**Original Article**

# Psychometric Properties of the Persian Version of Adult Eating Behavior Questionnaire in Patients with Epilepsy

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**What's Known**

- The eating behaviors of adults stems from an unhealthy lifestyle.
- Eating behaviors could influence treatment outcomes of adult people with epilepsy.

**What's New**

- Exploring eating behaviors need to be assessed with a valid and reliable instrument tailored for local cultures.
- The adult eating behavior questionnaire has an acceptable level of validity and reliability.

**Abstract**

**Background:** Adult eating behavior questionnaire (AEBQ) is an age upward extension tool that measures appetite traits in individuals. This instrument was developed by Hunot in 2016. The present study aimed to determine the psychometric properties of the Persian version of AEBQ in adults with epilepsy.

**Methods:** The current research is a cross-sectional study conducted in 2019 in Iran. 700 adults with epilepsy completed the 35-item AEBQ. Qualitative face validity, qualitative content and structure validity (exploratory factor analysis [EFA], N=400, and confirmatory factor analysis [CFA], N=300) appetitive traits were evaluated. Reliability was also measured using Cronbach's alpha, Construct reliability (CR), and Intra-Class Correlation (ICC). The SPSS 26-AMOS24 software was employed to analyze the data with a significance level of 0.05.

**Results:** The EFA and CFA results comprised eight factors, namely enjoyment of food, emotional over-eating, food responsiveness, hunger, satiety responsiveness, emotional under-eating, food fussiness, and eating slowly. Indices of root mean square error of approximation=0.068, parsimonious normed fit index=0.644, parsimonious comparative fit index=0.671, adjusted goodness of fit index=0.618, goodness of fit index=0.911, and Chi square degree-of-freedom ratio (normalized Chi square CMIN/DF=2.842) confirmed the fitness of the final model. Convergent and divergent validity was acceptable for all the factors. The results revealed that the internal stability>0.8 and CR>0.7 of the eight extracted AEBQ structures are confirmed. The ICC was 0.899 (95% CI: 0.878-0.917; P<0.001). The results also showed that AEBQ has acceptable convergent and divergent validity.

**Conclusion:** The eight-factor structure of AEBQ can measure eating behavior traits and is of good validity and reliability for assessing the eating behavior of Iranian adults with epilepsy.

## Introduction

Nutrition is believed to be a modifiable factor that affects the quality of life and independence of individuals, specifically adults. Diet choice is related to physiological or psychological and social changes at different ages.[1] The type of food consumed and dietary

patterns in adults are significantly associated with health status and several cardiovascular diseases, overweightness, obesity, and many other diseases.[2]

Overweightness and obesity are the most common problems in patients with epilepsy, whose prevalence in the Iranian adult population are 22.7% and 59.3%, respectively.[3] This is while the prevalence of epilepsy is 5%.[4] Numerous studies support the idea that obesity in patients with epilepsy (PWE ) is higher than the general population,[5, 6] and that PWEs have poorer health status and health-related behaviors than the general population. In addition, the problem is more prevalent among PWEs than other chronic diseases, such as migraine and diabetes.[5] The tendency to gain excess weight in patients with epilepsy is high due to decreased physical activity,[6] and the use of weight gain-facilitating drugs, such as valproate and pregabalin.[7]

On the other hand, undesirable eating habits, like decreased food intake, are common in patients with epilepsy.[8] Fear of weight gain and possible injuries during seizures due to weight gain or obesity, as well as cultural misconceptions about the effect of certain foods on the severity and frequency of seizures could lead to food deprivation in the patient. The fear of epilepsy-related stigma can lead to dietary negligence and protein-energy malnutrition.[9] In certain subcultures, belief in the relationship between consumption of certain foods and the number of seizures or the amount of saliva secretion during seizures (as a factor in transmitting the disease to others) has been considered a factor of food deprivation.[10] In another study, the cause of nutritional problems in children with epilepsy has been reported to be three meals a day with no whole grains.[11] Moreover, food taboos in some cultures, such as removing salty, spicy, sweet, oily, or boiled foods from the diet of a patient with epilepsy, are sometimes used for treating and controlling seizures.[12] In a study conducted in a developed country, the results showed that drug resistance in some children and the psychological consequences of the inability to control and manage the disease can reduce the patient's motivation to follow a diet and increase the risk of malnutrition in these people.[13] Bertoli and others noted the physical consequences of seizures, such as difficulty swallowing and chewing as factors in the malnutrition of patients with epilepsy. Since eating habits and behaviors are of great importance in the management of epilepsy,[14] it is necessary that patient care programs study the patient's eating habits as a predictor variable of

overweightness, obesity, and weight loss.[15] For this purpose, health service providers should be provided with appropriate tools with the socio-cultural atmosphere of that community.[4] Several eating behavior-related self-report tools have been validated in Iran, including the Eating Disorder Examination-Questionnaire (EDE-Q),[16] the Eating Attitudes Test-26 (EAT-26),[17] the Three-Factor Eating Questionnaire-R18 (TFEQ-R18),[18] the mindful eating questionnaire,[19] children's eating behavior questionnaire (CEBQ),[20] and Eating Behavior Pattern Questionnaire (EBPQ).[21] However, to provide a better picture of the relationship between appetite traits and weight, we could use an adult eating behavior questionnaire (AEBQ), while it allows longitudinally tracking appetite traits at different stages of life (from infancy, childhood, to adulthood). Knowing about AEBQ scores can also be conducive to providing more effective interventions to people in weight management programs by providing feedbacks on managing their appetite traits. It may also make it possible to identify people at risk for weight gain in order to develop and implement targeted obesity prevention efforts.[22] Therefore, to the best of our knowledge, the best uncomplicated and recommended tool to assess a set of traits associated with increased food intake, decreased food intake, and dietary variety is the AEBQ.[23] Since each questionnaire is affected by cultural context and the interpretation of the target group,[24] it is necessary to re-examine its psychometric properties in the new community and target group.

