

CHILDREN'S EATING BEHAVIOR QUESTIONNAIRE: FACTORIAL VALIDATION AND DIFFERENCES IN SEX AND EDUCATIONAL LEVEL IN THAI SCHOOL-AGE CHILDREN

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Abstract. The purposes of this study were to test the validity of the Thai version Children's Eating Behavior Questionnaire (CEBQ) and to describe the variation in eating style among school-age children. This school-based, cross sectional study was conducted in five primary public schools selected from Bangkok and the three regions of Thailand (North, Northeast, South). Six hundred and eighty students from the first and fourth grade classes were included in our study. The CEBQ was used to assess the eating styles among these children. Factor analysis revealed an eight-factor solution accounted for 57.1% of the total variance. Most of the scale items loaded as expected and their factor loadings were comparable to those obtained from the original study in England. The reliability coefficients are all within acceptable ranges (more than 0.7), with the exceptions of the subscales of 'slowness in eating' and 'emotional under eating' with the coefficients of 0.64 and 0.69, respectively. There were some significant differences in eating behaviors between sex and educational level. Boys scored higher on 'enjoyment of food' compared with girls ($p < 0.05$), as well as on 'desire to drink' ($p < 0.05$). Children in Grade 1 scored higher on 'satiety responsiveness' ($p < 0.001$) and 'slowness in eating' ($p < 0.001$) compared with those in Grade 4. This study supported the use of CEBQ as an appropriate tool for measuring the eating behaviors among Thai school-age children.

Keywords: school-age children, eating behavior, questionnaire, factor analysis
Thai children

INTRODUCTION

Eating problems are some of the most common, challenging issues for parents and pediatrician. Previous research has suggested that there are influences of ge-

netic and environmental factors on childhood eating habits (Birch and Fisher, 1998; Dubois *et al*, 2013).

A longitudinal twin study found that genetic predispositions explain, in a large part, the variations in traits related to appetite during childhood. However, when children get older, appetite-related behaviors become more sensitive to environmental influence outside the home (Dubois *et al*, 2013). Taylor *et al* (2005) reported that

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individual factors (knowledge, attitude, and food preferences), familial factors, and the nature of foods available in the physical environment have been identified as strong determinants of healthy eating in both children and adolescents. The media, in particularly television, also have enormous potential influences and can overshadow familial influences.

According to an epidemiology survey on eating behaviors among Chinese children, the prevalence of the common eating problems (such as pickiness, anorexia, food refusal) was greater than 60% according to parental reports and range from 25-to-40%, according to reports (Jin *et al*, 2009; Zhang *et al*, 2011). A longitudinal study of child development in Quebec, Canada found that 14-to-17% of preschool children were reported as being picky eaters, and 19-to-23% were reported as overeaters by their mothers (Dubois *et al*, 2007).

In Thailand, limited information is available regard to feeding and eating behaviors in children. Benjasuwantep *et al* (2013) found that the prevalence of feeding problems in preschool children was 26.9%, and the most frequent type of problem was in the highly selective intake category. Thongbai *et al* (2011) reported that the predictive risks of obesity in preschool children included a high score in food responsiveness, enjoyment of food, eating high fruit fiber diet, and drinking yogurt. There were two experimental studies that have been done on the effectiveness of healthy eating intervention among Thai school-age children (Duangchan *et al*, 2010; Kanyamee *et al*, 2013).

Several psychometric instruments have been developed to assess eating behavior in children. These include the Children's Eating Behavior Questionnaire (CEBQ) (Wardle *et al*, 2001), the Dutch Eating Behavior Questionnaire for Children

(DEBQ-C) (Dakanalis *et al*, 2013), the Oregon Research Institute Child Eating Behavior Inventory (ORI-CEBI) (Lewinsohn *et al*, 2005), and the Child Feeding Questionnaire (CFQ) (Birch *et al*, 2001).

The CEBQ is generally regarded as one of the most appropriate tools for assessing children's eating behaviors. The questionnaire was first developed and validated in United Kingdom (Wardle *et al*, 2001). It has since been validated with high reliability and validity in many Western countries. Dutch, Portuguese, Swedish, and Chilean studies have supported the use of the CEBQ as a psychometrically sound tool for assessing children's eating behaviors and demonstrated its applicability in overweight-related studies (Sleddens *et al*, 2008; Viana *et al*, 2008; Santos *et al*, 2011; Svensson *et al*, 2011).

