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The Relationship between Child Eating Behaviour with Body Mass Index among Toddlers Aged Two to Four Years Old

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ABSTRACT

Children eating behaviour was hypothesised as one of the factors associated with growth development as well as malnutrition among toddlers. This study aimed to explore the relationship between child eating behaviour among toddlers aged two to four years old and their respective Body Mass Index (BMI) or BMI for Age Z (BAZ). A cross-sectional study was conducted among parents and caregivers with toddlers between two to four years old, in the Klang Valley. The validated Children's Eating Behaviour Questionnaire (CEBQ) was used to measure their child eating habit and behaviours. A total of 96 parents or caregivers of toddlers participated. Girls had lower BAZ than boys (-1.20 vs -0.15, $p=0.030$), and significantly higher satiety responsiveness and food fussiness scores (3.14 vs 2.80, $p=0.005$ and 2.83 vs 2.44, $p=0.005$ respectively). Emotional overeating had opposite effects on BMI and BAZ between genders. In this study, girls aged two to four year old had lower BMI and BAZ than boys; and demonstrated higher food avoidance behaviour. Emotional overeating is associated with opposite effects on BMI and BAZ between boys and girls. Among all toddlers, satiety responsiveness and food fussiness were associated with lower BAZ.



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INTRODUCTION

Malnutrition among toddlers includes both under-nutrition and a growing disorder with overweight and obesity. The incidence of low body mass index has declined globally in the past two decades, but it remains to be prevalent in Asian and African countries (Black *et al.*, 2013). The prevalence of

stunting in children under the aged of 5 years is still an unsolvable problem in many Asian countries (Moench-Pfanner and Bloem, 2013). Malaysia, on the other hand, faces the threat of a double burden of stunting and obesity. As stated by the National Health and Morbidity Survey (National Health and Morbidity Survey, 2015) the prevalence of stunting in children under five years of age in Malaysia has raised from 17.2% (2006) to 20.7% (2016). Similar findings were also highlighted on childhood obesity, with 10% of children were overweight, and 12% were categorised as obese (Reeves *et al.*, 2018). It is imperative to elucidate the association between the children eating behaviour and their body weight to design a suitable intervention for healthy eating among children in this age range, thus resolving the issue of double burden.

The Children's Eating Behaviour Questionnaire (CEBQ) is a multi-dimensional, parent or caregiver-reported questionnaire, measuring children's

Table 1: Socio-demographics of the toddlers, N=96

Socio-demography characteristics	n (%)
Age (mean, s.d.)	3.24, 0.74
2 year old	17 (17.7)
3 year old	38 (39.6)
4 year old	41 (42.7)
Gender	
Boys	51 (53.1)
Girls	45 (46.9)
Sibling ordinal position	
First child	45 (46.9)
Second child	20 (20.8)
Third child or more	31 (32.3)
Total siblings	
One	25 (26.0)
Two	26 (27.1)
Three	26 (27.1)
Four or more	17 (17.7)
Father's education background	
Primary	1 (1.0)
Secondary	14 (14.6)
Tertiary	77 (80.2)
Mother's education background	
Primary	1 (1.0)
Secondary	11 (11.5)
Tertiary	82 (85.4)
Total household income	
Less than RM3,000	13 (13.5)
RM3,000 - RM5,000	24 (25.0)
RM5,000 - RM10,000	36 (37.5)
More than RM10,000	19 (19.8)

eating behaviours and it's relation to risk of malnutrition. It contains eight domains including four subscales that measure food-approach behaviours [Food Responsiveness (FR), Enjoyment of Food (EF), Emotional Overeating (EOE), Desire to Drink (DD)]. And another four subscales that reflect food-avoidant behaviours [Satiety Responsiveness (SR), Slowness in Eating (SE), Emotional Undereating (EUE) and Food Fussiness (FF)] (Svensson *et al.*, 2011; Tay *et al.*, 2016). Eating behaviour, in general, is related and influenced by psycho-physiological and environmental determinants. However, children below the age of pre-school depend on parental or caregiver feeding practices. Previous studies pointed out that the pressure either to eat or to restrict intake to the children are significantly associated with factors of the children weight status or the children behaviour. Children with low body mass index (BMI) are consistently associated with

higher pressure to eat from parents (Gregory *et al.*, 2010). We have, therefore, aimed to explore the relationship between child eating behaviour among toddlers aged two to four years old and their respective Body Mass Index (BMI) or BMI for age Z (BAZ).