The validity and reliability of the AEBQ have been evaluated in various studies on the adult population.[22, 23, 25] Therefore, this study was conducted to determine the psychometric properties of AEBQ in the Iranian adults with epilepsy.

## Patients and Methods

### Study Design

The current study is a methodological research conducted as a cross-sectional study in 2019 in Iran. It is part of a research project entitled "Relationship between Disease-Related Fear and Apathy and Nutrition Status in Adults with Epilepsy: a Multiple-Center Study". The study environment included the Iranian Epilepsy Association and the neurology clinics of the hospitals affiliated with Iran University of Medical Sciences (Hazrat Rasoul and Firoozgar Hospitals) in Tehran and the offices of neurologists in Ramsar, Tonekabon, and Shahrekord.

### Ethical Considerations

The ethics committee of Babol University of Medical Sciences approved the study protocol (IR.MUBABOL.HRI.REC.1398.132). Participating in the study was voluntary for all the subjects. Written informed consent was obtained from the patients with epilepsy. The objectives were explained for each sample at the beginning of the study, and all of them were given the right to withdraw from the study at any time. They were all also assured that there will be no reference to their identification in reporting this research.

### Participants

The convenience sampling method was used in this work. Various guidelines for sample size adequacy are available in methodological studies. In one of them, based on the number of questions of the examined tools, 10 participants are selected for each item.[26] The inclusion criteria were epilepsy for at least one year, treatment with antiepileptic drugs for at least one year, and the age range of 18 to 74 years. The exclusion criteria included unwillingness to continue cooperation.

### Instrument

#### Adult Eating Behavior Questionnaire (AEBQ)

This instrument was developed by Hunot in 2016. The questionnaire consists of 35 items and is scored on a five-point Likert scale (strongly disagree=1, disagree=2, neither agree nor disagree=3, agree=4, strongly agree=5). The food approach includes the dimensions of enjoyment of food (EF), emotional overeating (EOE), food responsiveness (FR), and hunger (H). Food avoidance includes the dimensions of satiety responsiveness (SR), emotional under-eating (EUE), food fussiness (FF), and slowness in eating (SE).[22]

Since AEBQ was utilized for the first time in Iran for measuring the eating behaviors in adults with epilepsy, its psychometric properties were examined during the following steps:

First, permission was granted from the tool designer. Second, AEBQ was translated from English to Persian (forward translation). To this end, two fluent English translators were asked to independently translate the tool from English to Persian. They were asked to translate tool items conceptually, not word-for-word. The translators were selected in a way that one of them was familiar with the terms of medical sciences and nutrition, and the other one was not familiar with the terms of medical sciences. At this stage, two translations were obtained independently. Subsequently, the translations

were reviewed in two sessions under the supervision of a coordinator (responsible researcher), the research team, and the translators. Inappropriate phrases or concepts were identified and corrected in the translated version. Any differences between the original version and the translated versions were then investigated. The translations were combined in these sessions. This way, the original translated versions were compared, and the differences and contradictions between them were corrected. Finally, from the original translations, the final Persian version of the translation of the tool was obtained.

Third, the final version was translated from Persian into English backwardly. It was done independently by two fluent translators in both Persian and English. These translators did not participate in the previous steps. The returned copies were reviewed by the lead researcher, research team, and translators, and the discrepancies and differences were discussed in order to reach a consensus. Fourth, in the next step, a pre-test was performed. In the pre-test, 10 adults with epilepsy were interviewed by an experienced interviewer using the cognitive interview method. At this stage, each part of the tool was tested. The participants in the pre-test represented the target group for which the instrument was used (in terms of age range, gender, duration of epilepsy, number of seizures per month, antiepileptic drugs, level of education, and marital status). Each participant was asked what they thought each item measured, and if they had to repeat the sentences in their own language and words to understand the questions. Each participant was asked what comes to his/her mind when they heard a specific phrase from the questionnaire. They were also asked how they chose their answers. The research team then compared the answers given by the participants to such questions with the answer option they had marked on the questionnaire. This process was performed for each item. The respondents were asked about the words that did not make sense or those they found unacceptable and offensive. They were asked which word or phrase was the closest to their common language. Following the pre-test, the final version of the questionnaire was prepared.

