3.5, 33.7)	-	-
Lower secondary (PMR)	48.0 (28.2, 68.4)	-	-	31.8 (21.6, 44.2)	-	-
Upper secondary (SPM)	34.5 (25.1, 45.2)	-	-	31.3 (25.2, 38.2)	-	-
Pre-university	23.7 (13.3, 38.7)	-	-	30.5 (20.3, 43.1)	-	-
University	31.8 (21.3, 44.5)	-	-	28.5 (20.6, 38.0)	-	-
Socio-economic status (n=640)						
<RM520 (hardcore poor)	40.1 (12.5, 75.8)	-	-	25.9 (77,5 9.2)	-	-
RM521- RM830 (poor)	-	-	-	9.6 (1.2, 48.1)	-	-
>RM831 (above poor)	31.5 (25.1, 38.8)	-	-	30.5 (26.0, 35.3)	-	-
Pubertal status						
Pre-pubertal	30.3 (21.7, 40.6)	1.00 (ref)	1.00 (ref)	22.4 (15.0, 32.2)	1.36 (0.66, 2.78)	1.06 (0.50, 2.22)
Beginning pubertal	33.1 (24.8, 42.7)	1.14 (0.62, 2.10)	1.12 (0.60, 2.07)	17.5 (11.2, 26.3)	1.00 (ref)	1.00 (ref)
Mid-pubertal	30.8 (20.1, 44.0)	1.02 (0.49, 2.12)	1.03 (0.49, 2.17)	34.2 (28.6, 40.4)	2.45 (1.37, 4.38)[*]	1.66 (0.91, 3.02)
Advanced or post-pubertal	76.7 (36.8, 94.9)	7.56 (1.26, 45.32)[*]	8.64 (1.55, 48.03)[*]	41.6 (29.7, 54.5)	3.35 (1.61, 6.98)[*]	2.34 (1.08, 5.06)[*]

[*] $p<0.05$

lescents.[31]

Malaysia is a multi-ethnic and multi-cultural country with Malay, Chinese and Indian as the three major ethnic groups. The presence of various ethnic groups in Malaysia has resulted in a rich diversity of food choices as each ethnic group has their own dishes. In this study, ethnicity was found to be associated with disordered eating among girls. Compared with Chinese girls, Indian and Malay girls were 5.04 and 3.79 times, respectively, more likely to develop disordered eating. There has been no similar published research of disordered eating using the ChEAT instrument that assessed ethnic differences in disordered eating among children in Malaysia. However, when comparing with a neighboring country, results in this study were in agreement with a study conducted in Singapore using EAT-26 and Eating Disorder Inventory (EDI) instruments among 4,461 female adolescents (mean age: 16.7 years).[18] They reported that Malay female adolescents were twice more likely to develop disordered eating compared with Chinese adolescents (Prevalence rate ratios: 2.05; 95% CI: 1.59-2.65). Another study in Malaysia also found that Malay and Indian adolescents engaged more often in behaviors to lose weight compared with Chinese adolescents.[37] In addition, the study reported that Malay and Indian adolescents reported greater pressure from adults, older siblings or cousins to lose weight than Chinese adolescents. This may explain the high prevalence of disordered eating among Indian and Malay adolescents in the present study. Although sex difference was not significantly associated with disordered eating in this study, it should be noted that Chinese girls reported a lower prevalence of disordered eating than Chinese boys. A Hong Kong study reported that Chinese girls were less likely to be concerned about diet to lose weight than Chinese boys.[38] This might be a possible reason for the unexpected difference between Chinese boys and Chinese girls in the current study. However, further studies are needed to evaluate the nature of the ethnic differences in disordered eating.

