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Original article

# Evaluation of the relationship between eating behaviour and body mass index in adults

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**Abstract.** *Background/aıms:* This study was planned to determine the eating behaviours of adults and to examine the relationship between eating behaviour and body mass index (BMI). This was a single-centre cross-sectional study. The study was conducted in a health institution in Afyonkarahisar, Turkey, between September 15 and November 1, 2021. *Materıals and methods:* The study was conducted with a total of 1,601 participants. In the study, height, body weight, place of residence, marital status, profession, educational status of the participants, and whether they used social media were questioned and their BMI values were calculated. Also, the Three-Factor Eating Questionnaire (TFEQ-R18) was used in the study. *Results:* Single individuals have been determined to eat more uncontrollably, experience emotional hunger and are more sensitive to hunger than married ones. Furthermore, as the level of education decreases, uncontrolled nutrition, emotional hunger and sensitivity to hunger increase. Non-working individuals were found to experience more emotional hunger. Those living in the city centre were found to eat more uncontrollably. Obese individuals were found to eat more uncontrollably and experience emotional hunger, and moreover, not able to practice cognitive restraint. *Conclusion:* As per our results, some measures should be taken to protect the health of individuals and to make this sustainable by having normal body weights. Eating behaviour change is one of the first of these measures and it should start in the family at an early age.

**Key words:** Nutrition, eating behaviour, TFEQ

## Introduction

Nutrition has an important place in the life of all living things. Maintaining a healthy life, protection from many chronic diseases, and development of the body's immune system against viral diseases are directly related to adequate and balanced nutrition (1). Inadequate and/or unbalanced nutrition of individuals can lead to the emergence of many diseases, as well as be closely related to weakness or obesity (2). Inadequate and/or unbalanced nutrition not only impairs the health of individuals but also negatively affects their quality of life (3). Besides, the treatment costs of diseases caused by inadequate and/or unbalanced nutrition bring a heavy burden on the economies of the countries (4). The whole world is striving to take several measures to improve the health parameters that arise due to incorrect eating behaviours or that can be prevented by adequate and balanced nutrition (4,5). Raising awareness in society about proper nutrition and increasing physical activity is one of the first of these measures. While raising the awareness of individuals on proper nutrition, it is extremely important that this is permanent and sustainable, that is, it becomes a lifestyle (5). There are differences in the eating behaviours and habits of People while meeting their nutritional needs. Genetic, demographic, physiological, psychological and environmental factors are effective in these differences (6). In particular, the eating behaviours in the family where the individual grows up

become a habit and are carried over to the next years and can be transferred to future generations if they are not corrected (7). New habits and attitudes in eating behaviours that emerge in the childhood and youth periods of individuals can be carried over to the next periods of their lives (5). Therefore, detecting incorrect eating habits at an early age or measuring the knowledge and attitudes of families about this issue and taking measures in accordance with the results is one of the most important investments that can be made in the health of future generations in the long term. Incorrect eating behaviours trigger many diseases and also cause the direct occurrence of some diseases (1-3).

Identifying wrong eating habits and behaviours in early periods and taking measures to prevent them would primarily contribute to the protection of individuals' health and increase their quality of life, and in the long term, the fact that it would contribute to the growth of healthy and strong individuals is necessary for the economic and social development of societies (1-5).

There are some scales developed to measure the eating habits of individuals. With the scale used in this study on adult individuals, it was aimed to measure the levels of restriction of people's eating (for weight control, cognitive restraint), uncontrolled eating (unconsciously excessive consumption of food or a tendency to this condition) and eating in emotional times and the level of sensitivity to hunger (ability to control eating when hunger is felt). Furthermore, the results of the scale used would be compared with BMI and some sociodemographic data, thus contributing to the literature.

## Material and methods

This was a single-centre cross-sectional study. The study was conducted in a health institution in Afyonkarahisar, Turkey, between September 15 and November 1, 2021. Afyonkarahisar is a city with a population of approximately 1 million located in the Inner Aegean region of Turkey geographically (8). The population of the study consisted of the age group of 18 and over. The study was carried out with 1,601 volunteer individuals who accepted the survey method, were randomly selected, did not have any obvious serious psychiatric disease, and did not have communication barriers (such as serious hearing and vision).