### Construct Validity

In this study, the construct validity (CV) of AEBQ was assessed using exploratory factor analysis (EFA; N=400) and confirmatory factor analysis (CFA; N=300). The Kaiser-Meyer-Olkin test (KMO) was employed for sample adequacy, and Bartlett's Test of Sphericity was used for

sphericity. KMO values between 0.7 and 0.8 were assumed to be good, and values between 0.8 and 0.9 were excellent.[27] Afterward, the hidden factors were extracted using principal axis factoring (PAF), Varimax Rotation, and Scree plot. The presence of one item in the factor was determined based on the following formula:

$$Construct\ validity\ (CV) = 5/152 \div \sqrt{(n-2)}\ C$$

with an approximation of 3.

In this formula, CV is the number of extractable factors, and n is the sample size.[28]

The factors were extracted using first- and second-order CFAs (Maximum likelihood estimation) and based on the most common goodness of fit indices, including Chi square ($\chi^2$), Chi square degree of freedom ratio (normalized Chi square CMIN/DF), adjusted goodness of fit index (AGFI)>0.8, parsimonious comparative fit index (PCFI)>0.50, comparative fit index (CFI)>0.90, incremental fit index (IFI)>0.90, parsimonious normed fit index (PNFI)>0.50, and root mean square error of approximation (RMSEA)<0.05.[29]

In this study, pooled CFA second-order confirmatory factor analysis was utilized. Construct reliability was also investigated through the correlations between the structural factors and demographic and clinical variables. Depending on the type of dependent variable, Pearson correlation coefficient, pointbiserial, or polyserial correlations were used.

*Convergent and Divergent Validity*

Convergent and divergent validity of AEBQ structure was measured via Fornell and Larker approach using average variance extracted (AVE), maximum shared squared variance (MSV), and average shared squared variance (ASV). To establish convergent validity, AVE must be greater than 5.5, and to confirm divergent validity, MSV and ASV must be less than AVE.[30]

*Reliability*

To evaluate the internal stability of AEBQ, Cronbach's alpha, McDonald omega (ω), and Theta (θ) coefficients were estimated, and values greater than 0.7 were considered to be appropriate.[31] Subsequently, CR was calculated with CFA. The Test-retest reliability method was employed to determine the stability of the tool. The research tool was given to 40 adults with epilepsy, who were eligible for the study within a period of two weeks. To calculate the reliability, correlation coefficient and ICC were used.[32]

*Statistical Analyses*

SPSS 26-AMOS24 software (SPSS Inc., Chicago, IL) was utilized for data analysis. To determine whether the data distribution is normal, skewness and kurtosis indices were calculated. In this study, the default normality was assessed based on skewness=±3 and kurtosis=±7. To evaluate the normality of multivariate, Mardia coefficient <8 was used. To examine the absence of Multivariate outlier data, the index (above 20) of d-squared Mahalanobis was assessed (P<0.001).[33] In addition, the standard error of measurement (SEM) (SEM=SD×√[1-ICC]), the minimum detectable change (MDC) (MDC=SEM×Z score×√2), and the minimum important change (MIC) (MIC=0.5×SD of Δ score) were calculated.

## Results

Among the subjects (N=700), 378 were female (54%), 411 were single (58.73%), 306 had a primary school level of education (43.70%), and 314 were self-employed (44.88%). Additionally, the mean age, seizure onset age, duration of disease, and duration of use of antiepileptic drugs of the subjects were 38.87±11.67, 8.29±8.23, 30.48±11.59, and 27.34±11.25 years, respectively. The mean physical activity and number of epileptic seizures per month of the subjects were 158.36±140.91 and 2.47±2.52, respectively. 337 people had lower than adequate income (48.1%), 372 (53.1%) had moderate physical activity intensity. The BMI of 356 (50.86%) ranged between 18.6 and 24.9, and that of 191 (27.29%) was between 25 and 29.9 (table 1).

*Construct Validity*

The obtained results indicated that KMO=0.721 and Bartletts Sephercity Test=7905.002 were statistically significant (P<0.001). The factor extraction was based on an absolute factor loading value of >0.3, eigenvalues >1, communalities >0.2, and scree plots (figure 1).



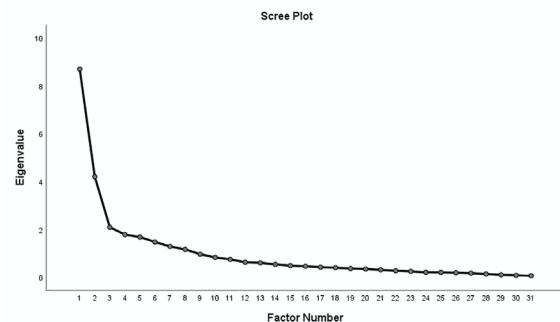**Figure 1:** The figure shows the scree plot of eigenvalues for principal components analysis of the AEBQ.

