The relationship between food addiction and emotional eating in individuals at risk for anorexia nervosa

O. AYTAŞ[1], H. ALATAŞ[2]

[1]Ozgür Aytaş Psychiatry Clinic, Malatya, Turkey
[2]Nutrition and Dietetic Department, Faculty of Health Sciences, Malatya Turgut Ozal University, Malatya, Turkey

Abstract. – **OBJECTIVE:** The aim of this study was to determine the relationship between anorexia nervosa, food addiction, and emotional eating.

SUBJECTS AND METHODS: The study was carried out with 395 university students. The Eating Attitude Test (EAT)-26 was used to determine the risk of anorexia nervosa in individuals. Yale Eating Addiction Scale (YFAS) and The Dutch Eating Behavior Questionnaire (DEBQ) were used to determine the eating behaviors that may be effective in anorexia nervosa. Digital scales were used for weight measurement, and a non-stretchable tape measure according to standard techniques was used for measuring height, waist, and hip circumferences.

RESULTS: In this study, in which individuals at (high and medium) risk of anorexia nervosa were examined, 62.03% were females, and the mean age was 25.21±4.33 years. The mean BMI value was 22.25±3.48 kg/cm². In the study, 8.35% of people with both anorexia nervosa (AN) risk and food addiction made up 19.75% of the food addict population (p=0.023). The distribution of DEBQ scores by sub-dimension shows that AN risk decreases as external eating score decreases. The group at the highest risk for AN also had the highest emotional eating score (p=0.029). In the multiple linear regression analyses, emotional eating behavior, gender, and BMI were predictive factors for eating attitude or anorexia nervosa risk.

CONCLUSIONS: Food addiction increases the risk of eating disorders and the most important factor affecting them is BMI. Women were more likely than men to have anorexia nervosa and food addiction. This study informed young adults about food addiction, eating disorders, and anorexia nervosa.

Key Words:
   Anorexia nervosa, Adult, Eating disorders, Emotional eating, Food addiction.

Introduction

Anorexia nervosa (AN) is characterized by an extreme fear of gaining weight, leading to severe restrictions on the amount of food consumed. This fear causes the individuals to feel like they have no choice but to starve themselves. The prevalence of this disease differs depending on the diagnostic criteria that are used and the characteristics of the samples that are collected[1]. When performing an external diagnosis of AN, the first step is to assess the patient's current level of general medical care. Eating behavior disorder brings with it many diseases[2,3]. In eating disorders, the individual has problems with his/her appearance and body weight. He or she perceives himself/herself as overweight, even if he/she is normal or underweight according to his/her body mass index (BMI). He/she constantly wants to be thin or cannot stop eating obsessively. A key distinction between these two related maladaptive patterns of eating behaviors is the presence of body image dissatisfaction, which subsequently leads to abnormal eating behaviors and extreme self-evaluation[4]. Previous studies[5,6] have shown that factors such as young age, having a relative in the first degree who has an eating disorder (such as a mother, father, or sibling), experiencing the loss of a loved one due to death or illness, adjusting to a new school, work, or home environment, experiencing changes in weight, divorce, puberty problems, socio-cultural norms, or sexual trauma can all contribute to the development of eating disorders. Attending college coincides with the completion of one's years spent maturing into an adult[7]. People's ideas about their bodies change during adolescence because bodies change rapidly during this time, they become more concerned

Corresponding Author: Ozgür Aytaş, MD; e-mail: drozguraytas@hotmail.com

with their own physical appearance as well as the external appearance of other people, and they compare themselves to others more frequently. In addition, factors such as an individual's sense of self-acceptance, the moral values and social judgments of the past and present, as well as the media, all play a part. It is more likely that a person would have eating habits that are not normal in early adulthood if they had a diet and eating habits that were not normal when they were adolescents. People often find it difficult to adjust to their new environments when they go to university because it is a time when they are away from their families, their eating routines may change, and they are required to make new friends[8,9]. Additionally, stress and anxiety are amplified by the presence of student groups and perfectionist personalities. Consumption of food might also have contributed to developed anxiety. The effects that people have on their appearance can be influenced by the fact that they are members of a group and that they feel the need to prove themselves[2,10]. As a consequence, the eating disorder becomes more widespread due to interactions with people from various socioeconomic backgrounds. The aim of this study is to reveal the factors that are effective in the emergence of AN in university students in light of the above-mentioned issues (gender, financial situation, pressure, special diet used by the doctor, BMI, and exercise).

