Reliability and Validity of the Korean Version of the General-Food Craving Questionnaire-Trait for Children

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Objective The General-Food Craving Questionnaire-Trait (G-FCQ-T) is a validated, assessment scale for food craving. The aim of this study was to measure its reliability and validity for Korean children.

Methods A total of 172 children (94 boys and 78 girls) were selected to fill out a set of questionnaires, including the G-FCQ-T, the Children’s version of the Dutch Eating Behavior Questionnaire (DEBQ-C), and the Three-Factor Eating Questionnaire (TFEQ) in the Korean language.

Results The internal consistency (Cronbach’s alpha=0.933) and test-retest reliability (r=0.653) were satisfactory. The G-FCQ-T showed a significantly positive correlation with the DEBQ-C (r=0.560) and the TFEQ (r=0.397). The optimum cutoff score of the G-FCQ-T set by Receiver Operating Characteristics analysis was 51, with sensitivity and specificity of 0.833 and 0.825, respectively, for children.

Conclusion The G-FCQ-T showed good reliability and validity for assessing food craving for children and could become a practical instrument in clinical and research settings.

INTRODUCTION

“Craving” represents a strong motivational state and is defined in the dictionary as an intense desire or longing. In a similar vein, food craving is most often deemed as an intense urge to eat a certain food that is hard to stand up. Food craving is a matter of general experience among people and the prevalence of food craving ranges from 52% to 97% in previous reports.

Several studies reported that food craving has been linked to future food consumption and a previous study demonstrated that high food cravers had stronger automatic approach inclinations for food compared to low food cravers. Furthermore, food craving is related to body weight and may be clinically associated with obesity. In obese people, it has been linked to the body mass index (BMI), the number of lifetime weight loss attempts, and the frequency of dropouts from obesity treatments. That is, obese or overweight adults show more food craving than normal or underweight adults do.

Obesity in childhood is associated with adverse health consequences such as glucose intolerance and hyperlipidemia and predicts adult obesity. Although, it is still not well known whether food craving differs depending on age, a previous neuroimaging study reported that adolescents showed increased ventral striatum activation in response to food compared with adults. The ventral striatum is a part of the brain reward system and a few studies have indicated that heightened activity in this area was associated with the craving process. Another study also showed that children experience stronger craving, greater striatal recruitment, less prefrontal activity, and less frontal lobe activation than adults during food craving.

Key Words Craving, Scale, Validation studies.
otstriatal coupling than adults. These findings imply that targeting subjective craving responses to food may be an important treatment element for subsequent weight gain and obesity.

However, people vary in the frequency, intensity, and types of food craving, so it is difficult to understand what exactly a food craving is. In the current conceptualization, food craving is assumed to be a complex phenomenon as it includes physiological, cognitive, emotional, and behavioral factors.

The most frequently used tools for assessing food craving are the Food Craving Questionnaires (FCQ). A trait of food craving that is consistent and long lasting characteristics across times and situations can be evaluated FCQ-Trait (FCQ-T). The FCQ-T is a self-report questionnaire, that was developed from above-mentioned viewpoint of the multidimensionality of food craving, and is sensitive to weight-loss treatment changes in obese individuals. The FCQ-T was later modified to measure a general index of trait food craving (General FCQ-T, G-FCQ-T) instead of a specific food craving.

As previously mentioned, childhood is a sensitive period for the acquisition of obesity. To assess food craving in children could be useful for the investigation of the characteristics of children’s general food consumption and cravings compared to adults and may be helpful to predict susceptibility to obesity including further adult obesity and weight-loss treatment success. There are a few instruments, such as the Children’s version of the Dutch Eating Behavior Questionnaire (DEBQ-C) to measure children’s eating styles that may contribute to or attenuate the development of overweight status. Nonetheless, to our knowledge, there is no instrument to evaluate children’s eating behavior targeted especially at food craving. Therefore, the purposes of the present study were to evaluate the G-FCQ-T’s reliability and validity for children while maintaining its basic structure.

METHODS

Study design and setting

This was a cross-sectional study of 5th grade students from an elementary school in Chung-ju city in South Korea. These students were approached from April 2015 to May 2015. Participants were 172 children (94 boys and 78 girls) with a mean age of 10.3 years (SD=0.5). This study was approved by the Institutional Review Board of Seoul St. Mary’s Hospital (IRB number: KIRB-00512-21-003).

