Reliability and Validity Study of the Children's Eating Behavior Questionnaire in Chinese School-Age Children

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Summary Children’s Eating Behavior Questionnaire (CEBQ) was widely used in western countries to measure children’s eating behavior and played an important role in the research on the risk of childhood obesity, but it is rarely used in China yet. This study aimed to examine the Chinese version of CEBQ’s reliability and validity in a pilot study, then applied it to bigger population. Data was collected with CEBQ in two districts of Shanghai, respectively. Using stratified cluster sampling method, a total of 2,520 children were included in the study. The questionnaires were filled out by children’s parents. It was proved that the Cronbach’s coefficient α of the questionnaire was greater than 0.7, indicating that the questionnaire had good internal consistency. Aside from the subscales ‘Emotional undereating’ and ‘Food fussiness’, the Pearson’s correlation coefficients of the other subscales were all greater than 0.5. It showed that test-retest reliability of CEBQ was acceptable. We found that boys and girls had different eating behavior characteristics. And there was a graded association between eating behavior and nutritional status of school-age children. It suggested that appetite traits of school-age children could be used as indicators of susceptibility to weight gain. In conclusion, the Chinese version of CEBQ was of good reliability and validity, so it is considered as a reliable tool that can be applied to Chinese school-age children’s eating behavior and related studies.

Key Words reliability and validity, eating behavior, questionnaire, school-age children

Obesity has become a global public health problem that threatens children’s health (1). At present, about 16% of school-age children in China are overweight or obese, and the rise of overweight and obesity in children will increase the incidence of chronic non-communicable diseases such as hypertension, diabetes and dyslipidemia throughout the life cycle (2). There is growing evidence that obese children mature into obese adults easier, while thinner children tend to stay as thinner adults (3, 4).

Adiposity would ‘track’ across the life course, so it is vital to prevent overweight and obesity in childhood. Childhood obesity has been affected by many factors such as gene (5), family environment (6), early feeding (7), diet (8), physical activity (9), psychology (10) and so on. One of the most important factors is eating behavior, proved in experimental laboratory studies (11).

Bad eating habits are common among young children. Differences in individual appetite characteristics may determine how children regulate their food intake, which is closely related to their later growth and development (12). Besides, emotion is thought to have significant influences on food intake. And speed of eating is indicated as an important factor for adiposity development. Higher eating speed could implicate lower responsiveness to internal signals of satiety that is more common in obese children (13).

The Children’s Eating Behavior Questionnaire (CEBQ) is a psychometric measure of behavioral traits about eating. It is cheap and convenient to conduct on a large scale and is widely used in western countries (14–17). Recently, the questionnaire has been adopted in South America (18), Asia (19) and other countries, which have been validated with high reliability and validity. CEBQ had also been used in a Chinese research, but its subjects were children aged 12–18 mo and only 19 items of the questionnaire were valid in that study (20).

Some studies have found that children’s eating behavior may still be changing at the age of 1–6 (21). Therefore, this study was based on the hypothesis that the eating behavior of school-age children has been stabilized. The present study aimed to test the reliability and validity of the questionnaire, and apply it to a specific group of school-age children to explore the relationship between their eating behavior and weight gain.

MATERIALS AND METHODS

Study design and participants. The reliability and validity test of Chinese version of CEBQ were finished by school-age children from grade one to grade five of an elementary school in Songjiang District, Shanghai, China in 2010. In the pilot study, two classes were selected for each grade, with a total of 396 students. Two weeks later, 184 of them completed the retest survey. After that, using stratified cluster sampling method, CEBQ was applied to 1,030 and 1,490 children aged 7
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**Measures.** CEBQ is a parental-report instrument, designed by Jane Wardle (22), consisting of eight subscales for a total of thirty-five questions. The items are rated on a Five-point Likert scale, from 1–5 (1=Never, 2=Rarely, 3=Sometimes, 4=Often, 5=Always). The questionnaire was developed to measure four 'food-approach' dimensions (Food responsiveness, Emotional overeating, Enjoyment of food and Desire to drink), and four 'food-avoidant' dimensions (Satiety responsiveness, Slowness in eating, Emotional undereating and Food fussiness), related to children's growth and development. The CEBQ was translated into Chinese and confirmed by three experts in the field of nutrition who were Chinese speakers and fluent speakers of the English language. Subscale scores were obtained by calculating the mean of the items.