MATERIALS AND METHODS

Study Design and Participants

This cross-sectional study was conducted among parents and caregivers with children aged two to four years old, in the Klang Valley. A total of 96 healthy children were recruited. Syndromic child or children with chronic diseases, bowel or digestive system anomalies, restricted diets or on dietary supplements were excluded from this study. All procedures were conducted following Universiti Sains Islam Malaysia (USIM) Ethics Committee approval

Table 2: Body Mass Index and the Children's Eating Behaviour Question naire (CEBQ) scores of the toddlers, N=96

	Total, n=96 mean (s.d.)	Boys, n=51 mean (s.d.)	Girls, n=45 mean (s.d.)	p value
Age distribution	3.32 (0.85)	3.12 (0.79)	3.40 (0.65)	0.062
Body Mass Index (BMI)	15.62 (2.82)	16.23 (2.83)	14.92 (2.68)	0.023
BMI for age Z (BAZ)	-0.64 (2.38)	-0.15 (2.13)	-1.20 (2.54)	0.030
Food approach behaviours				
Food responsiveness	2.65 (0.78)	2.73 (0.75)	2.56 (0.81)	0.286
Enjoyment of food	3.75 (0.81)	3.88 (0.79)	3.59 (0.82)	0.081
Emotional overeating	2.11 (0.73)	2.14 (0.81)	2.07 (0.62)	0.602
Desire to drink	3.22 (0.92)	3.29 (0.94)	3.15 (0.89)	0.444
Food avoidant behaviours				
Satiety responsiveness	2.96 (0.59)	2.80 (0.54)	3.14 (0.61)	0.005
Slowness in eating	2.87 (0.63)	2.88 (0.68)	2.86 (0.57)	0.851
Emotional undereating	3.15 (0.81)	3.24 (0.75)	3.06 (0.88)	0.300
Food fussiness	2.62 (0.67)	2.44 (0.63)	2.83 (0.66)	0.005

Independent t-test was used to test statistical difference between boys and girls. Significant to $p < 0.05$

(reference number: USIM/REC/0318-44).

Measures

Questionnaires

After written informed consent was obtained, the parent or caregiver completed a series of questionnaires via face-to-face interview, while their children's weight and height were measured for BMI. The demographic questions regarding the children and their parents included gender, parental educational background, monthly total household income and child's medical history, followed by the validated Children's Eating Behaviour Questionnaire (CEBQ).

The CEBQ is contained of 35 items, each evaluated on a five-point Likert scale. The scale ranges from never to always, based on the eight subscales. The sum and mean of each subscale were calculated as per the questionnaire protocol.

Child Body Mass Index

The anthropometric measurements were performed by a trained research assistant using a standardised digital calibrated floor scale (Seca 217). The scale was placed on firm flooring (tile). Bodyweight was measured without clothes, diapers or shoes. While the child stood with both feet on the scale, the recorded weight was taken.

The height was measured using a portable stadiometer (Seca 217). The measurement was taken without shoes with the child's back to the wall while ensuring the child was standing with head, shoulders, buttocks and feet flat. With feet together, heels were ensured to touch the wall with straightening legs and arms at sides. The height was measured by ensuring the corner of the eyes, and the top of the ears are level. Then, the flat headpiece was lowered until it touches the head while the investigator's eyes were at the same level as the headpiece. The height was recorded to the nearest 0.1 cm.

BMI was calculated in kg/m^2 using online BMI calculator, and was converted to standardised z-scores, according to age and gender-based on the Centre for Diseases Control (CDC) growth charts using online Paediatric Z-score calculator from Children's Hospital of Philadelphia Research Institute.

Statistical Analysis

Statistical analyses were performed using the IBM SPSS version 24. Independent t-test was used to determine any difference between boys and girls for their BMI, BAZ and CEBQ sub-scales. Pearson correlation coefficient, r , was used to determine any relationship between CEBQ sub-scales and BMI or BAZ. The significant value was taken if $p < 0.05$.

Table 3: Correlations between CEBQ sub-scales and Body Mass Index (BMI) or BMI for age Z (BAZ)

CEBQ sub-scales	BMI		BAZ	
	r	value	r	value
Boys, n=51				
Food approach behaviours				
Food responsiveness	0.027	0.426	-0.003	0.492
Enjoyment of food	-0.0102	0.238	-0.044	0.380
Emotional overeating	-0.302	0.016	-0.285	0.023
Desire to drink	0.089	0.268	0.055	0.350
Food avoidant behaviours				
Satiety responsiveness	-0.097	0.502	-0.110	0.447
Slowness in eating	0.019	0.448	0.010	0.474
Emotional under-eating	-0.198	0.082	-0.141	0.162
Food fussiness	0.069	0.315	0.006	0.484
Girls, n=45				
Food approach behaviours				
Food responsiveness	0.178	0.120	0.125	0.206
Enjoyment of food	0.136	0.186	0.158	0.150
Emotional overeating	0.322	0.015	0.297	0.024
Desire to drink	-0.054	0.363	-0.033	0.414
Food avoidant behaviours				
Satiety responsiveness	-0.273	0.035	-0.237	0.116
Slowness in eating	-0.131	0.196	-0.089	0.282
Emotional under-eating	-0.134	0.190	-0.172	0.130
Food fussiness	-0.066	0.333	-0.238	0.058
Total, n=96				
Food approach behaviours				
Food responsiveness	0.108	0.146	0.076	0.232
Enjoyment of food	0.025	0.403	0.076	0.230
Emotional overeating	-0.043	0.340	-0.011	0.458
Desire to drink	0.038	0.356	0.022	0.416
Food avoidant behaviours				
Satiety responsiveness	-0.237	0.020	-0.232	0.024
Slowness in eating	-0.042	0.342	-0.036	0.362
Emotional under-eating	-0.171	0.074	-0.151	0.072
Food fussiness	-0.075	0.234	-0.188	0.034

r = Pearson correlation coefficient, one-tailed hypothesis testing, significant to p value <0.05