Procedure

Stage 1

The authors acquired the English version of the G-FCQ-T from Nijs et al. with permission. The G-FCQ-T scales were translated into Korean by two bilingual language psychiatrists, and modified to be adapted to young students, employing understandable sentences. Then a back translation was carried out by a third bilingual psychiatrist and the back-translated version was reviewed.

Stage 2

Each student and parent received an explanation of the purpose of the study. Parental consent was obtained for all participants. The students were administered the following questionnaires: the G-FCQ-T (1st G-FCQ-T), DEBQ-C, and Three-Factor Eating Questionnaire (TFEQ). The questionnaires were given under the supervision of a researcher and a teacher at the school. The researcher helped with reading if necessary.

In addition, weight and height were measured and BMI was calculated. To determine whether a student was underweight (BMI <5th percentile), normal weight (5th–84th percentile), overweight (85th–94th percentile), or obese (BMI ≥95th percentile), we used international cut-off scores.

Stage 3

A month after completing the first set of questionnaires (1st G-FCQ-T, DEBQ-C, and TFEQ), the 172 students were requested to complete the G-FCQ-T (2nd G-FCQ-T) scale for a second time.

Instruments

G-FCQ-T

The G-FCQ-T was developed to assess a general urge to eat and measures characteristics of food craving as a trait. The G-FCQ-T is a self-report scale with 21 items and each question has a 6-point Likert scale ranging from 1 to 6 (1=never to 6=always). The higher the total score is, the greater the degree of food craving. The scale contains four subdomains: 1) preoccupation with food, to assess obsessive thinking about food or eating (6 items), 2) loss of control, which is difficulty stopping eating when exposed to food cues (6 items), 3) positive outcome expectancy, to assess the extent of the expectation that eating will provide positive or negative reinforcement (5 items), and 4) emotional craving for food when experiencing negative emotions (4 items). The G-FCQ-T has demonstrated acceptable internal consistency with a Cronbach’s α coefficient of 0.90 and construct validity in previous work.

DEBQ-C

The DEBQ-C is a 20-item measure of three types of eating behavior for children, namely emotional (7-items), external (6-items), and restrained eating (7-items). Items in the emotional eating subscale assess the proneness to overeat in response
to negative emotional states. Items in the external eating subscale assess the proneness to overeat in response to food-related cues. Additionally, items in the restrained eating subscale assess the proneness to restrict food for weight control. The DEBQ-C allows three-choice responses of no (1), sometimes (2), or yes (3). In samples of 7- to 12-year-olds, Cronbach’s alpha ranged from 0.73 to 0.82. In this study’s sample, Cronbach’s alpha was 0.862, 0.945, 0.828, and 0.886 for total DEBQ-C, emotional, external, and restrained eating, respectively.

TFEQ
This scale is for prediction of eating behaviors. The TFEQ is made up 3 factors that assess a person’s attitude toward eating. 1) Cognitive restraints of eating (21-items) reflects the tendency of some persons to cognitively control eating behavior and behaviorally restrain food intake in order to regulate their body weight. 2) Disinhibition of eating control (16-items) refers to personal differences in loss of inhibition of eating. 3) Susceptibility to hunger (14-items) reflects the subjective feeling of hunger and its behavioral consequences. The Cronbach’s alpha was 0.820. In the current study, Cronbach’s alpha was 0.809 for the total score and ranged from 0.621 to 0.803 for the subscales.

Statistical analysis
All analyses were conducted using the Statistical Package for the Social Sciences version 21.0 (IBM Corp., Armonk, NY, USA).

The internal consistencies of the G-FCQ-T and its subscales were evaluated by measuring Cronbach’s alpha coefficients. The test-retest reliability was assessed by means of Pearson correlation coefficient.

Pearson’s correlation was used to investigate the construct validity of the G-FCQ-T by examining relationships with the DEBQ-C and TFEQ. The sensitivity, specificity, and area under the curve (AUC) were calculated and to find optimal cutoff points to predict high food cravers, receiver operating characteristic (ROC) analysis was applied to all participants dependent on the sum of emotional and external eating scales of DEBQ-C at the mean+2SD (standard deviation).