However, one study in China did not demonstrate this association. Cao *et al* (2012) used the CEBQ to study eating behaviors among Chinese toddlers and concluded that the CEBQ may be affected by age and cultural differences. To the best of our knowledge, there have been no other validation studies on the CEBQ applicability in the others Asian cultural backgrounds, and this includes Thailand. The primary aim of this study was to examine the factorial structure and the reliability of the Thai version of the CEBQ in school-age children. The second aim was to compare the differences in eating behaviors regards to gender and educational level.

MATERIALS AND METHODS

Participants and procedures

The school-based, cross sectional study was conducted in 5 primary public schools in Thailand in February and March of 2012. One primary school was selected from one province in each region (North,

Northeast and South) and two schools from Bangkok. Simple random sampling technique was employed. Two classrooms were selected from each of the first and fourth grades. All students in these classes were included in our study. Parents of these participants were provided with and signed the informed consent prior to participate in this survey. The Children's Eating Behavior Questionnaire (CEBQ) was distributed by the teachers to the parents.

Measures

The Children's Eating Behavior Questionnaire (CEBQ) is a retrospective, parental reported questionnaire that has been used worldwide to examine eating behaviors of children 6 to 11 years of age. The original version of CEBQ consists of 35 items that evaluates eight subscales of eating behavior: food responsiveness (FR = 5 items), enjoyment of food (EF=4 items), emotional overeating (EOE=4 items), desire to drink (DD=3 items), slowness in eating (SE=4 items), satiety responsiveness (SR=5 items), food fussiness (FF=6 items), and emotional under eating (EUE=4 items).

The items are rated on a five-point Likert scales (1=Never, 2=Rarely, 3=Sometimes, 4= Often, 5=Always). The CEBQ was translated into Thai language by the research expert team at the Institute for Population and Social Research (IPSR), Mahidol University and a developmental-behavioral pediatrician at Srinakharinwirot University. Pilot testing was done to evaluate the accuracy and appropriateness of the form.

Statistical analysis

A Principal Components Analysis (PCA) with Varimax rotation was used for all items of the CEBQ to confirm the applicability of the original eight-factor structure for our sample. Criteria used in order to avoid over- or under-extraction

of factors were eigenvalues, factor loadings and Kaiser-Meyer-Olkin (KMO) Test. Factors with eigenvalues greater than 1.0 were selected (Beavers *et al*, 2013), and only items with factor loadings greater than 0.4 were considered (Stevens, 1996). For KMO test with value greater than 0.5 was acceptable (Beavers *et al*, 2013). In addition, an internal reliability coefficient (Cronbach's alpha) for each scale was assessed to examine the reliability within the scale. Criteria values for reliability were referred to a guideline by Nunnally (1978) that recommended reliability of 0.70 or higher. This study also presented an average corrected item-total correlation for each scale to show the contribution of the items to the scale. Criteria to consider correlation as 'Good' (above 0.30) or 'Unreliable' (below 0.15) were adopted from Dutch study (Sleddens *et al*, 2008).

Bivariate relationships between item scale scores on each of the eight factors of the CEBQ were assessed using non-parametric statistics, Spearman's rho, because all eight scales were non-normally distributed. However, criteria for the size of the effect across scales were the same as used in Pearson's correlations. Correlations between 0.8 and 1.0 were considered as large, medium around 0.5, and small between 0.2 and 0.3 (Cohen, 1988). Finally, gender and education level differences between scales were analyzed using the Mann-Whitney *U* test rather than the *t*-test, because all these scales were skewed.

Ethical considerations

Ethical approval for this study was granted by Srinakharinwirot University (SWUEC/E-092/2557; 2014/10/15).

RESULTS

The total of 879 sets of questionnaires were distributed to parents, 700 sets were

returned to our research team (response rate=79.6%). Twenty questionnaires were excluded as some data were missing. Ultimately, 680 (77.4%) were used in the data analyses.

Demographic characteristics

The mean age of the participating students was 8.28 (SD=1.61) years, 48.2% of students were girls, 95.7% were Buddhist, and 44.1% resided in Bangkok. A large proportion of the parents had a college degree: 78.6% of the fathers and 77.4% of the mothers.

Confirmation of factor structure

Factor analysis revealed an eight-factor solution (Table 1) with eigenvalues greater than 1, and the KMO value was 0.865, which was meritorious according to Kaiser's criteria (Beavers *et al*, 2013). The eight factors explained 57.1% of the variance in the 35 items, although the variance extracted seemed low; however, some indicate 50% of the variance explained is acceptable (Beavers *et al*, 2013). Moreover, the percentage of explained variance from this study was comparable to earlier studies range from 58%-63% (Wardle *et al*, 2001; Sleddens *et al*, 2008; Viana *et al*, 2008).