**Basic information.** Such as children's gender, date of birth, height and weight (which were measured by their parents in accordance with the written request), was also obtained from the questionnaire. Body mass index (BMI) was calculated by dividing weight (unit: kilogram) by the square of height (unit: meter), used to categorize participants into underweight, healthy weight, overweight and obese groups later. According to specific criteria in China, including screening for overweight and obesity among school-age children and adolescents (WS/T 586-2018) and screening standard for malnutrition of school-age children and adolescents (WS/T 456-2014).

**Statistical analysis.** Internal consistency was evaluated by Cronbach’s coefficient α. Test-retest reliability was assessed using Pearson’s correlation coefficient. Score differences of subscales between boys and girls were tested by the independent t-test. One-way ANOVA was used to measure the difference in subscale scores between different body weight groups. The study used Epidata to enter the questionnaires and Microsoft Excel to create the database. All analyses were carried out using SPSS v25.0 (SPSS Inc., Chicago, IL, USA).

**RESULT**

**Reliability and validity.**

Mean scores and Cronbach’s coefficient α were calculated from 369 parents for each CEBQ subscale. Internal consistency explained by the Cronbach’s coefficient α ranged from 0.49 for ‘Food fussiness’ to 0.82 for ‘Slowness in eating’ (Table 1). The overall Cronbach’s coefficient α of the questionnaire was 0.74, indicating high internal consistency of the questionnaire.

**Table 1. Internal reliability of CEBQ (n=396).**

| Scale                     | Mean (SD) | Cronbach’s coefficient α |
|---------------------------|-----------|--------------------------|
| Food responsiveness      | 2.50 (0.82) | 0.77                     |
| Emotional overeating      | 1.92 (0.61) | 0.57                     |
| Enjoyment of food         | 3.09 (0.70) | 0.66                     |
| Desire to drink           | 2.72 (0.81) | 0.67                     |
| Satiety responsiveness    | 2.71 (0.69) | 0.62                     |
| Slowness in eating        | 2.68 (0.98) | 0.82                     |
| Emotional undereating     | 2.80 (0.83) | 0.66                     |
| Food fussiness            | 2.82 (0.63) | 0.49                     |

Complete data were available for 2,520 school-age children (Sample 1: n=1,030; Sample 2: n=1,490) and they were described in Table 3. In sample 1, 47.4% were girls (n=488), while in sample 2, 45.7% were girls (n= 681). The average age of the overall sample was 8.93 years old. Overall, the prevalence of overweight was 13.5%.
and of obesity rate 14.8%, hence the combined prevalence of overweight and obesity rate was 28.3%. Obesity among boys was significantly higher compared to among girls (33.5% vs. 22.3%, \( p < 0.05 \)).

**Gender difference**

In ‘food-approach’ dimensions, boys’ average subscale scores were higher than that of girls. Both boys and girls scored more than three points on ‘Enjoyment of food’ scale in particular. Conversely, boys’ average scores of ‘Satiety responsiveness’ and ‘Slowness in eating’ in ‘food-avoidant’ dimensions were lower than girls’ scores. Differences were more pronounced in Sample 1, namely Songjiang District (Table 4).

**Weight categories difference**

Differences between weight categories of school-age children in two samples were described in Fig. 1. For subscales of ‘food-approach’ dimensions, except for ‘Desire to drink’ scale, significant higher scores were found in obese group compared with underweight group. On the contrary, underweight subjects scored significantly higher on the subscales of ‘food-avoidant’ dimensions than the overweight and obese subjects. Children in obese group had higher scores in the ‘Desire to drink’ subscale than healthy weight group obviously. And underweight children got high points easily in the ‘Emotional undereating’ and ‘Food fussiness’ scales.

**DISCUSSION**

The prevalence of childhood obesity in some urban areas of China has been already reached a similar level of the developed countries (23). The overweight and obesity rate of school-age children in Shanghai has exceeded 27.8%. It is imperative to use a better tool like CEBQ, a parent-report questionnaire that has been frequently used abroad (24), to screen Chinese childhood obesity. To authors’ knowledge, this was the first time the validity of full Chinese version of CEBQ was tested in school-age children. And this was the first applied study that had a relatively large sample size to find out the relationship between children’s eating behavior traits and nutritional status.

On the whole, school-age children were interested in eating. But we found that boys and girls had distinctly different eating behavior characteristics. Boys’ feeding behavior was more susceptible to negative emotions. Boys had a stronger need for food and water than girls, and boys usually ate faster than girls, less likely to feel full. All of the above were potential factors that made boys are more likely to develop obesity than girls.