Exploratory principal component analysis with varimax rotation was performed on the G-FCQ-T.

RESULTS

Demographics and clinical characteristics (Table 1)
The percentage of people with 1) underweight, 2) normal weight, 3) overweight, and 4) obesity was 5.3, 64.9, 14.0, and 15.8%, respectively. No difference was seen in the BMI distribution between males and females. The mean total score of the 1st G-FCQ-T, DEBQ-C, TFEQ, and 2nd G-FCQ-T was 38.7, 31.2, 13.1, and 37.8, respectively. There were no gender differences in total or subdomain scores of 1st G-FCQ-T, DEBQ-C, TFEQ, and 2nd G-FCQ-T except for subscale scores of TFEQ cognitive control (12.9±3.7 in male, 14.0±4.3 in female, p<0.05) (data not shown). Only the DEBQ-C total (a, b<d) and DEBQ-C restrained eating subscale (a, b<c, d), TFEQ total (a, b<d), TFEQ cognitive restraints subscale (a, b<d), and TFEQ disinhibition subscale (b<d) scores showed significant differences between the BMI groups in the total or subdomain scores of the 1st G-FCQ-T, DEBQ-C, TFEQ, and 2nd G-FCQ-T (not shown).

Internal consistency and test-retest reliability
(Table 2, Figure 1)
In 172 participants, the Cronbach’s α coefficient was 0.933

Table 1. Characteristics of the study population (N=172)

| Variables          | Mean (SD) | N (%) |
|--------------------|-----------|-------|
| Age (years)        | 10.3 (0.5)|       |
| Gender             |           |       |
| Male               | 94 (54.7) |       |
| Female             | 78 (45.3) |       |
| BMI                | 19.8 (4.3)|       |
| Underweight (a)    | 9 (5.3)   |       |
| Normal weight (b)  | 111 (64.9)|       |
| Overweight (c)     | 24 (14.0) |       |
| Obesity (d)        | 27 (15.8) |       |
| 1st G-FCQ-T        | 38.7 (16.5)|     |
| Preoccupation with food | 9.4 (4.6)|     |
| Loss of control    | 11.3 (5.5)|     |
| Positive outcome expectancy | 11.4 (5.6)|     |
| Emotional craving  | 6.1 (3.0) |       |
| DEBQ-C             | 31.2 (6.7)|     |
| Emotional eating   | 8.5 (2.8) |       |
| External eating    | 9.3 (3.0) |       |
| Restrained eating  | 13.4 (4.0)|     |
| TFEQ               | 13.1 (5.6)|     |
| Cognitive restraints | 6.8 (3.7)|     |
| Disinhibition      | 3.9 (1.7) |       |
| Susceptibility to Hunger | 2.4 (2.4)|     |
| 2nd G-FCQ-T        | 37.8 (15.3)|     |
| Preoccupation with food | 9.1 (3.7)|     |
| Loss of control    | 11.2 (5.4)|     |
| Positive outcome expectancy | 10.8 (5.3)|     |
| Emotional craving  | 6.3 (3.0) |       |

G-FCQ-T: General-Food Craving Questionnaire-Trait, DEBQ-C: Children’s version of the Dutch Eating Behavior Questionnaire, TFEQ: Three-Factor Eating Questionnaire
for G-FCQ-T. The single item-total correlation coefficients ranged from 0.54 to 0.74 (Table 2). The test-retest reliability was measured after a 1-month interval. Cronbach’s α after a 1-month interval was 0.925. The correlation coefficient of the G-FCQ-T total scores in the 2 trials was 0.653 and showed good test-retest reliability (p<0.001) (Figure 1).

**Construct validity (Table 3)**

To assess construct validity, we compared the G-FCQ-T with the DEBQ-C and TFEQ. The correlation coefficients were 0.560 (p<0.01) and 0.397 (p<0.01) for G-FCQ-T total score with DEBQ-C and TFEQ total score, respectively. There were more considerable correlations between G-FCQ-T and DEBQ-C scores than between G-FCQ-T and TFEQ scores. The G-FCQ-T total and all 4 subdomain scores were related to the DEBQ-C emotional eating and external eating subscale scores, but no significant correlation between the G-FCQ-T and DEBQ-C restrained eating subscale was found. Further, G-FCQ-T scores were also related to the TFEQ disinhibition and susceptibility to hunger subscales, but no significant correlation between the G-FCQ-T and TFEQ cognitive restraint subscale was found. In addition, the strongest correlations were shown between the DEBQ-C emotional eating and G-FCQ-T emotional craving subscale, and between the DEBQ-C external eating and G-FCQ-T loss of control subscale.