The education level of parents, parental monthly income, and socioeconomic status were not significantly associated with disordered eating in the present study. These may be explained by the lack of family connectedness between parents and children. Thus, children's eating attitudes might not be influenced by the education level of their parents. In addition, the state of Selangor is one of the most highly developed and urbanized states in Malaysia. Most parents work due to the higher cost of living, and their children are left in the care of housemaids, babysitters or daycare centers. Similarly, another study has found that socioeconomic status was not significantly associated with disordered eating among female adolescents in a school-based study in Ontario, Canada.[39] In addition, Tam, Ng, Yu, and Young also indicated that socioeconomic status was not associated with disordered eating among Hong Kong adolescents.[17]

To date, there is only one local study conducted in 2005 which reported the prevalence of disordered eating among 8 to 9 years old children in Selangor.[21] The study by Zalilah and Zaidah was focused only on Malay girls and pubertal status was not reported in that study. The present study provides the updated data on the prevalence of disordered eating among children aged 10 to 11 years old in Selangor, Malaysia. Furthermore, in addition to girls, this study also included boys, whereas most other studies focused on girls. The present study suggests that both boys and girls are at risk of disordered eating. This study also found that factors associated with disordered eating were different for boys and girls. Thus, sex differences should be taken into consideration when conducting future studies that examine other potential risk factors of disordered eating such as psychological and socio-cultural factors.

This study has several limitations. Its cross-sectional design did not allow for the assessment of the progression of symptoms over time or the inference of causal relationships. The ChEAT screening instrument was used to measure symptoms and concerns characteristic of eating disorders, and no structured clinical interviews were conducted to diagnose eating disorders. Furthermore, questionnaires used in this study were self-administered and thus, depended mostly on the honesty and willingness of the respondents to answer the questions.

Conclusion
The prevalence of disordered eating among children in this study was 30.8%. Among boys, those who were in older age group and in an advanced or post-pubertal stage were the risk factors for disordered eating. Among girls, being a Malay or Indian, in an advanced or post-pubertal stage and older age group were the risk factors for disordered eating. Further research is required to affirm the associations between these factors towards disordered eating in children. This study highlights the need to consider ethnic and pubertal status differences when designing intervention programs to prevent disordered eating among adolescents.

AUTHOR DISCLOSURES
The authors declare that they have no conflict of interest.

REFERENCES
1. United States Department of Health Human Services. Body wise handbook. Eating disorders information for middle school personnel (3rd ed.). Washington, DC: US Department of Health and Human Services; 2005. [cited 2013/8/13]; Available from: http://maine.gov/education/sh/ eatingdisorders/bodywise.pdf.
2. Alliance for Eating Disorders Awareness. What are eating disorders. [cited 2013/8/13]; Available from: http://www. allianceforeatingdisorders.com/portal/what-are-eating-disord ers#.VXnbMPmqqko.
3. Stice E, Davis K, Miller NP, Marti CN. Fasting increases risk for onset of binge eating and bulimic pathology: a 5-

year prospective study. J Abnorm Psychol. 2008;117:941-6. doi: 10.1037/a0013644.

4. Eating Disorder Foundation. What is an eating disorder. [cited 2013/08/13]; Available from: http://eatingdisorder foundation.org/learn-more/about-eating-disorders/.

5. Buhrich N. Frequency of presentation of anorexia nervosa in Malaysia. Aust Nz J Psychiat. 1981;15:153-5. doi: 10.3109/00048678109159426.

6. Swanson SA, Crow SJ, Le Grange D, Swendsen J, Merikangas KR. Prevalence and correlates of eating disorders in adolescents: Results from the national comorbidity survey replication adolescent supplement. Arch Gen Psychiatry. 2011;68:714-23. doi: 10.1001/archgen psychiatry.2011.22.

7. Field AE, Austin S, Taylor C, Malspeis S, Rosner B, Rockett HR, Gillman MW, Colditz GA. Relation between dieting and weight change among preadolescents and adolescents. Pediatrics. 2003;112:900-6. doi: 10.1542/peds.112.4.900.

8. Jacobi C, Hayward C, de Zwaan M, Kraemer HC, Agras WS. Coming to terms with risk factors for eating disorders: application of risk terminology and suggestions for a general taxonomy. Psychol Bull. 2004;130:19-65. doi: 10.1037/0033-2909.130.1.19.