The height and weight, age, marital status, educational status, place of residence, and whether they used social media and wanted to participate in the study were questioned and recorded. Body Mass Index (BMI) ($kg/m^2$) has been calculated according to the recorded height (m) and body weight (kg) value [BMI formula: body weight (kg)/height ($m^2$)]. BMI values were evaluated according to the criteria set by the World Health Organization for adults. BMI ≤ 18.5 was considered as underweight, 18.5-25.0 normal, 25.0-30.0 overweight, and 30≥obese.

Three-Factor Eating Questionnaire (TFEQ-18) is a scale developed by Stunkard and Messick in 1985 to determine the psychological eating behaviours of individuals (9) and revised by Karlsson et al. in 2000 (10). The Turkish validity and reliability study of the scale was conducted by Kıraç et al. in 2015 (11). The reliability coefficient (Cronbach's α value) was found to be 0.71. The scale consists of four sub-factors that evaluate emotional eating behaviour, cognitive restraint of eating behaviour, uncontrolled eating behaviour, and sensitivity to hunger behaviour. The higher the score of each sub-factor, the stronger the behaviour is.

*Factor 1: Uncontrolled Eating* measures the levels of individuals showing excessive eating toward hunger and decreasing eating control. It is a tendency to eat more than normal.

*Factor 2: Emotional Nutrition-emotional hunger* measures the level of the inadequacy of individuals against emotional symptoms.

*Factor 3: Cognitive Restraint of Eating* measures the level of cognitive restriction of eating in order to keep the body weight in balance and to increase the weight loss of the individuals.

*Factor 4: Sensitivity to Hunger* measures the levels of difficulty in controlling food intake when there is an appetite for eating (11).

An uncontrolled eating habit is defined as eating more than normal. Emotional eating behaviour, on the other hand, is defined as continuous eating behaviour during a period of emotional changes such as

loneliness, getting used to a new place, and depression. Sensitivity to hunger is the consumption of too much food so that one does not know what they are eating when hungry.

*Statistical analysis*

Continuous quantitative variables are given as n and percentage. Continuous variables consisting of independent measurements and showing normal distribution were analyzed with the Independent Samples T-Test, while the Mann-Whitney Rank Sum Test was used for the data that did not show normal distribution. One-way ANOVA was used for continuous variables, and the Pearson chi-squared test was used for categorical variables. Furthermore, One-way ANOVA post hoc Turkey's, and Pearson Correlation Test were used when necessary. A p-value < 0.05 is considered statistically significant. All data analyses were performed with SPSS 21 package programs.

*Ethics Committee;* Ethics Committee approval for the study (2021/446) was obtained on 03.09.2021 from the Clinical Research Ethics Committee of Afyonkarahisar Health Sciences University.

## Results

The study was conducted with a total of 1,601 participants, 32.4% male, and 67.6% female. The mean age of the participants was 29.40±10.04 (18-65) years. The mean BMI values of the participants were as follows: 18.96±1.74-22 in the underweight group (14.7%), 22.48±1.40 in normal weight (50%), 27.06±1.34 in the overweight (25.7%), and 33.29±3.57 kg/$m^2$ in the obese group (9.6%). The majority of the participants in the study were single (66.5%), with an undergraduate education level (69%), not working (52.5%), using social media actively (95.1%), and living in the city centre (67%). In the study, it was determined with a significant difference that males eat more uncontrollably than females, that is, they are prone to overeating, and that they cannot control eating in case of hunger, that is, they are more sensitive to hunger. The females were found to be more successful than males in cognitive restraint to keep their body weight under control or lose weight, with a significant difference (Table 1). In terms of marital status, while married participants were determined to be more careful in the cognitive restraint field to keep their body weight under control or lose weight compared to singles, singles were more careful than married ones in all other areas. Significant differences were found in all areas regarding marital status (Table 1).