Subjects and Methods

A cross-sectional study is planned. Students from two universities in southern Turkey took part in the study. Students were enrolled in the study regardless of the university course they were following. Inclusion criteria to take part in the study were: to be between 18 and 35 years old and know how to read and speak Turkish. People who were able to communicate were included in the study. All procedures performed in this study were conducted in accordance with the 2013 Helsinki Declaration and its subsequent amendments or comparable ethical standards. The study protocol was approved by the Ethics Committee of Mardin Artuklu University, non-interventional clinical research, with the session decision dated 12.01.2023 and numbered 2023/15-15.

In addition, informed consent was obtained from all individual participants in the study.

Because of the current epidemic, the data for the study was gathered using the Google Surveys pro-gram, a simple, easy-to-use online platform. The questionnaire form is divided into four sections: the students' descriptive information, the Dutch Eating Behavior Questionnaire (DEBQ), The Eating Attitude Test-40, and the Modified Yale Food Addiction Scale Version 2.0. (mYFAS 2.0).

Measures

Sociodemographic and anthropometric questionnaire

Age, gender, marital status, level of completed education, college, course, height, weight, eating patterns, weight satisfaction, and (healthy or unhealthy diet) were surveyed for this study.

The body mass index (BMI) was determined by dividing the individual's body weight in kilograms by the square of their height in meters. Standard BMI classifications[11] state that an individual is considered to be underweight if the BMI is lower than 18.5 kg/m^2, normal weight if the BMI is between 18.5 and 24.9 kg/m^2, overweight if the BMI is between 25.0 and 29.9 kg/m^2, and obese if the BMI is more than 30.0 kg/m^2.

The Eating Attitude Test-40

The Eating Attitude Test (EAT) is a 6-point Likert-type scale with 40 items that Garner and Garfinkel[12] created to test AN symptoms. The answers are always, very often, often, sometimes, rarely, and never. Savaşır and Erol[13] performed the study in our country in the year 1989. The participants could get from 0 to 120 points on the scale, with 30 points being the cut-off point. If the total score was over 30, it was classified as "high risk". If it was between 21 and 30, it was considered "moderate risk", and if it was lower than 21, it was "low risk". The Cronbach's alpha internal consistency coefficient for the first version of the scale was found to be 0.70. While in our study, it was found to be 0.819. This shows that the scale is reliable in the group we used[14].

The Yale Food Addiction Scale, Version 2.0 with some changes (mYFAS 2.0)

The YFAS 2.0 assesses addiction-like eating behavior during the past 12 months. The Modified Yale Food Addiction Scale Version 2.0 is a shorter version of the Yale Food Addiction Scale Version 2.0, which was made using the Diagnostic and Statistical Manual of Mental Disorders criteria for substance use disorders (DSM-V)[15]. This scale was made with 13 questions and a Likert scale with 8 points (0=never, 7=every day). The

11 questions on the scale are the same as the 11 criteria for substance use disorder in the DSM-V. The last two questions (5th and 6th) are about substance use disorders and are clinically significant. Note that there is no sum score calculated from the single items of the YFAS 2.0; each of the 11 diagnostic criteria was considered fulfilled if one or more of the relevant questions for each criterion reached the threshold.

Based on the number of symptoms: it is judged by how many of the criteria the participants meet. The most a person can get from the scale is 11 points.