RESULTS AND DISCUSSION

Ninety-six parents of toddlers aged 2 to 4 years old participated in this study. The mean (s.d.) age of the toddlers was 3.24 (0.74) (Table 1). There were slightly more boys (53.1%) than girls (46.9%). Boys had significantly higher BMI in comparison to girls, $p=0.023$ and 0.030 , respectively (Table 2). Girls scored higher than boys for satiety responsiveness and food fussiness. There was no significant variance between boys and girls with regards to other CEBQ subscales.

For emotional overeating subscale, boys demonstrated a significant negative, fair correlation with BMI ($r -0.259$, $p=0.033$) and BAZ ($r -0.251$, $p=0.038$). In contrast, girls had a meaningful positive, reasonable relationship for this subscale when corresponded to their BMI ($r 0.322$, $p=0.015$) and BAZ ($r 0.297$, $p=0.023$) (Table 3). In terms of satiety responsiveness, girls had significant negative, fair correlation with BMI ($r -0.273$, $p=0.034$). There was also a significant negative but weak correlation between food fussiness for all toddlers and their BAZ ($r -0.172$, $p=0.047$).

The CEBQ has been developed to describes early precursors of eating disorders among children. Studies have shown that overweight or obese children demonstrate healthier food approach behaviour and weaker food avoidant behaviour (Viana *et al.*, 2008; Webber *et al.*, 2009). Another study conducted among Malaysian schoolchildren has also shown that their body adiposity was positively correlated with food approach behaviour, and negatively correlated with food avoidant behaviour (Tay *et al.*, 2016). These findings strongly imply the contribution of an individual's eating behaviours toward developing weight problems, including overweight and obesity. Hence, intervention strategies focusing on changes in the eating behaviours are strongly recommend.

To the best of our knowledge, this study is the first to describe eating behaviours associated with BMI-for-age Z-scores (BAZ) among Malaysian toddlers aged two to four years old. BAZ for both genders were within the normal range as according to the Child Growth Standards classification by the World Health Organization (WHO) (de Onis and Lobstein, 2010). Hence, the toddlers in this study have a good nutritional status. The present study found that BAZ for girls was significantly lower compared to boys. This finding is in agreement with results at the national levels (Khor *et al.*, 2006). However, the difference was not significant. A recent finding from the Malaysian National Health Morbidity Surveys in 2015 revealed that

more than 80% of Malaysian children age 0-4 years old have normal nutritional status (National Health and Morbidity Survey, 2015). With regards to the eight subscales of CEBQ which were divided into two major dimensions of eating behaviours, that are food approach behaviours and food avoidant behaviours; the present study found that food approach behaviours were not statistically different between genders. Research conducted on similar aged children also showed the same results (Svensson *et al.*, 2011). However, another study among older children has been demonstrated that emotional overeating subscale was significantly different between genders (Tay *et al.*, 2016). This might be due to different eating styles between boys and girls.

Additionally, we have found that satiety responsiveness and food fussiness were statistically different between genders. The girls reported higher satiety responsiveness, which could be explained by lower BAZ among girls in this study. In addition to that, higher food fussiness among girls also leads to lower BAZ as compared to boys.

In general, we have found that all four subscales for food approach behaviours had a negligible relationship with BAZ among toddlers age 2-4 years old. However, emotional overeating subscale had a significantly negative low relationship with BAZ among boys; and had a significantly positive low relationship with BAZ among girls. This showed that girls were likely to eat more while experiencing negative emotions and engagement in this condition positively affects their BAZ.

Slowness in eating and emotional undereating subscales had a negligible relationship with BAZ for both genders. Meanwhile, satiety responsiveness had a significantly negative low relationship with BMI for girls. This could account for girls having lower BMI and BAZ in comparison to boys. Collectively, satiety responsiveness for all toddlers had a significantly negative low relationship with BAZ. Relationship between food fussiness and BAZ was found to be significant. However, the strength of the relationship is negligible.

CONCLUSIONS

In this study, girls aged two to four-year-old had lower BMI and BAZ than boys; and demonstrated higher food avoidance behaviour. Emotional overeating is associated with opposite effects on BMI and BAZ between boys and girls. Among all toddlers, satiety responsiveness and food fussiness were associated with lower BAZ.

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Conflict of Interest

The authors declare that they have no conflict of interest for this study.

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