For the scale items, most of the scale items loaded as expected and their factor loadings were comparable to those obtained from the original study. However, there were four items that did not load onto the expected factor. For example, the item 'my child has a big appetite', loaded onto EF rather than on SR scale. This is because child with a 'big appetite' can imply their enjoyment of food no less than their Satiety Responsiveness (as specify in the original study (Wardle *et al*, 2001).

The other items, such as 'my child refuses new foods at first,' 'my child is difficult to please with meals,' and 'my child

decides that s/he doesn't like food, even without tasting it' did not load onto the expected factor FF, but did on the SR scale. This may be due to in Thailand, especially in urban areas with the middle to high-socioeconomic status, several parents provide their children variety of snacks. As a result, their children feel full and take less food on the main meals, regardless of what the main meals are.

Internal reliability

Internal reliability coefficients (Cronbach's alphas) for the different CEBQ subscales are shown in Table 2. The reliability coefficients ranged from 0.64 to 0.80. Almost all scales were within acceptable ranges (≥ 0.7), except for the subscales of 'slowness in eating' and 'emotional under eating,' with the coefficients of 0.64 and 0.69, respectively. The average corrected item-total correlation of the items to the scale indicated an adequate consistency of item content within the CEBQ subscales (0.45-0.59). In addition, all of these corrected item-total correlations were considered 'good' with correlation above 0.3.

Correlations between scales

Spearman Rank Correlation Coefficient, or Spearman's rho, between subscales of the CEBQ are shown in Table 3. The correlations indicated that the positive eating responsive scales (FR, EF, EOE, and DD) and the negative eating responsive scales (SR, SE, EUE, and FF) tend to be positively inter-correlated. For example, the positive eating responsive scales, FR was largely and positively correlated with EF (0.51); indicating that children who are more responsive to food cues also tend to enjoy their food. Likewise, the negative eating responsive scales, positive medium correlations were found between SR and SE (0.47), and SR and EUE (0.43), suggesting that children who are more satiety

Table 1
Factor loadings on the Varimax Rotated Solution of Principal Components Analyses
with all 35 items of CEBQ ($N=680$).

Scale name and items	Loading
Enjoyment of food (Factor 1; 9.6% variance)	
My child loves food	0.76
My child has a big appetite	0.46
My child finishes his/her meal very quickly	0.42
My child is interested in food	0.77
My child is always asking for food	0.49
My child enjoys eating	0.72
My child eats more when s/he is happy	0.53
Satiety responsiveness (Factor 2; 9.4% variance)	
My child refuses new foods at first	0.47
My child leaves food on his/her plate at the end of a meal	0.57
My child gets full before his/her meal is finished	0.69
My child is difficult to please with meals	0.62
My child gets full up easily has had a snack just before	0.72
My child decides that s/he doesn't like food, even without tasting it	0.59
If allowed to, my child would eat too much	0.63
Given the choice, my child would eat most of the time	0.65
My child looks forward to mealtimes	0.39
My child eats more when s/he has nothing else to do	0.56
Even if my child is full up, s/he finds room to eat his/her favorite food	0.62
If given the chance, my child would always have food in his/her mouth	0.68
Food fussiness (Factor 4; 6.5% variance)	
My child enjoys tasting new foods	0.77
My child enjoys a wide variety of foods	0.70
My child is interested in tasting food s/he hasn't tasted before	0.77
Emotional overeating (Factor 5; 6.1% variance)	
My child eats more when worried	0.77
My child eats more when annoyed	0.71
My child eats more when anxious	0.78
My child eats less when s/he is angry	0.73
My child eats less when s/he is tired	0.66
My child eats less when s/he is upset	0.68
Desire to drink (Factor 7; 5.5% variance)	
If giving the chance, my child would	0.83
If giving the chance, my child would always having a drink	0.82
My child eats slowly to finish a meal	0.73
My child eats more and more slowly	0.50

responsive also tend to eat slower and lesser under negative emotions.

Sex and education level differences

This study examined sex and educa-

tion level variations in children's eating behavior using the Mann-Whitney U test (Table 4). The results indicated that there were some significant differences regarding sex. Boys enjoyed food more than girls

Table 2
Internal reliability of the CEBQ in a school-aged Thai sample, 2012 (N=680).