9. Killen JD, Taylor CB, Hayward C Haydel KF, Wilson DM, Hammer L, Kraemer H, Blair-Greiner A, Strachowski D. Weight concerns influence the development of eating disorders: a 4-year prospective study. J Consult Clin Psychol. 1996;64:936-40. doi: 10.1037/0022-006X.64.5.936.

10. Tsai MR, Chang YJ, Lien PJ, Wong Y. Survey on eating disorders related thoughts, behaviors and dietary intake in female junior high school students in Taiwan. Asia Pac J Clin Nutr. 2011;20:196-205.

11. McNicholas F, Dooley B, Keogh L, Lydon A, Lennon R, Ahern S, Coyle C, Whelan A, Donoghue LO. Eating problems in Irish children and adolescence – EPICA. Ir J Psychol Med. 2010;27:172-8. doi: 10.1017/S07909667000 01476.

12. McVey G, Tweed S, Blackmore E. Dieting among preadolescent and young adolescent females. CMAJ 2004; 170:1559-61. doi: 10.1503/cmaj.1031247.

13. Santos M, Richards CS, Bleckley MK. Comorbidity between depression and disordered eating in adolescents. Eat Behav. 2007;8:440-9. doi: 10.1016/j.eatbeh.2007.03.005.

14. Bilali A, Galanis P, Velonakis E, Katostaras T. Factors associated with abnormal eating attitudes among Greek adolescents. J Nutr Educ Behav. 2010;42:292-8. doi: 10.1016/j.jneb.2009.06.005.

15. Musaiger AO, Al-Mannai M, Tayyem R, Al-Lalla O, Ali EY, Kalam F et al. Risk of disordered eating attitudes among adolescents in seven Arab countries by gender and obesity: a cross-cultural study. Appetite. 2013;60:162-7. doi: 10.1016/j.appet.2012.10.012.

16. Pourghassem Gargari B, Kooshavar D, Seyed Sajadi N, Safoura S, Hamed Behzad M, Shahrokhi H. Disordered eating attitudes and their correlates among Iranian high school girls. Health Promot Perspect. 2011;1:41-9. doi: 10.5681/hpp.2011.003

17. Tam CK, Ng CF, Yu CM, Young BW. Disordered eating attitudes and behaviours among adolescents in Hong Kong: prevalence and correlates. J Paediatr Child Health. 2007;43: 811-7. doi: 10.1111/j.1440-1754.2007.01195.x.

18. Ho TF, Tai BC, Lee EL, Cheng S, Liow PH. Prevalence and profile of females at risk of eating disorders in Singapore. Singapore Med J. 2006;47:499-503.

19. Wong Y, Chang YJ, Tsao SW. Disturbed eating tendency and related factors in grade four to six elementary school

students in Taiwan. Asia Pac J Clin Nutr. 2014;23:112-20. doi: 10.6133apcn.214.23.1.

20. Yang SJ, Kim JM, Yoon JS. Disturbed eating attitudes and behaviors in South Korean boys and girls: a school-based cross-sectional study. Yonsei Med J. 2010;51:302-9. doi: 10.3349/ymj.2010.51.3.302

21. Zalilah M, Zaidah M. Correlates of Children's Eating Attitude Test scores among primary school children. Percept Mot Skills. 2005;100:463-72. doi: 10.2466/pms.100.2.463-472.

22. Soo KL. Factors Contributing to Disordered Eating Behaviours and At-Risk of Eating Disorders among Adolescent Girls in Kelantan, Malaysia [dissertation] Selangor: Universiti Putra Malaysia; 2008.

23. Lai CM, Mak KK, Pang JS, Fong SS, Ho RC, Guldan GS. The associations of sociocultural attitudes towards appearance with body dissatisfaction and eating behaviors in Hong Kong adolescents. Eat Behav. 2013;14:320-4. doi: 10.1016/j.eatbeh.2013.05.004.