- No Food Addiction=one or fewer symptoms/ Does not meet criteria for impairment/distress criteria;
- Mild Food Addiction=2 or 3 symptoms and impairment/distress criteria;
- Moderate Food Addiction=4 or 5 symptoms and impairment/distress criteria;
- Severe Food Addiction=6 or more symptoms and impairment/distress criteria.

Questionnaire on Dutch Eating Behavior (DEBQ)

It was created to assess individuals' emotional eating, restrained eating, and external eating behaviors. This scale was designed as a 5-point Likert scale with 33 items. The scale is scored based on the subscale scores for emotional eating, restrained eating, and external eating. The rise in subscale scores indicates that people engage in more subscale-related behaviors. Bozan et al[16] (2011) conducted a validity and reliability study in Turkey, and Cronbach's coefficient was found to be 0.94.

Statistical Analysis

Statistical analyses were performed using the SPSS 22.0 (IBM Corp., Armonk, NY, USA) program, a social sciences package. Summary statistics like mean, standard deviation, minimum and maximum values, numbers, and percentages are used to describe the data. The Kolmogorov-Smirnov test was used to see if the data were distributed in the usual way. The "Independent Samples *t*-test" for normally distributed data examined the two groups' differences. The Mann-Whitney U test was used to see how different two separate groups were from each other. When conducting the correlation analysis between the eating attitude test, the Dutch eating behavior scale sub-dimensions, body mass index, and the food addiction scale scores, the Pearson's

or Spearman's correlation test were utilized depending on the circumstances. Multiple linear regression analysis of factors affecting food addiction model 1 and model 2 were performed[17]. After removing all confounding factors, model 1 and model 2 were created. A *p*-value <0.05 was determined to indicate statistical significance.

Results

The general demographic characteristics of the individuals are shown in Table I. In this study, in which individuals at risk of anorexia nervosa were examined, 62.03% were females, and the mean age was 25.21±4.33 years. It was determined that 81.27% of the individuals were between the ages of 18-25, and the mean BMI value was 22.25±3.48 kg/cm². 35.70% of the individuals participating in the study were overweight or obese, 23.80% were actively working, 50.89% had undergraduate education, 9.87% had a disease diagnosed by a doctor, and 52.15% had a smoking habit. It was determined that 72.91% of them had an average monthly income of 1,000 TL or less. It has been observed that the number of daily meals was one or two meals in 83.04% of the individuals. It was found that the frequently skipped meal was breakfast, and the habit of doing regular physical activity was 33.92%.

According to the eating attitude test results conducted on individuals, the relationship between the risk of AN and food addiction is detailed in Table II. The research discovered that 8.35% of people with both AN risk and food addiction made up 19.75% of the total population with food addiction (*p*=0.023). The distribution of the scores of the individuals, according to the AN risk and according to the sub-dimensions of the DEBQ scores, was examined. It was observed that the risk of AN decreased as the external eating score of the individuals decreased. It was discovered that the group with the highest risk for AN also had the highest score for emotional eating (*p*=0.029).

It was found that the eating attitude test and the DEBQ scale subgroups had a positive and statistically significant relationship. The age of the individuals and their restrictive eating behavior were found to be positively and significantly correlated (*p*<0.05). BMI and monthly income were positively correlated (*p*<0.05). An increase in BMI is correlated with an increase in monthly income (Table III).

Table I. General characteristics of the individuals participating in the study.