CEBQ subscales	Cronbach's alpha	Average corrected item-total correlation
Enjoyment of food	0.80	0.53
Satiety responsiveness	0.76	0.48
Food responsiveness	0.76	0.51
Food fussiness	0.76	0.59
Emotional overeating	0.73	0.56
Emotional undereating	0.69	0.51
Desire to drink	0.72	0.55
Slowness in eating	0.64	0.45

Table 3
Relationship between the CEBQ subscales in a school-aged Thai sample, 2012 (N=680).

CEBQ scales	1 FR	2 EF	3 EOE	4 DD	5 SR	6 SE	7 EUE	8 FF
1 Food responsiveness (FR)	1							
2 Enjoyment of food (EF)	0.51 ^a	1						
3 Emotional overeating (EOE)	0.43 ^a	0.29 ^a	1					
4 Desire to drink (DD)	0.44 ^a	0.33 ^a	0.22 ^a	1				
5 Satiety responsiveness (SR)	0.16 ^a	-0.06	0.10	0.26 ^a	1			
6 Slowness in eating (SE)	0.14 ^a	-0.06	0.06	0.18 ^a	0.47 ^a	1		
7 Emotional undereating (EUE)	0.31 ^a	0.15 ^a	0.26 ^a	0.24 ^a	0.43 ^a	0.26 ^a	1	
8 Food fussiness (FF)	0.28 ^a	0.39 ^a	0.12	0.25 ^a	-0.05	0.08	0.14 ^a	1

^a $p < 0.001$.

(Median =3.1 vs 3.0; $U=51,630$; $p=0.017$). In addition, boys scored significantly higher on DD than girls (Median =2.7 vs 2.3; $U=52,468$; $p=0.039$). There were also some significant differences in education level. Children in Grade 1 were rated as being more satiety sensitive compared with children in Grade 4 (Median =2.7 vs 2.4; $U=44,778.5$; $p < 0.001$). Moreover, children in Grade 1 also ate more slowly than children in Grade 4 (Median = 2.5 vs 2.3; $U=47,834.0$; $p < 0.001$).

DISCUSSION

In this present study, we have evaluated the hypothesized 8-factors structure of the CEBQ in healthy Thai school-age children. The results have shown good psychometric properties of the Thai version of the CEBQ in terms of factor structure, internal reliability, and correlations between subscales corresponding to the original study in United Kingdom (Wardle *et al*, 2001). Factor analysis indicated that

Table 4
Median (Min-Max) of CEBQ subscale scores in a school-aged Thai sample, 2012 by sex and educational level (N=680).

CEBQ subscales	Gender		Educational level	
	Boys (n=352)	Girls (n=328)	Grade 1 (n=298)	Grade 4 (n=382)
Food responsiveness	1.8 (1.0-5.0)	1.7 (1.0-4.5)	1.8 (1.0-5.0)	1.8 (1.0-4.5)
Enjoyment of food	3.1 ^a (1.0-5.0)	3.0 ^a (1.1-5.0)	3.0 (1.1-5.0)	3.1 (1.0-5.0)
Emotional overeating	1.0 (1.0-4.3)	1.0 (1.0-4.0)	1.0 (1.0-4.3)	1.0 (1.0-4.3)
Desire to drink	2.7 ^a (1.0-5.0)	2.3 ^a (1.0-5.0)	2.7 (1.0-5.0)	2.3 (1.0-5.0)
Satiety responsiveness	2.6 (1.0-5.0)	2.6 (1.0-4.9)	2.7 ^b (1.0-5.0)	2.4 ^b (1.0-4.7)
Slowness in eating	2.3 (1.0-5.0)	2.3 (1.0-5.0)	2.5 ^b (1.0-5.0)	2.3 ^b (1.0-5.0)
Emotional undereating	2.0 (1.0-5.0)	2.0 (1.0-4.7)	2.0 (1.0-5.0)	2.0 (1.0-4.7)
Food fussiness	2.7 (1.0-5.0)	2.7 (1.0-5.0)	2.7 (1.0-5.0)	2.7 (1.0-5.0)

^aMedians significant at an alpha level of < 0.05.

^bMedians significant at an alpha level of < 0.001.

an eight-factor structure was the best solution for our sample.

We compared our results with previous studies on the CEBQ validation from the other countries. Most of the CEBQ validation studies in European countries, such as the Netherlands, Portugal, and Sweden had shown good psychometric properties that were similar to the original UK study (Sleddens *et al*, 2008; Viana *et al*, 2008; Svensson *et al*, 2011).