**Table 2. Corrected item-total correlations and Cronbach’s alpha if item was deleted for the G-FCQ-T**

| Item | Scale mean if item deleted | Scale variance if item deleted | Corrected item-total correlation | Cronbach’s alpha if item deleted |
|------|---------------------------|-------------------------------|----------------------------------|---------------------------------|
| 1    | 36.72                     | 246.343                       | 0.660                            | 0.928                           |
| 2    | 36.81                     | 245.568                       | 0.627                            | 0.929                           |
| 3    | 36.64                     | 243.764                       | 0.621                            | 0.929                           |
| 4    | 36.61                     | 246.953                       | 0.575                            | 0.930                           |
| 5    | 37.10                     | 247.591                       | 0.719                            | 0.928                           |
| 6    | 36.78                     | 243.998                       | 0.690                            | 0.928                           |
| 7    | 37.17                     | 254.928                       | 0.535                            | 0.931                           |
| 8    | 37.07                     | 248.276                       | 0.705                            | 0.932                           |
| 9    | 36.72                     | 244.495                       | 0.623                            | 0.929                           |
| 10   | 37.34                     | 257.958                       | 0.542                            | 0.931                           |
| 11   | 37.30                     | 254.107                       | 0.687                            | 0.929                           |
| 12   | 37.40                     | 258.019                       | 0.605                            | 0.930                           |
| 13   | 37.29                     | 251.435                       | 0.687                            | 0.928                           |
| 14   | 36.94                     | 249.125                       | 0.584                            | 0.930                           |
| 15   | 36.63                     | 243.136                       | 0.618                            | 0.929                           |
| 16   | 35.95                     | 243.301                       | 0.548                            | 0.932                           |
| 17   | 36.04                     | 238.940                       | 0.578                            | 0.931                           |
| 18   | 36.66                     | 243.116                       | 0.637                            | 0.929                           |
| 19   | 37.22                     | 253.354                       | 0.600                            | 0.930                           |
| 20   | 37.31                     | 256.252                       | 0.611                            | 0.930                           |
| 21   | 37.17                     | 250.644                       | 0.736                            | 0.928                           |

G-FCQ-T: General-Food Craving Questionnaire-Trait
ROC analysis (Table 4, Figure 2)

ROC analysis was applied to predict food craving. Sensitivity and specificity were calculated for G-FCQ-T scores relative to the sum of emotional and external eating scales of DEBQ-C at the mean+2SD. The DEBQ-C was constructed using children18 and previous studies demonstrated that food cravers had significantly elevated external eating and emotional eating subscale scores on the DEBQ.22,23 The AUC value was 0.917 (0.856–0.978), the cut-off value was 51, sensitivity value was 0.833, and specificity value was 0.825. Applying the given cut-off point in the present sample, food cravers accounted for about 20% of the sample (n=34).

Exploratory factor analysis (Table 5)

The Kaiser-Meyer-Olkin measure showed a value of 0.909 and Bartlett’s test of sphericity was significant (p<0.001). The principal-components factor analysis on the items from the G-FCQ-T for all 172 subjects revealed that there were four factors that explained 65.61% of the total variance. Factor I explained 45.63% of the variance (eigenvalue, 9.58) and was construed as loss of control. Factor II (eigenvalue, 1.68) loaded on preoccupation with food. Factor III (eigenvalue, 1.48) loaded on positive outcome expectancy. Factor IV (eigenvalue, 1.04) loaded on negative emotional craving. However, question (Q) number 3 (Q3), Q8, and Q9 were classified in preoccupation with food, Q6 in positive outcome expectancy, and Q16 in negative emotional craving in the original version.