Gender	n	%
Woman	245	62.03
Male	150	37.97
Age (years) (x±SD)	25.21±4.33	
Age range		
18-25 years old	321	81.27
25-30 years	55	13.92
30 and 35 years	19	4.81
BMI (kg/cm^2) (X±SD)	22.25 ± 3.48	
Weight status		
Underweight	33	8.86
Normal weight	221	55.94
Overweight/obese	141	35.70
Working status		
Yes	94	23.80
No	301	76.20
Course of degree		
Associate degree	140	35.44
License	201	50.89
Degree	30	7.59
Doctorate	24	6.08
Diagnosed disease		
Yes	39	9.87
No	356	90.13
Smoking habit		
Yes	206	52.15
No	150	37.97
Quit	39	9.87
Monthly income		
1,000 TL and below	288	72.91
1,000-2,000 TL	65	16.46
3,000 TL and above	42	10.63
Number of meals per day		
One meal	107	27.09
Two meals	221	55.95
Three meals	67	16.96
Frequently skipped meals		
Breakfast	188	47.59
Noon	103	26.08
evening	104	26.33
Regular physical activity		
Yes	134	33.92
No	261	66.08
The mean duration of physical activity per week		
0-30 minutes	24	6.08
30-60 minutes	62	15.70
60-90 minutes	25	6.33
Over 90 minutes	23	5.82

x±SD=mean; SD=standard deviation; n=number of participants; %=relative frequency.

The eating attitude test-40 score was predicted using multiple linear regression analysis models based on The Yale Food Addiction Scale score (food addiction), DEBQ subscales, gender, and BMI results (Table IV). It was discovered that Model 1's additional variables, such as gender, restricted eating, age, and food addiction scale scores, were significant predictors of the eating attitude test-40 score [F (248.077), $p<0.001$]. The four factors in the model can account for 76% of the variation in the food addiction score.

In the second model, emotional eating behavior, gender, and BMI were found to be effective on eating attitude [F (241.122), $p<0.001$]. It was observed that three factors (BMI, gender, and emotional eating score) added to the model could explain the change by 57% in the food addiction score.

Discussion

In this study, the rate of students with an eating disorder at risk of anorexia nervosa (EAT≥20) was found to be 8.5%. Similar studies[18,19] conducted among university students in the USA showed that the rate of individuals at risk of anorexia nervosa was between 9% and 15%. According to a similar study conducted in Romania, the rate of individuals with an EAT-26 >20 points was found to be 7% [20]. In another study[21] of university students in China, the rate of individuals with an EAT-26>20 points was found to be 4.5%. (Please, clearly explain the results obtained by these two studies).

The wide variety of positive EAT scores represents how the incidence of eating disorders varies significantly among college students in various parts of the world due to differences in geographic location. The currently available evidence[22] does not suggest that more developed countries have higher rates of disordered eating behavior than other countries. This is because the prevalence of disordered eating behavior among university students ranges from 9% to 20.5% in Western countries and from 4.5% to 23% in Eastern countries[23]. The EAT-26 was utilized as a measurement method in all of the studies. Because EAT-26 scores were highly correlated with AN symptoms, and the questionnaire showed a high level of reliability[24]. The proportion of individuals found to be at high risk of AN in this study was comparable to that found in other studies[21,25,26]. Patients who follow a restrictive eating pattern typically avoid high-caloric and high-palatable foods.

Table II. The relationship between eating attitude test and food addiction and DEBQ subscales scores of individuals according to AN risk.

		The Eating Attitude Test-40- AN risk				p^a
		High risk for AN n=67	Medium risk for AN n=110	Low risk for AN n=218	N (%)	
The Yale Food Addiction Scale, Version 2.0, with some changes (mYFAS 2.0)	No Food Addiction	**33 (8.35)**	88 (22.28)	196 (49.62)	317 (80.25)	**0.023**
	Food Addiction	**34 (8.60)**	22 (5.56)	22 (5.57)	**78 (19.75)**	
Questionnaire on Dutch Eating Behavior (DEBQ)	DEBQ subscales					p^b
	External eating	34.22±4.01	33.47±7.47	30.90±8.16		0.389
	Restrained eating	28.45±7.29	25.29±8.32	29.96±5.45		0.193
	Emotional	43.31±12.86	37.19±13.57	24.43±6.48		**0.029**

p^a: Pearson's Chi square, p^b: Kruskall-Wallis H Test.

Table III. Correlation analysis of factors associated with the Eating Attitude Test-40.