**Table 1:** Demographic characteristics of the participants (N=700)

| Variable | | N (%) |
|---|---|---|
| Sex | Male | 322 (46) |
| | Female | 378 (54) |
| Marital status | Single | 411 (58.73) |
| | Married | 248 (35.43) |
| | Widowed | 41 (5.84) |
| Occupation | Employee | 47 (6.71) |
| | Manual worker | 110 (15.71) |
| | Retired | 17 (2.42) |
| | Unemployed | 72 (10.28) |
| | Self-employed | 314 (44.88) |
| | Housewife | 140 (20) |
| Level of education | Illiterate | 73 (10.40) |
| | Primary School | 306 (43.70) |
| | High School | 237 (33.90) |
| | University Degree | 84 (12) |
| Income level | Adequate | 128 (18.30) |
| | Somewhat adequate | 235 (33.60) |
| | Lower than adequate | 337(48.10) |
| Insurance status | Insured | 566 (80.97) |
| | Not Insured | 134 (19.03) |
| Intensity of physical activity | Adequate | 228 (32.60) |
| | Average | 372 (53.10) |
| | Intense | 100 (14.30) |
| Stress experience in the last three months | Yes | 508 (72.64) |
| | No | 192 (27.36) |
| BMI | ≤18.5 | 34 (4.86) |
| | 18.6-24.9 | 356 (50.86) |
| | 25-29.9 | 191 (27.29) |
| | 30-34.9 | 93 (13.29) |
| | 35-39.9 | 21 (3) |
| | ≥40 | 5 (0.71) |
| Type of epilepsy | Primary | 319 (45.50) |
| | Secondary | 381 (54.50) |
| Epilepsy condition | Controlled | 70 (10) |
| | Poorly Controlled | 324 (46.30) |
| | Well Controlled | 306 (43.70) |
| Family history of epilepsy | Yes | 207 (29.60) |
| | No | 493 (70.40) |
| Antiepileptic drugs | Carbamazepine and Phenytoin | 17 (2.40) |
| | Carbamazepine | 208 (29.70) |
| | Sodium valproate | 17 (2.40) |
| | Primidone | 9 (1.30) |
| | Carbamazepine and Phenobarbital | 49 (7) |
| | Phenobarbital | 41 (5.90) |
| | Sodium Valproate | 39 (5.60) |
| | Primidone and Sodium Valproate | 19 (2.80) |
| | No Drug Consumption | 301 (43) |
| Epilepsy medication regimen | Single-Drug | 87 (12.40) |
| | Multi-Drug | 613 (87.60) |
| Other diseases | Cardiovascular | 79 (11.30) |
| | Orthopedics | 62 (8.90) |
| | Digestive problems | 83 (11.90) |
| | Diabetes | 32 (4.60) |
| | Neurology and psychiatry | 18 (2.60) |
| | Hypertension | 34 (4.90) |
| | No other diseases | 392 (44.20) |

In the EFA of the AEBQ structure, eight factors were extracted, four of which were related to "food approach" and four were related to "food avoidance". The eigenvalues of these eight factors averaged 2470 and explained a total of 61,7% of the total structural variance of eating behaviors. The factor loads of all the items (except items 2, 6, 11, and 33) were greater than 0.4 (table 2).

As is depicted in table 3 and figure 2, the first-order CFA and the goodness fit index of Chi square were obtained ($\chi^2$ [403]=1145.641, P<0.001). Afterward, to evaluate the fit of the model, other indices were examined, in all of which RMSEA=0.068, PCFI=0.671, PNFI=0.644, AGFI=0.618, IFI=0.914, and CFI=0.911 confirmed the proper fit of the final model.

After examining the correlation between

**Table 2:** Exploratory factors extracted from the adult eating behavior questionnaire (N=400)

| | Eigenvalue (%variance explained) | *h² | Factors determined through PAF | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| | | | EF | EOE | EUE | FF | FR | H | SE | SR |
| 1. I love food. | 3.50 (10.96%) | 0.69 | 0.73 | | | | | | | |
| 3. I enjoy eating. | | 0.81 | 0.79 | | | | | | | |
| 4. I look forward to mealtimes. | | 0.67 | 0.55 | | | | | | | |
| 5. I eat more when I am annoyed. | 3.49 (10.93%) | 0.74 | | 0.67 | | | | | | |
| 8. I eat more when I am worried. | | 0.63 | | 0.65 | | | | | | |
| 10. I eat more when I am upset. | | 0.72 | | 0.70 | | | | | | |
| 16. I eat more when I am anxious. | | 0.73 | | 0.75 | | | | | | |
| 21. I eat more when I am angry. | | 0.56 | | 0.67 | | | | | | |
| 15. I eat less when I am worried. | 2.64 (8.27%) | 0.50 | | | 0.57 | | | | | |
| 18. I eat less when I am angry. | | 0.67 | | | 0.76 | | | | | |
| 20. I eat less when I am upset. | | 0.66 | | | 0.75 | | | | | |
| 27. I eat less when I am annoyed. | | 0.60 | | | 0.64 | | | | | |
| 35. I eat less when I am anxious. | | 0.74 | | | 0.77 | | | | | |
| 7. I refuse new foods at first. | 2.47 (7.72%) | 0.44 | | | | 0.58 | | | | |
| 12. I enjoy tasting new foods. | | 0.67 | | | | 0.63 | | | | |
| 19. I am interested in tasting new foods I have not tasted before. | | 0.71 | | | | 0.78 | | | | |
| 24. I enjoy a wide variety of foods. | | 0.65 | | | | 0.71 | | | | |
| 13. I often feel hungry when I am with someone who is eating. | 2.16 (6.77%) | 0.53 | | | | | 0.54 | | | |
| 17. Given the choice, I would eat most of the time. | | 0.56 | | | | | 0.68 | | | |
| 22. I am always thinking about food. | | 0.52 | | | | | 0.61 | | | |
| 9. If I miss a meal, I get irritable. | 2.16 (6.75%) | 0.64 | | | | | | 0.69 | | |
| 28. I often feel so hungry that I have to eat something right away. | | 0.53 | | | | | | 0.43 | | |
| 32. I often feel hungry. | | 0.53 | | | | | | 0.53 | | |
| 34. If my meals are delayed, I get light-headed. | | 0.66 | | | | | | 0.74 | | |
| 14. I often finish my meals quickly. | 1.83 (5.73%) | 0.29 | | | | | | | 0.44 | |
| 25. I am often last at finishing a meal. | | 0.61 | | | | | | | 0.54 | |
| 26. I eat more and more slowly during the course of a meal. | | 0.78 | | | | | | | 0.81 | |
| 29. I eat slowly. | | 0.69 | | | | | | | 0.77 | |
| 23. I often get full before my meal is finished. | 1.47 (4.61%) | 0.50 | | | | | | | | 0.44 |
| 30. I cannot eat a meal if I have had a snack just before. | | 0.48 | | | | | | | | 0.77 |
| 31. I get full easily. | | 0.76 | | | | | | | | 0.75 |