DISCUSSION

The current results suggest that the G-FCQ-T is a valid and reliable instrument for measuring food craving for children. The internal consistency and test-retest reliability were satis-
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Table 5. Exploratory factor analysis of the G-FCQ-T

| Question                                                                 | Factor I | Factor II | Factor III | Factor IV |
|-------------------------------------------------------------------------|----------|-----------|------------|-----------|
| 1. If I eat what I'm craving, I often lose control and eat too much     | 0.806    | 0.148     | 0.153      | 0.201     |
| 2. When I crave something, I know I won't be able to stop eating once I start | 0.705    | 0.217     | 0.275      | -0.010    |
| 3. Food cravings always make me think of ways to get what I want to eat | 0.672    | 0.248     | 0.163      | 0.169     |
| 4. If I get what I'm craving I cannot stop myself from eating it        | 0.666    | 0.015     | 0.131      | 0.442     |
| 5. Once I start eating, I have trouble stopping                        | 0.603    | 0.348     | 0.383      | 0.058     |
| 6. Sometimes, eating makes things seem just perfect                     | 0.556    | 0.182     | 0.354      | 0.358     |
| 7. When I am with someone who is overeating, I usually overeat too     | 0.552    | 0.458     | 0.093      | -0.053    |
| 8. I find myself absorbed in food                                       | 0.539    | 0.447     | 0.238      | 0.254     |
| 9. Whenever I go to a buffet I end up eating more than what I needed    | 0.457    | 0.257     | 0.444      | 0.081     |
| 10. I spend a lot of time thinking about whatever it is I will eat next  | 0.096    | 0.763     | 0.136      | 0.260     |
| 11. I can't stop thinking about eating no matter how hard I try         | 0.228    | 0.755     | 0.258      | 0.268     |
| 12. If I am craving something, thoughts of eating it consume me         | 0.285    | 0.748     | 0.160      | 0.088     |
| 13. I feel like I have food on my mind all the time                     | 0.370    | 0.722     | 0.211      | 0.139     |
| 14. I feel less anxious after I eat                                    | 0.037    | 0.217     | 0.780      | 0.208     |
| 15. When I eat food, I feel comforted                                   | 0.148    | 0.200     | 0.777      | 0.208     |
| 16. Eating what I crave makes me feel better                           | 0.219    | -0.015    | 0.708      | 0.249     |
| 17. When I eat what I crave, I feel great                              | 0.289    | 0.211     | 0.685      | -0.074    |
| 18. My feelings often make me want to eat                              | 0.328    | 0.178     | 0.650      | 0.110     |
| 19. When I’m stressed out, I crave food                                | 0.257    | 0.251     | 0.195      | 0.801     |
| 20. I crave foods when I'm upset                                       | 0.116    | 0.528     | 0.185      | 0.702     |
| 21. I crave foods when I feel bored, angry or sad                      | 0.254    | 0.493     | 0.398      | 0.503     |

Rotation method: Varimax with Kaiser Normalization. Highest loadings, on the basis of which items are allocated to a factor, are printed in bold. G-FCQ-T: General-Food Craving Questionnaire-Trait

The results of comparing the G-FCQ-T with DEBQ-C or TFEQ also showed good validity and significant positive correlations between the G-FCQ-T and DEBQ-C or TFEQ scores. The optimum cutoff score of G-FCQ-T set by ROC analysis was 51 in children.

Consistent with our results, previous studies with young adults showed high internal consistency (Cronbach’s alpha=0.875–0.90) and two- or three-week test-retest reliability (r=0.79–0.850) for the G-FCQ-T. Additionally, they showed significant positive correlations between the G-FCQ-T and adult version of the DEBQ (r=0.23–0.492) or TFEQ (r=0.435). These results implied that the G-FCQ-T has good psychometric properties for the assessment of food craving both in children and adults.

Furthermore, the present study also demonstrated the associations between the G-FCQ-T and DEBQ-C or TFEQ subscales. Significant positive correlations were shown between the G-FCQ-T scales and DEBQ-C emotional or external eating, and between the G-FCQ-T scales and the TFEQ disinhibition or susceptibility to hunger subscales. These subscales reflect a tendency toward disinhibited eating occurrence along with food exposure, negative feelings, or subjective feelings of hunger. Although the DEBQ-C and TFEQ are measurements to assess not food craving but eating behavior, previous studies have shown associations between external, emotional eating, disinhibition, and susceptibility to hunger with strength and frequency of food craving similar to our results. That is the reason why the present authors deemed participants with scores exceeding the mean plus two standard deviations of the sum scores on the DEBQ-C emotional and external eating to be eligible for the group of high food cravers in the ROC analysis.