Although there was no significant difference found, uncontrolled nutrition, emotional hunger, and sensitivity to hunger increase as education level decreases. Those who do not work and those who work as government employees were found to be more emotionally inclined to eat than retirees and this was significant. The participants who used social media were found to be significantly more conscious about keeping their body weight under control. The participants who lived in the city centre were determined to be significantly more likely to eat than those who lived in the districts. In the BMI classification, the obese group participants were determined to be more prone to overeating and emotional eating than the other groups and were insufficient in cognitive restraint to keep their body weight under control. Overweight participants were found to be more successful in cognitive restraint to keep their body weight under control or to lose weight, and a significant difference was found (Table 1). As per the correlation test carried out, emotional hunger was found to decrease as age increased (Table 2).

## Discussion

Some individuals are more prone to gain weight (12). Although this condition is related to genetic structure, it is also affected by many parameters. Many factors, from the living environment to eating behaviour in the family, can be listed among these reasons (13). The prevalence of obesity has almost doubled after the 1980s (12,13). While increasing obesity causes a dramatic increase in many chronic diseases, treatment costs also bring a heavy burden on the economies of the countries (14). This has led scientists to study human behaviour in the increase of obesity. Several scales have been developed to

**Table 1.** Sociodemographic data, BMI classification, and Three-Factor Eating Questionnaire (TFEQ-18) distribution of the participants.

| | | | Three-Factor Eating Questionnaire (TFEQ-18) | | | |
|---|---|---|---|---|---|---|
| | | **% (n)** | **Factor 1** | **Factor 2** | **Factor 3** | **Factor 4** |
| **Gender**a | **Female** | 67.6 (1083) | 11.27±3.03 | 6.96±2.74 | 16.11±3.70 | 8.83±3.19 |
| | **Male** | 32.4 (518) | 11.90±3.28 | 6.78±2.74 | 15.27±3.70 | 9.23±3.16 |
| | | | **p<0.001** male > female | p=0.219 --- | **p<0.001** female > male | **p=0.022** male > female |
| **Marital status**a | **Married** | 33.5 (537) | 11.19±3.39 | 6.66±2.92 | 16.33±3.61 | 8.67±3.38 |
| | **Single** | 66.5 (1064) | 11.62±2.98 | 7.02±2.64 | 15.59±3.75 | 9.11±3.07 |
| | | | **p=0.013** single > married | **p=0.017** single > married | **p<0.001** married > single | **p=0.011** single > married |
| **Educational status**b | **Primary school** | 3.4 (55) | 11.55±3.03 | 7.27±3.07 | 16.00±3.27 | 8.73±3.41 |
| | **Secondary school** | 4.8 (77) | 11.40±3.32 | 6.84±3.10 | 16.69±4.01 | 8.49±3.64 |
| | **High school** | 22.7 (364) | 11.80±3.63 | 6.84±2.82 | 15.94±4.04 | 9.33±3.59 |
| | **Undergraduate and ↑** | 69.0 (1105) | 11.37±2.93 | 6.91±2.67 | 15.74±3.60 | 8.88±2.99 |
| | | | p>0.05 | | | |
| **Profession**c | **Not working** | 52.5 (840) | 11.52±3.05 | 7.02±2.73 | 15.69±3.85 | 8.98±3.13 |
| | **Government employee** | 24.0 (384) | 11.43±2.97 | 6.89±2.65 | 16.11±3.57 | 8.91±2.93 |
| | **Labourer** | 20.8 (333) | 11.49±3.41 | 6.79±2.89 | 15.82±3.45 | 9.08±3.56 |
| | **Retired** | 2.7 (44) | 10.86±3.69 | 5.66±2.43 | 16.41±4.35 | 8.02±3.33 |
| | | | p>0.05 | **p=0.011** Not working>Retired Government employee>retired | p>0.05 | p>0.05 |
| **Use of Social media**a | **Yes** | 95.1 (1522) | 11.47±3.13 | 6.90±2.74 | 15.89±3.72 | 8.94±3.18 |
| | **No** | 4.9 (79) | 11.66±3.15 | 7.03±2.75 | 14.90±3.61 | 9.33±3.29 |
| | | | p>0.05 | p>0.05 | **p=0.021** | p>0.05 |