*h²: Communalities

**Table 3:** Goodness of fit indices of the adult eating behavior questionnaire in pooled confirmatory factor analysis

| CFA | $\chi^2$(df) | P value | CMIN/df | RMSEA | PCFI | PNFI | AGFI | IFI | CFI |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| First-order after structure modification | 1145.64 (40) | <0.001 | 2.84 | 0.06 | 0.67 | 0.64 | 0.61 | 0.91 | 0.91 |
| Pooled CFA Second-order after | 1187.01 (42) | <0.001 | 2.79 | 0.06 | 0.67 | 0.64 | 0.62 | 0.91 | 0.91 |

CFA: Confirmatory factor analysis; CMIN/DF: Chi square/degree-of-freedom ratio; RMSEA: Root mean square error of approximation; PCFI: Parsimonious comparative fit index; PNFI: Parsimonious normed fit index; AGFI: Adjusted goodness of fit index; IFI: Incremental fit index; CFI: Comparative fit index. Fit indices: PNFI, PCFI, AGFI (>0.5), CFI, IFI (>0.9), RMSEA (>0.08), CMIN/DF (>3 good, >5 acceptable)
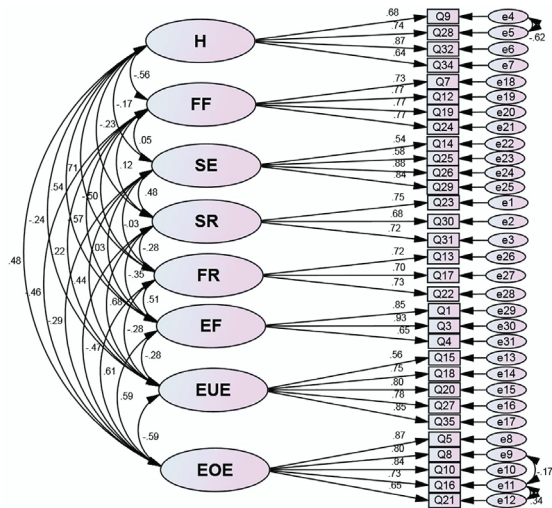
**Figure 2:** The figure shows the modified model of the first-order confirmation factor analysis. H: Hunger; FF: Food fussiness; SE: Slowness in eating; SR: Satiety responsiveness; FR: Food responsiveness; EF: Enjoyment of food; EUE: Emotional under-eating; EOE: Emotional over-eating

significance level of less than 0.001.

*Convergent and Divergent Validity*

The results showed that in the first-order CFA, the AVE of all the factors was greater than 0.5, and the AVE of each factor was greater than its ASV and MSV. We also found that the AEBQ structure had suitable convergent and divergent validity. Furthermore, in the second-order CFA, AVE was >0.5, indicating convergent validity confirmation (table 4).

*Reliability*

The obtained findings implied that the internal stability and CR>0.7 of the eight extracted AEBQ structures are confirmed (table 4). The stability of AEBQ was assessed using ICC. The mean scores before and after the test were 97.24±9.04 and 98.76±7.61, respectively. The ICC was 0.899 (95% CI: 0.878-0.917; P<0.001). The results also showed that SEM, MDC, and MIC of AEBQ were 0.528, 1.464, and 0.144, respectively (table 5).

In general, the scales were correlated with each other in the expected direction. The "food approach" scales were positively correlated and the "food avoidance" scales were negatively correlated. The "food avoidance" scales were also positively correlated (table 6).

The correlations between appetitive traits and BMI showed a weak positive correlation between BMI and H, FR, EOE, and EF subscales. There was also a weak negative correlation between BMI and SR, EUE, and FF subclasses. The results indicated a weak negative correlation between gender and subclasses H, FR, EF, SR, and SE (table 7).