However, some studies done in non-European countries did not support the use of CEBQ as an eating behavior evaluation tool. Sparks and Radnitz (2012) reported that the 7-model of the CEBQ failed to replicate in a low-income, Hispanic/African American sample. This finding implies that the CEBQ might not be appropriate in the evaluation of eating behaviors in low-socioeconomic status sample. Cao *et al* (2012) tested the CEBQ in Chinese toddlers and concluded that, although the CEBQ was a valuable psychometric instrument, it may be affected by cultural differences.

However, a study in Australia did not find the culture effects on the use of the CEBQ. Mallan *et al* (2013) studied the CEBQ validation in three ethnically and culturally diverse samples of mothers in Australia. These include NOURISH, Indian, and Chinese samples. The results supported the cross-cultural utility of the CEBQ as a tool in the assessment of the young children residing in Australia. Similar with the Australian study, this present study supports the use of the CEBQ for Thai children.

We examined the differences in eating styles between boys and girls. The results suggested that there were significant differences in the 'food approach' subscale, but not for the 'food avoidant' subscale. Boys scored higher than girls in most of the food approach subscales, including EF and DD. In a cohort of 3,000 Australian children and adolescents, Abbott *et al* (2010) found that adolescent boys tend to underestimate their weight status more than girls did; whereas, adolescent girls

overestimated more than underestimated their weight status. Children's self-perception in body image was a strong influence on their eating style.

Ramos and Stein (2000) found that family is responsible for the development of children's behavior through social learning. Mothers attempt to control and impose restrictions on their daughters' diet and not on their sons' due to social pressure (women are supposed to be lean). It has been reported that boys and girls have different eating styles; however, it is not known at what age these differences start to develop. Previous research has tried to track the development trajectory of gender differences across the early years up to the point that girls and boys differentiate in their attitudes to body shape and changes in eating styles. Svensson *et al* (2011) found no differences in eating behaviors between the genders among Swedish preschool children. Sleddens *et al* (2008) reported significant gender difference in eating styles among early school-age Dutch children.

Boys scored higher in the FF and EOE than girls did, but girls scored higher in the EF than boys. Wardle *et al* (1992) reported the strong gender differences in eating styles and attitudes in relation to eating among British teenagers. This is often attributed to girls' concerns about their weight that lead to dietary restraint and thereby a difference in the emotional relationship with food and eating.

In terms of psychological development, Sigmund Freud has described middle childhood as 'the latency period.' This is the time when the psychodynamics of relationships with important others are characterized by the sublimation of sexual feelings into age-appropriate activities. They are typically involved in same-sex

relationships, and playgroups tend to include children of the same gender. In addition, children are increasingly interested in what it means to be 'male' or 'female,' as well as their gender role and identity (Hillman and Spigarelli, 2009; Rappley and Kallman, 2009). From the available information, we have hypothesized that the difference in eating styles between boys and girls might start to develop during early school-age period.

Our results have found a difference in the CEBQ subscales between Grade 1 and Grade 4 children. There were significant differences in the 'food avoidant' subscale but not for the 'food approach' subscale. Grade 1 children scored higher in the SR and SE subscales than did Grade 4 children. Similar to our results, the original UK study had found that the SR and SE subscales decreased with age (Wardle *et al*, 2001).

However, some studies have not demonstrated the age differences in eating style. Farrow and Blissett (2012) found support for the suggestion that children have general styles of eating and responses to food that begin as early as 2 years of age and remain stable between the ages of 2 and 5. These findings also support the test-retest reliability of the CEBQ as a measure of eating behavior across early childhood. Ashcroft *et al* (2008) has indicated that there are highly significant correlations for eating behaviors between 4 and 11 years, including SR, SE, FF, FR, EF, and EOE and EUE, indicating stability in these eating behaviors. The Dutch study in 6-7 year-old children did not find the age effects on the CEBQ subscale. This may be due to the narrow age range of the sample in this study (Sleddens *et al*, 2008).

This study has several limitations that should be acknowledged. First, the

sample population might not be a true national representative for all groups of Thai children. Our findings are limited to school-age children who lived in the urban areas and come from the middle to high-socioeconomic status families. Validation studies should be done in other groups of samples, such as, preschool children, adolescents, children living in rural areas, and those from low- socioeconomic status families. Second, we did not evaluate the relationships between mean item scale scores and Body Mass Index (BMI). Further research is necessary to explore relationship between the CEBQ score and obesity among Thai children.

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