The above research results supported the idea that approach-related and avoidance-related appetitive traits were systematically (and oppositely) related to adiposity (25). In general, there was a graded association between eating behavior and nutritional status in school-age children. Compared to healthy weight children, overweight and obese children showed more sensitive to external food cues, less fussiness, lower responsiveness to internal satiety signals and faster speed of eating. Underweight children were just the opposite. Picky kids were inclined to eat less and slower leading to a slower weight gain. It suggested that early assessment of these appetitive traits could be a useful technique to find susceptibility to weight gain of school-age children.

Our group had used principal component analysis

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**Table 3. Sample characteristics.**

| Variable          | Overall sample \((n = 2,520)\) Mean (SD) | Sample 1 \((n = 1,030)\) Mean (SD) | Sample 2 \((n = 1,490)\) Mean (SD) |
|-------------------|------------------------------------------|-------------------------------------|-------------------------------------|
| Age (y)           | 8.93 (0.90)                              | 9.18 (0.89)                         | 8.76 (0.88)                         |
| Height (cm)       | 135.79 (8.34)                            | 136.30 (8.42)                       | 135.44 (8.26)                       |
| Weight (kg)       | 32.25 (9.07)                             | 32.11 (7.83)                        | 32.35 (9.84)                        |
| BMI (kg/m²)       | 17.36 (4.08)                             | 17.19 (3.50)                        | 17.47 (4.44)                        |

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**Table 4. Mean (SD) of CEBQ subscale scores by gender-group.**

| Scale                        | Sample 1 Boys \((n = 542)\) Mean (SD) | Sample 1 Girls \((n = 488)\) Mean (SD) | p-value | Sample 2 Boys \((n = 809)\) Mean (SD) | Sample 2 Girls \((n = 681)\) Mean (SD) | p-value |
|------------------------------|----------------------------------------|----------------------------------------|----------|----------------------------------------|----------------------------------------|----------|
| Food responsiveness         | 2.51 (0.76)                            | 2.43 (0.79)                            | 0.091    | 2.53 (0.75)                            | 2.49 (0.78)                            | 0.299    |
| Emotional overeating        | 2.00 (0.62)                            | 1.93 (0.63)                            | 0.075    | 2.24 (0.69)                            | 2.18 (0.69)                            | 0.124    |
| Enjoyment of food           | 3.21 (0.72)                            | 3.12 (0.71)                            | 0.037    | 3.34 (0.75)                            | 3.30 (0.73)                            | 0.386    |
| Desire to drink             | 2.72 (0.71)                            | 2.59 (0.77)                            | 0.005    | 2.62 (0.74)                            | 2.51 (0.71)                            | 0.003    |
| Satiety responsiveness      | 2.59 (0.68)                            | 2.71 (0.68)                            | 0.005    | 2.64 (0.62)                            | 2.68 (0.62)                            | 0.169    |
| Slowness in eating          | 2.57 (0.90)                            | 2.72 (0.87)                            | 0.007    | 2.77 (0.74)                            | 2.87 (0.72)                            | 0.005    |
| Emotional undereating       | 2.77 (0.76)                            | 2.78 (0.82)                            | 0.803    | 2.81 (0.72)                            | 2.77 (0.79)                            | 0.290    |
| Food fussiness              | 2.86 (0.68)                            | 2.81 (0.67)                            | 0.241    | 2.95 (0.60)                            | 2.96 (0.60)                            | 0.823    |
(PCA) to test the construct validity of CEBQ, and the questionnaire can be divided into two dimensions indeed corresponding to ‘food-approach’ and ‘food-avoidant’. But the ‘Enjoyment of food’ and ‘Emotional undereating’ subscales couldn’t be categorized explicitly in one dimension. In fact, some research did report that the factor structure of CEBQ still has been a matter of debate (26). So, we need to refine the correlations between items and do further revision of the questionnaire by adding or deleting questions to make it having better construct validity. Then we could use CEBQ to estimate children’s susceptibility to weight gain by subscale scores according to certain rules in the future.

Three main limitations of this study should be noted. First, the study used parental reporting to obtain the height and weight of school-age children. This method facilitated the collection of data and was applied to various studies (27, 28), but parents may overestimate the children’s relevant indicators compared with direct measurement. And the number of survey sites was not enough, resulting in that the sample population might not be representative for the whole Chinese school-age children. Futhermore, confounding factors were not considered in the comparison between groups.

Despite the limitations of the survey, Chinese version of CEBQ had good reliability and validity, so it is considered as a reliable tool that can be applied to study deeper relationship between school-age children’s eating behavior and nutritional status. At the same time, it can be used to find school-age children who may be overweight and obesity as early as possible. As such, timely intervention to reduce the rate of overweight and obesity among school-age children in China can be initiated.

Disclosure of state of COI

No conflicts of interest to be declared.

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