As is depicted in figures 4 and 5, with an

the factors and identifying the subscales in the first-order CFA model, the second-order CFA was performed using the structural equation modeling. Due to the fact that in this study, the subscales were included in the two main constructs of food approach and food avoidance, the analysis of pooled CFA was performed to measure the second-order structures. The fit indices of the two models of the first-order confirmatory factor analysis and second-order pooled CFA are depicted in table 3. Figure 3 represents the structural model and the second-order CFA of the two structures of food approach and food avoidance with standardized factor loading. The number of factor loads obtained for all AEBQ items was greater than 0.5 with a
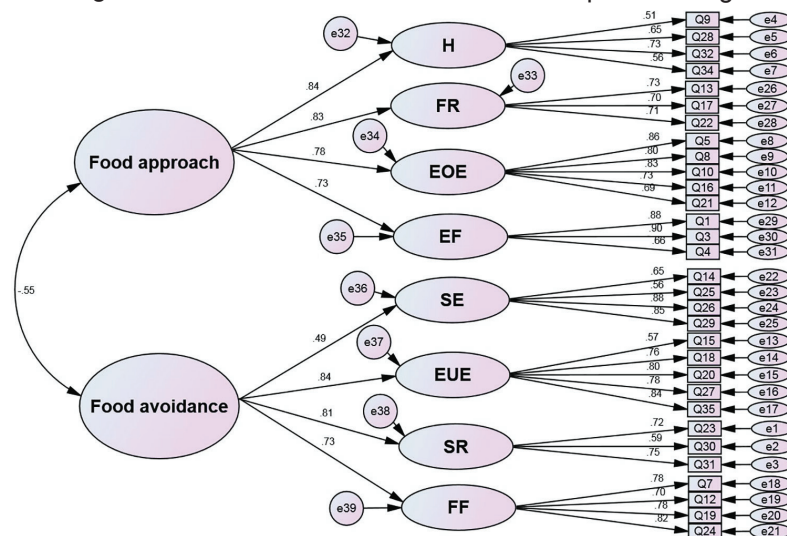


**Figure 3:** The figure shows the modified model of the second-order confirmation factor analysis. H: Hunger; FR: Food responsiveness; EOE: Emotional over-eating; EF: Enjoyment of food; SE: Slowness in eating; EUE: Emotional under-eating; SR: Satiety responsiveness; FF: Food fussiness

**Table 4:** Assessment of reliability and validity of adult eating behavior questionnaire

| Factor | Cronbach's alpha coefficients | Theta coefficient | McDonald omega coefficient | Construct reliability | First-order | | | Second-order | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Average variance extracted | Maximum shared squared variance | Average shared squared variance | Average variance extracted | Construct reliability |
| H | 0.73 | 0.73 | 0.72 | 0.82 | 0.54 | 0.50 | 0.21 | 0.63 | 0.87 |
| FR | 0.77 | 0.76 | 0.77 | 0.76 | 0.51 | 0.50 | 0.22 | | |
| EOE | 0.89 | 0.89 | 0.89 | 0.88 | 0.61 | 0.37 | 0.25 | | |
| EF | 0.83 | 0.83 | 0.84 | 0.85 | 0.66 | 0.34 | 0.20 | | |
| SR | 0.73 | 0.72 | 0.73 | 0.76 | 0.51 | 0.46 | 0.16 | 0.53 | 0.81 |
| EUE | 0.87 | 0.89 | 0.87 | 0.86 | 0.56 | 0.46 | 0.21 | | |
| FF | 0.73 | 0.74 | 0.73 | 0.84 | 0.57 | 0.32 | 0.16 | | |
| SE | 0.76 | 0.75 | 0.76 | 0.80 | 0.52 | 0.23 | 0.07 | | |

H: Hunger; FR: Food responsiveness; EOE: Emotional over-eating; EF: Enjoyment of food; SR: Satiety responsiveness; EUE: Emotional under-eating; FF: Food fussiness; SE: Slowness in eating

**Table 5:** Intra-class correlation, standard error of measurement, minimal detectable change, and minimal important change of adult eating behavior questionnaire

| Factor | Range of score | ICC(95% CI) | P value | SEM | MDC | MIC | Agreement |
|---|---|---|---|---|---|---|---|
| H | 4-20 | 0.93 (0.92-0.94) | <0.001 | 0.25 | 0.71 | 0.17 | Positive |
| FR | 3-15 | 0.91 (0.90-0.93) | <0.001 | 0.28 | 0.77 | 0.19 | Positive |
| EOE | 5-25 | 0.94 (0.93-0.95) | <0.001 | 0.28 | 0.79 | 0.19 | Positive |
| EF | 3-15 | 0.97 (0.96-0.98) | <0.001 | 0.18 | 0.52 | 0.13 | Positive |
| Food Approach | 15-75 | 0.94 (0.93-0.95) | <0.001 | 0.45 | 1.25 | 0.20 | Positive |
| SR | 4-20 | 0.92 (0.90-0.93) | <0.001 | 0.31 | 0.87 | 0.14 | Positive |
| EUE | 5-15 | 0.97 (0.96-0.97) | <0.001 | 0.19 | 0.53 | 0.21 | Positive |
| FF | 5-25 | 0.97 (0.95-0.98) | <0.001 | 0.14 | 0.39 | 0.14 | Positive |
| SE | 4-20 | 0.90 (0.87-0.91) | <0.001 | 0.29 | 0.82 | 0.28 | Positive |
| Food Avoidance | 18-90 | 0.97 (0.96-0.98) | <0.001 | 0.24 | 0.67 | 0.20 | Positive |
| Total | 31-155 | 0.89 (0.87-0.91) | <0.001 | 0.52 | 1.46 | 0.14 | Positive |