24. Ferreiro F, Seoane G, Senra C. Gender-related risk and protective factors for depressive symptoms and disordered eating in adolescence: a 4-year longitudinal study. J Youth Adolesc. 2012;41:607-22. doi: 10.1007/s10964-011-9718-7.

25. Farah WZ, Mohd NM, Hazizi A. Physical activity, eating behaviour and body image perception among young adolescents in Kuantan, Pahang, Malaysia. Malays J Nutr. 2011;17:325-36.

26. Mousa TY, Al-Domi HA, Mashal RH, Jibril MA-K. Eating disturbances among adolescent schoolgirls in Jordan. Appetite. 2010;54:196-201. doi: 10.1016/j.appet.2009.10.008.

27. Baker JH, Thornton LM, Lichtenstein P, Bulik CM. Pubertal development predicts eating behaviors in adolescence. Int J Eat Disord. 2012;45:819-26. doi: 10.1002/eat.22022.

28. Baker JH, Thornton LM, Bulik CM, Kendler KS, Lichtenstein P. Shared genetic effects between age at menarche and disordered eating. J Adolesc Health. 2012;51: 491-6. doi: 10.1016/j.jadohealth.2012. 02.013.

29. Combs JL, Pearson CM, Zapolski TC, Smith GT. Preadolescent disordered eating predicts subsequent eating dysfunction. J Pediatr Psychol. 2013;38:41-9. doi: 10.1093/jpepsy/jss094.

30. Combs JL, Pearson CM, Smith GT. A risk model for preadolescent disordered eating. Int J Eat Disorder. 2011;44: 596-604. doi: 10.1002/eat.20851.

31. McNicholas F, Dooley B, McNamara N, Lennon R. The impact of self-reported pubertal status and pubertal timing on disordered eating in Irish adolescents. Eur Eat Disord Rev. 2012;20:355-62. doi: 10.1002/erv.2171.

32. Zehr JL, Culbert KM, Sisk CL, Klump KL. An association of early puberty with disordered eating and anxiety in a population of undergraduate women and men. Horm Behav. 2007;52:427-35. doi: 10.1016/j.yhbeh.2007.06.005

33. Petersen AC, Crockett L, Richards M, Boxer A. A self-report measure of pubertal status: reliability, validity, and initial norms. J Youth Adolesc. 1988;17:117-33. doi: 10.1007/bf01537962.

34. Maloney MJ, McGuire JB, Daniels SR. Reliability testing of a children's version of the Eating Attitude Test. J Am Acad Child Adolesc Psychiatry. 1988;27:541-3. doi: 10.1097/00004583-198809000-00004.

35. Yusoff F, Saari R, Naidu BM, Ahmad NA, Omar A, Aris T. Methodology of the national school-based health survey in Malaysia, 2012. Asia Pac J Public Health 2014;26:9S-17S. doi: 10.1177/ 1010539514542424.

36. Dan SP, Mohd NM, Zalilah MS. Determination of factors associated with physical activity levels among adolescents attending school in Kuantan, Malaysia. Malays J Nutr. 2011; 17:175-87.

37. Mellor D, McCabe M, Ricciardelli L, Yeow J, Daliza N, Hapidzal NF. Sociocultural influences on body dissatisfaction and body change behaviors among Malaysian adolescents. Body image. 2009;6:121-8. doi:10.1016/j.bodyim.2008.11.003.

38. Wong JP, Ho SY, Lai MK, Leung GM, Stewart SM, Lam TH. Overweight, obesity, weight-related concerns and behaviours in Hong Kong Chinese children and adolescents. Acta Paediatr. 2005;94:595-601. doi: 10.1111/j.1651-2227.2005.tb01945.x.

39. Jones JM, Bennett S, Olmsted MP, Lawson ML, Rodin G. Disordered eating attitudes and behaviours in teenaged girls: a school-based study. CMAJ. 2001;165:547-52.