	EAT-40	External eating	Restrained eating	Emotional eating	Age	BMI	Monthly income
EAT-40	1						
External eating	0.641**	1					
Restrained eating	0.324*	0.238*	1				
Emotional eating	0.455**	0.244*	0.098	1			
Age	0.146	0.156	0.239*	0.141	1		
BMI	0.351*	0.249*	0.186	0.327**	0.059	1	
Monthly income	0.104	0.157	0.045	0.109	0.047	0.391*	1

BMI: Body Mass Index, EAT-40: Eating Attitude Test. p: Spearman's correlation value. *$p<0.05$, **$p<0.001$

Table IV. Multiple linear regression analysis of individuals with Eating Attitude Test-40 according to the Yale Food Addiction Scale, subscale of Dutch Eating Behavior Scales with some changes.

	B	Beta	p	R	R²	F	p	95% CI	
Model 1				**0.876**	**0.767**	**248.077**	**0.001**		
Gender (Female)	1.150	.308	0.001					1.004	1.201
Restrained eating score	1.835	.128	0.004					1.047	2.190
The Yale Food Addiction Scale score	1.901	.780	0.031					0.990	1.766
Age (year)	1.048	.485	0.002					0.861	1.233
Monthly income (TL)	1.128	.961	0.004					1.005	1.458
Model 2				**0.755**	**0.570**	**241.122**	**0.001**		
Emotional eating score	-1.095	-.346	0.001					0.716	1.412
Gender (ref. Woman)	0.579	.207	0.038					1.025	1.815
BMI (kg/cm²)	1.394	.269	0.045					0.901	1.542

BMI: Body Mass Index.

However, it is still being determined why these patients met the criteria for food addiction. Prior research[27] has pondered how AN patients might interpret YFAS questions and how their responses might be influenced more by their perceived impulses to food than by their actual intake.

When the eating habits of college students were compared, there was no difference between nutrition departments, health departments that did not deal with nutrition, and other departments. Also, there were no differences between the academic sections of the EAT-26 subscales (dietary restriction, binge eating behavior, and oral control level) or the TFEQ-R18 subscales (cognitive restriction, loss of control, and emotional eating)[28,29]. In this study, each person's level of education was observed. People with more education are less likely to have AN and be addicted to food. Nevertheless, the high rates of diet restriction among first-year college students were likely balanced out by healthy ways to control weight or healthier food choices, and they did not always turn into eating disorders in later years. Studies[30,31] related to this found that students who did well in school had lower dietary restriction scores.

The Eating Disorder Examination Questionnaire (EDE-Q) was used in the study by Linardon et al[32] to categorize as "probable binge eating disorder (BED) cases", and the prevalence of food addiction (FA) was discovered to be 42.3%. According to DSM-5 criteria, El Archi et al[28] examined FA and cravings in a sample of patients at high risk for eating disorder (ED) and discovered that FA prevalence was higher than AN and BED in the group at risk for bulimia nervosa (BN). In addition, Hauck et al[33] examined the relationship between food addiction and disordered eating in a sample of German amateur endurance athletes. It computed the likelihood of FA as determined by the YFAS. The risk was found to be higher in people with food and exercise addiction, at 14.1% and 15.3%, respectively. Individuals' weekly exercise durations were examined in this study. It has been noted that few people have the habit of engaging in regular physical activity. Smoking addiction is thought to be accompanied by eating disorders, such as food addiction. In this study, it was found that 52.15% of the participants had a cigarette addiction.

In another study[34], 10% of university students had a high risk of AN. In other studies[35,36] conducted with university students, 11.5% of participants were found to be at high risk of AN, 7% of participants were found to be at high risk of AN, and 16% of undergraduate students were diagnosed with an eating disorder, with the majority of them being women. This latter finding could be explained by the fact that women are more likely to have eating disorders due to their strong desire to lose weight and media-induced dissatisfaction with their bodies[28]. Individuals' AN risk was determined to be 16.95% in this study. It was discovered that the risk of AN increased as these individuals' emotional eating scores increased.