SEM: Standard error of measurement; MDC: Minimal detectable change; MIC: Minimal important change, H: Hunger; FR: Food responsiveness; EOE: Emotional over-eating; EF: Enjoyment of food; SR: Satiety responsiveness; EUE: Emotional under-eating; FF: Food fussiness; SE: Slowness in eating

**Table 6:** Mean and correlations between appetitive traits (N=700)

| Appetitive traits | | Mean±SD | Food approach subscales | | | | Food avoidance subscales | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | H | FR | EOE | EF[a] | SR | EUE | FF | SE |
| Food approach subscales | H | 2.76±1.04 | - | 0.58[c] | 0.43[c] | 0.54[c] | -0.13[c] | -0.15[c] | -0.444[c] | -0.26[c] |
| | FR | 2.07±0.98 | | - | 0.52[c] | 0.46[c] | -0.20[c] | -0.23[c] | -0.36[c] | -0.14[c] |
| | EOE | 2.35±1.19 | | | - | 0.56[c] | -0.38[c] | -0.50[c] | 0.38[c] | -0.10[b] |
| | EF[a] | 3.29±1.19 | | | | - | -0.32[c] | -0.30[c] | -0.48[c] | -0.01 |
| Food avoidance subscales | SR | 2.67±1.12 | | | | | - | 0.55[c] | 0.03 | 0.34[c] |
| | EUE | 2.93±1.23 | | | | | | - | 0.14[c] | 0.38[c] |
| | FF | 3.12±0.90 | | | | | | | - | 0.11[b] |
| | SE | 2.71±0.94 | | | | | | | | - |

H: hunger; FR: food responsiveness; EOE: emotional over-eating; EF: enjoyment of food; SR: satiety responsiveness; EUE: emotional under-eating; FF: food fussiness; SE: slowness in eating. a) Pearson's correlation was used for normally distributed mean scores; b) Correlation was significant at 0.05 (2-tailed); c) Correlation was significant at 0.01 (2-tailed)

**Table 7:** Correlations between adult eating behavior questionnaire and demographic variables (N=700)

| | Food approach subscale | | | | Food avoidance subscale | | | |
|---|---|---|---|---|---|---|---|---|
| | Hunger | Food responsiveness | Emotional over-eating | Enjoyment of food | Satiety responsiveness | Emotional under-eating | Food fussiness | Slowness in eating |
| BMI[c] | 0.18[b] | 0.31[b] | 0.18[b] | 0.24[b] | -0.22[b] | -0.18[b] | -0.19[b] | 0.06 |
| Sex | -0.19[b] | -0.14[a] | 0 | -0.20[b] | -0.16[a] | 0.06 | 0.02 | -0.11[a] |

Pearson correlation or point-biserial correlations; a) Correlation was significant at 0.05 (2-tailed); b) Correlation was significant at 0.01 (2-tailed); c) Polyserial correlations. BMI: Body Mass Index
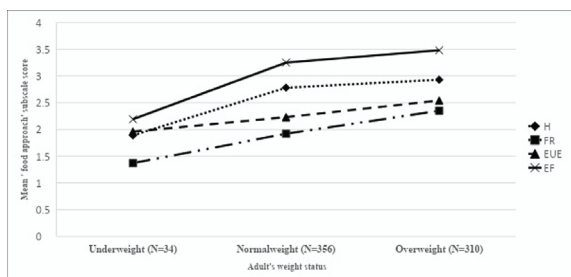
**Figure 4:** The figure shows the mean food approach scores at body mass index levels.
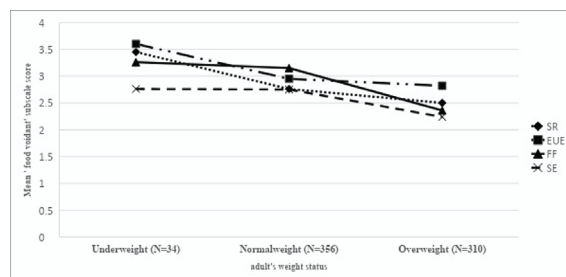


**Figure 5:** The figure shows the mean food avoidance scores at body mass index levels.

increase in body mass index, the mean scores of food approach subscales increase and the mean scores of food avoidance constructs decrease.