We only used the DEBQ-C scores as a standard as it is a children-adapted scale, rather than the TFEQ ones. The cutoff score of the G-FCQ-T in the present study (a total score of 51) is a stricter criterion than that of another study that used scoring in the upper third (about a total score of 40 in the present study) to predict food craving.

According to exploratory factor analysis, the G-FCQ-T had a four-factor structure; the present authors interpreted the four factors as indicative of preoccupation with food and...
loss of control (Q 3, 5, and 17). These factors contain a mixture of questions on uncontrolled eating behavior, connected with thoughts or preoccupation with food. The reason for failure to replicate these two factors may be related to age differences of the participants. The original version of G-FCQ-T was developed in a sample of college students. An earlier study reported that thoughts preoccupied with food or craving and uncontrolled food consumption are tightly coupled in childhood but become less so with age. This finding implies that the link between preoccupation with food and lack of control over eating in children can be attributed to this mixed result in scale construction. In the case of Q6 and Q16 of the G-FCQ-T in our sample, the translation of these items might have underrepresented the meaning of positive outcome expectancy or negative emotion influence food craving, and this may also have affected the scale construction. Therefore, further validation work in larger and independent samples of children is required.

Past research indicates that gender differences may be present in the characteristics of food craving, such as prevalence, affective state, or food selection during food craving. Compared to men, women were more likely to experience food craving and reported more emotional eating, and these differences were assumed to be related to hormonal differences. In addition, another study showed a significant positive relationship between BMI and food craving and food-craving responses to food stimuli were related to measures of insulin resistance and thalamic brain activation in individuals with obesity compared to those of normal weight. In contrast to earlier findings, however, the results of the present study showed no differences in food craving between gender and BMI groups. These inconsistencies may be due to the ages of participants, since in our study, all participants were children, including premenarcheal girls.

This study has the following limitations. First, participants were limited to 5th grade elementary school students from one school of a specific region. Prior studies have noted developmental comfort food preferences and developmental changes in functional brain responses to images of foods. Second, we did not screen for psychiatric disorders especially eating disorders, or assess which phase of the menstrual cycle the female students were in. Several reports have shown that food craving was followed by binge eating, one of the features of eating disorders, and that menstrual cycle effects on eating occur independently. Therefore, the results need to be replicated in samples with various age groups, particularly adolescents, and in individuals with eating disorders. Third, the G-FCQ-T was developed in a sample of university students, not children. Although the present authors tried to modify the scale to adapt it to young students, and used the children’s version of the DEBQ to evaluate construct validity, the original version of the G-FCQ-T was validated with young adults. Fourth, the DEBQ-C and TFEQ were not validated among Korean children or adolescents. However, the DEBQ-C and TFEQ were validated among 473 Spanish children aged 10 to 14 years and 769 Dutch children aged 7 to 12 years, and among 192 Spanish children aged 8.8 to 16.8 years, respectively. Fifth, DEBQ-C scores, instead of a clinical diagnosis of food craving, were used in the ROC analysis because of the difficulty of confirming craving and lack of consensus about the definition of craving. Nevertheless, a cutoff point was obtained by applying relatively strict criteria, and this point may be useful to inform preliminary research and prompt decision to assess food craving. Sixth, we examined the test-retest reliability by performing the retest after a 1-month interval. Even though the time between the test and re-test in the present study was longer than that used in previous studies, we could not exclude the attribution of the learning effect by the participants. A faster learning rate has been reported when the retest time interval decreases. Therefore, longer test-retest intervals could reflect better test-retest reliability.

In spite of these limitations, this study suggests that the G-FCQ-T has satisfactory psychometric properties in children. That is, the G-FCQ-T is a reliable and valid tool for assessing craving in children in Korea. Furthermore, this study also provided a cutoff score, which may assist clinicians in screening for high food cravers in children. When considering that childhood is a sensitive period for the acquisition of obesity and the association between food craving and obesity, this scale and cutoff point will provide new insights to approach the management of and predict susceptibility to overeating and obesity in children. More research is required to evaluate the G-FCQ-T, including confirmatory factor analysis and studies applying to a wide range of age groups.

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