| | | | Three-Factor Eating Questionnaire (TFEQ-18) | | | |
|---|---|---|---|---|---|---|
| | | % (n) | Factor 1 | Factor 2 | Factor 3 | Factor 4 |
| **Area of residence**c | **City** | 67 (1072) | 11.62±3.21 | 6.94±2.75 | 15.97±3.82 | 9.07±3.21 |
| | **District** | 28.7 (460) | 11.07±2.92 | 6.85±2.73 | 15.64±3.29 | 8.73±3.10 |
| | **Village** | 4.3 (69) | 11.87±3.00 | 6.65±2.79 | 15.04±4.61 | 8.88±3.27 |
| | | | **p=0.004 city>district** | p>0.05 | p>0.05 | p>0.05 |
| **BMI**c | **Underweight** | 14.7 (235) | 10.67±2.96 | 6.44±2.77 | 15.54±3.97 | 8.51±3.15 |
| | **Normal weight** | 50.0 (801) | 11.33±3.14 | 6.85±2.62 | 15.94±3.73 | 8.75±3.04 |
| | **Overweight** | 25.7 (412) | 11.78±2.99 | 7.01±2.81 | 16.05±3.57 | 9.17±3.31 |
| | **Obese** | 9.6 (153) | 12.62±3.31 | 7.61±3.00 | 15.18±3.58 | 10.20±3.34 |
| | | | **p<0.001** normal weight>underweight overweight>underweight obese>underweight obese>normal weight obese>overweight | **p<0.001** obese>underweight obese>normal weight | **p<0.044** obese>overweight | **p<0.001** obese>underweigt obese>normal weight obese>overweight |

---[a] t-test, ---[b] one-way ANOVA, ---[c] ANOVA-post hoc Tukey's test

**Table 2.** Age and Three-Factor Eating Questionnaire Pearson Correlation Test.

| | | Age | | |
|---|---|---|---|---|
| | | r | p | |
| **Three-Factor Eating Questionnaire TFQE-18** | Factor 1 | -0.071 | **=0.004** | A very weak negative correlation |
| | Factor 2 | -0.084 | **=0.001** | A very weak negative correlation |
| | Factor 3 | 0.121 | **p<0.001** | A positive weak correlation |
| | Factor 4 | -0.088 | **p<0.001** | A negative weak correlation |

measure eating behaviours (9,15-18). The TFEQ is one of these scales. The sub-dimensions of the scale evaluate the areas of susceptibility to overeating, emotional eating, cognitive restraint food consumption, and loss of control in case of hunger (19). Some studies have reported that there is a direct correlation between the increase in BMI value and the inability to control eating (20). It has been highlighted in some studies that females are more inclined to eat compared to men (19).

A positive correlation was also found in our study between the increase in BMI and the inability to control eating. However, contrary to the data in the literature, the inability to control eating, the tendency to eat and sensitivity to hunger were found more in the male population. In particular, women were determined to be more successful in cognitive restraint, which is most often used to keep the body weight under control.

In our study, although it was not significant, it was found that emotional hunger was determined to be more common in women (Table 1) (21-23).

This has been explained by the fact that females' emotional states and eating behaviours change more than men's, and they are also more stressed. Furthermore, Body Weight Perception has been reported to lead to differences in cognitive restrain and emotional hunger behaviours (24). In that particular study conducted with university students, emotional eating behaviour and cognitive restraint status were reported to be more common in female students than male students.

In our study, in line with the literature, emotional eating behaviour and cognitive restraint scores were higher for women ($p<0.001$).