## Discussion

The internal stability of AEBQ was assessed using Cronbach's alpha, which was greater than 0.7, indicating that the instrument has acceptable internal stability.[34] This result is consistent with the results of the study by Zickgraf and Rigby, Hunot and others, and Mallan and others, respectively, on 337 bariatric surgery seeking samples, 954 adults, and 998 adult students.[22, 23, 25]

Herein, CR was also calculated. CR is a kind of alternative to Cronbach's alpha coefficient in structural equation model (SEM) analysis. In the present study, CR was more than 0.7, which is an acceptable amount.[34] The stability of AEBQ over time (test-retest) was calculated by ICC. Since, it was higher than 0.75, the degree of stability was considered to be acceptable.[35] The results of the study by Hunot and others also reported that the stability of AEBQ in 93 samples was acceptable (Cronbach's alpha=0.73-0.91).[22]

EFA and CFA methods were used to evaluate the validity of the AEBQ structure. The eight factors were determined based on eigenvalues and scree plots. The eigenvalues of these eight factors averaged 2.470 and explained a total of 61,772% of the total variance of the AEBQ structure. This finding is consistent with the results of the study by Mallan and others.[25] Furthermore, Hunot and others identified seven factors, namely hunger, emotional over-eating, enjoyment of food, satiety responsiveness, emotional under-eating, food fussiness, and slowness in eating, which together accounted for 64.27% of the total variance of the AEBQ structure.[22] Beckett and others reported that in studies of psychology and humanities of the time, when the amount of variance is between 50% and 60%, factor extraction is appropriate.[36] In the present study, the number of items in each factor was at least three. At least three observed items must be present in the CFA for

each latent variable.[36]

In the current work, the CFA model was used to evaluate the validity of the AEBQ structure. According to the recommendations of Meyers and others, Chi square, RMSEA, PNFI, PCFI, AGFI, GFI, and CMIN/df indices were examined.[29] The results revealed that in the first-order CFA, the goodness of fit index of Chi square and other indicators confirmed the proper fit of the final model. The suitability indices of pooled CFA second-order analysis also showed that the number of factor loads obtained for all the AEBQ items was greater than 0.5 and was significant at P<0.001, indicating that the items could explain the factors they needed to.

The results demonstrated that in the first-order CFA, the AVE of all the factors was greater than 0.5, and the AVE of each factor was larger than its ASV and MSV, which indicates that the AEBQ structure has convergent and divergent validity. In addition, in the second-order factor analysis, AVE was >0.5, indicating the confirmation of convergent validity. Beckett and others stated that there is a convergent validity once the structural elements in question are close to each other and share a large variance with each other. There is also a time of divergent narrative, when the items of the construct in question or the latent factors extracted are completely separated.[36]

The obtained results herein implied that the scales were related in the expected direction, the food approach sub-scales were positively related, the food avoidance sub-scales were negatively related, and the food avoidance sub-scales were positively related to each other.

In the study by Zickgraf and Rigby, the subscales related to the food approach were intercorrelated from intermediate to high level, and their correlation with satiety responsiveness and slow eating was small yet significant. On the other hand, satiety responsiveness and slow eating were positively correlated. Moreover, as in previous samples, food fussiness was positively correlated to satiety responsiveness, but negatively to food enjoyment.[23]

The correlations between appetitive traits and BMI showed that with increased body mass index score in adults with epilepsy, food approach sub-scores, including H, FR, EOE, and EF increased, and BMI scores increased with the decrease in BMI scores for food avoidance subclasses, including SR, EUE, and FF. Hunot and others also concluded that appetitive traits and BMI are correlated and adults with higher BMI scored higher in FR, EOE, and EF and lower for SR, EUE, and SE.[22] The results of Mallan and others showed that EOE is expected to be associated with a higher BMI. However, on the contrary to predictions, other food approach skills, such as FR and FE, were not significantly associated with BMI. Hunger was significantly associated with a low BMI. According to expectations, all food avoidance scales, except for FF, were associated with low BMI.[25]

Examining the relationship between gender and appetite traits showed a weak negative correlation between gender and H, FR, and EF factors. The scores of women in these three factors were higher than those of men (P<0.05). The results also illustrated a weak negative correlation between the sex with SR and SE factors. Accordingly, the scores of women in these three factors were higher than those of men (P<0.05). There were no significant relationships between gender and EOE, EUE, and FF factors (P>0.05). Hunot and others also reported that gender was associated with certain food approach traits. Women were more likely to report higher scores for EOE (P=0.003). Meanwhile, there were no statistically significant relationships between gender and factors of hunger, food responsiveness, or enjoyment of food (all Ps>0.05). Food avoidance traits, SR, and SE were also significantly associated with gender; women obtained higher scores in these traits (both P=0.002). There were no relationships between gender and FF (P=0.427).[22] One of the most important limitations of this study was the use of self-reported mode to complete the questionnaire, which could affect the results to some extent. The other limitation was the lack of other tools related to eating behavior traits, which could be conducive to the determination of concurrent validity.

## Conclusion

The Persian version, eight-factor, 31-item AEBQ construct could measure eating behavior traits with good validity and reliability among Iranian adults with epilepsy. Using this tool, the risk behaviors of obesity and overweightness in adults with epilepsy could be described. Thus,

it helps researchers to follow appetite traits from childhood and adolescence and take the necessary measures to prevent obesity, particularly in patients with epilepsy. This tool could be employed by psychologists, neurologists, and nutritionists in treatment follow-ups for screening potentially maladaptive eating behaviors in adults with epilepsy and taking specific dietary and lifestyle modifications. Future validation of AEBQ in diverse populations will enable wider use of this tool.

## Authors' Contribution

A.Sh, R.Gh, R.E.R, Kh.J.G, A.M, M.M, R.M, F.Gh: Study concept and design, Acquisition, and interpretation of data, Drafting and critical revision of the manuscript; All authors have read and approved the final manuscript and agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

**Conflict of Interest:** None declared.

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