In a study[37] of young teens, the number of women with high YFAS scores was higher (24.8%) than that of men (16.2%). In the past, women were more likely than men to be addicted to food[38-40]. But some studies[29,41] show that there is no statistically significant link between food addiction and gender. Generally, women are more likely to be addicted to food than men. This could be because men and women have different hormone levels and dietary preferences[42].

In this study, it was found that the risk for AN may be connected to food addiction. It was found that people with high EAT-26 scores also had high YFAS scores. People with a high EAT-26 score also had high scores for emotional eating. People can become more interested in food when their emotional state changes. People develop problems like AN after a certain amount of time because they overeat food when they do not want to. So, having a high YFAS score was linked to a higher risk of AN[43]. Other similar studies[44-46] have found the same things. So, it can be said that the risk of an eating disorder can lead to the risk of food addiction and *vice versa*[47].

This study discovered a positive and statistically significant relationship between EAT-26 and YFAS score and BMI. It was discovered that a person's likelihood of developing AN was directly related to a person's level of food addiction. This study observed that individuals with a high BMI have a higher risk of AN and food addiction. According to one study[48], people with a high YFAS score had a higher BMI, waist circumference, and hip circumference than people with a low YFAS score. The body mass index (BMI), total body weight, and YFAS scores were all positively correlated. As a result, the risk of developing a food addiction rises along with an individual's BMI and overall body weight. Obese participants had the highest YFAS scores, while normal-weight participants had the lowest scores. These findings are based on the BMI classification. Another study[49] found a similar pattern, with YFAS scores increasing with increases in BMI and total body weight. Several additional studies[43,50] on this topic have found a link between body weight and food addiction, as well as a link between BMI and food addiction. Both of these connections were discovered to be statistically significant. Further-

more, other studies[51] have shown that the vast majority of people who are addicted to food are either overweight or obese. Because of the behavioral and neurobiological similarities between binge eating episodes and food addiction, it is reasonable to assume that obesity is caused by food addiction. Furthermore, obesity is unavoidable because addictive foods are typically high in fat and sugar and have a high energy density. Furthermore, one study[50] found that increased food addiction behaviors were associated with increased overeating, depression, and anxiety in obese people. Schulte and Gearhardt[52] investigated the prevalence of an association between food addiction and obesity, as well as demographic factors, in a sample intended to be representative of the United States of America. People with low body weight (45.65%) or obese (19.26%) had higher levels of food addiction, while people with normal (12.16%) or high body weights (10%) had lower levels of food addiction. Food addiction was found to correlate positively with factors such as age, body mass index (BMI), being female, white, and having a low income. The authors[53] hypothesized that the link between FA and problematic eating behavior could be associated with various phenotypes other than obesity.

Changes in the emotional state carry a number of risks. It has been discovered that feelings significantly impact diet decisions, and there is some evidence[54] to suggest that depressed people may consume a different diet than non-depressed people. Cravings are reported by up to 97% of women and 68% of men, according to Weingarten and Elston[55] (1991). Furthermore, it has been discovered[54] that depressed people may have cravings or an urge to seek out and consume certain foods that differ from those experienced by non-depressed people.

Limitations

There are some limitations in this study. The fact that the study was conducted only on university students limits its generalizability. The fact that it is a cross-sectional study limits the causality explanation.

Conclusions

The findings of this study demonstrated that there is a positive correlation between food addiction and the risk of eating disorders as well as BMI and that women are more likely than men to suffer from anorexia nervosa as well as food addiction. This study's findings are significant because they educate young adults about the prevalence of the risk of food addiction and disordered eating behaviors and the relationship between these factors and obesity. Finally, the data collection tools used in this study are dependable, simple, and applicable when applied to young adults.

ORCID ID
Ozgür Aytaş: 0000-0003-0809-2264
Hacer Alataş: 0000-0002-6441-0362

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