It has been shown that the vast majority of participants who are overweight and obese perceive themselves as being of normal weight. It has been noted in the same study that participants who perceive themselves as overweight tend to show more emotional eating behaviour than other participants. This result has been explained as an increase in uncontrolled eating behaviour with the development of negative body perception (24). The subconscious desire to lose weight or the impulse of cognitive restraint of obese individuals may be triggering food consumption. This is in line with the statement of Serin and Sanlıer, "Individuals who are constantly restrictive in their food intake may display excessive eating behaviours after a while" (25).

In a study in which the participants were divided into normal weight, overweight, obese, and control groups (n=48), obese individuals were found to have higher uncontrolled eating behaviour and hunger sensitivity scores and lower cognitive restrain scores than individuals with normal weight (26).

The results of our study also indicated that obese individuals are more prone to eating, emotional hunger, and inability to resist food ($p<0.001$).

Similarly, in a study conducted in the Czech Republic with 1,429 men and 1,624 women and BMI was associated with TFEQ, a positive correlation was found in all sub-factors of TFEQ in males and the areas of uncontrolled eating and sensitivity to hunger in females (27).

As BMI value increases, the score of the sub-dimensions scale increase, so, similar to our results, obese people were found to be more prone to eating, emotional hunger, and inability to resist food.

In another study investigating the effects of age and BMI value on the TFEQ score in males, the BMI value was found to have a significant effect on uncontrolled eating ($p<0.05$), sensitivity to hunger was significantly higher in overweight men ($p<0.05$), and the level of hunger in young males was reported to be significantly higher than in the older males (28).

We did not differentiate between age groups in our study, however, the findings support our results.

In Lesdema et al.'s study conducted with 1,000 adults in France, BMI, gender, and TFEQ scale scores were compared. As a result of their study, a positive relationship was found between the BMI classification and the cognitive restraint, uncontrolled eating, and sensitivity to hunger areas of the TFEQ. Furthermore, cognitive restraint has been reported to be higher in overweight individuals than in other groups. Uncontrolled eating, on the other hand, was found to be higher in overweight and obese individuals. It has been also reported that sensitivity to hunger was significantly higher in obese individuals (29).

There are other studies with similar results in the literature (30). In our study, obese male individuals were found to have more tendency to eat and could not resist hunger. Also, in our study, male participants living alone were determined to be more prone to eating ($p<0.001$). There are studies showing that single male participants tend to eat more and eat irregularly compared to married ones (31). The fact that married participants had more regular eating habits might be due to the cultural structure of our country. In the traditional structure of our country, meals (breakfast-dinner) where family members can gather at home are eaten together (32).

Meal times may differ for individuals living alone. Furthermore, those living in the city were determined to have more tendency to eat than those living in districts or villages (0=0.004). This might be due to the fact that people who live in the city or metropolis might have more food options, easy access and an abundance of attractive alternatives which was supported by the studies conducted about food outlets and locations (33). In recent years, social networks are becoming also very popular in the field of nutrition with the development of food options and food delivery services (34). Because people can place their food orders to be delivered to their homes by looking at the options and opportunities on these networks. The use of social media was questioned for this reason., however, no significant difference was found between the users (almost all of the participants use it) and the non-users in terms of the three-factor nutrition scale.

As a result of our study, obese individuals were determined to eat more uncontrollably and experience emotional hunger, and they are not prone to cognitive restraint. In line with our results, some measures should be taken to protect the health of individuals and make that this is sustainable by having normal body weights. The beginning of these measures should be the eating behaviour change which needs to start in the family at an early age.

**Ethıcs:** Ethics Committee approval for the study (2021/446) was obtained on 03.09.2021 from the Clinical Research Ethics Committee of Afyonkarahisar Health Sciences University.

**Informed Consent:** All participants gave their oral consent to participate in this study.

**Authorship Contributions:** NES; Concept, Design, Data Collection and/or Processing, Analysis and/or Interpretation, Literature Search, Writing.

**Conflict of Interest:** Author declares that has no commercial associations (e.g. consultancies, stock ownership, equity interest, patent/licensing arrangement etc.) that might pose a conflict of interest in connection with the submitted article.

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