



Food Choice, Eating Behaviors, and Associations with Depression Levels and Body Mass Index: A Cross-Sectional Study

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Abstract

Background: Depression is not only a mental health condition, but also a complex disorder that affects eating behaviors and food choices, leading to changes in body weight. This study aimed to evaluate the relationship between body mass index, eating behaviors, food choices, and depression levels in adults.

Methods: This cross-sectional study conducted in Istanbul from Apr to Jun 2022 included 208 adults aged 18 to 65 yr (mean 30.84 ± 9.21 yr). A questionnaire consisting of sociodemographic information, Food Choice Questionnaire (FCQ), Dutch Eating Behavior Questionnaire (DEBQ) and Beck Depression Inventory (BDI) was applied. Height and body weight were measured.

Results: Of the participants were 9.6% underweight, 48.1% normal, 30.8% overweight, and 11.5% obese. Underweight individuals had significantly lower weight control scores compared to normal and overweight, and their restrictive eating scores were significantly lower than those of normal, overweight, and obese ($P=0.001$). Compliance scores affecting food choice were significantly lower in individuals with minimal depression than in those with mild and moderate depression ($P=0.018$). Emotional and external eating were higher in moderately depressed individuals than in those with minimal depression ($P=0.001$; $P=0.018$, respectively). Restrictive eating was significantly lower in individuals with minimal depression than in those with moderate and severe ($P<0.001$). Mood, appropriateness, natural content, weight control, and ethical concern affecting food choice were associated with eating behaviors ($P<0.05$).

Conclusion: Body weight and depression levels were important factors in food choice and eating behaviors in adults. Our findings emphasize the importance of considering eating behaviors and depression levels in individuals' food choice motivations.

Keywords: Body mass index; Food choice; Depression; Emotional eating; Obesity

Introduction

Nutrition involves the use of nutrients for growth, health, and development, from conception to death, affecting both physical needs and emotional well-being (1, 2). Food choice is a determinant factor affecting individuals' perceptions

and attitudes toward nutrition. Food choice is a conscious or unconscious preference for food during food purchase and consumption; it involves a complex interaction of many social, environmental, and individual factors (3). Food



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choice and emotional eating, one of the eating attitude behaviors, closely affect the depression state (4).

Emotional eating is defined as eating behavior in response to emotional states, especially negative emotions, without following internal hunger cues (5). Emotional eating stems from using food to manage negative emotions or mistaking emotional cues for hunger and satiety (6). Emotions and food intake are interconnected, and emotional states are known to influence food choices in the quantity and quality of food intake (7). Emotional eating behaviors have been reported to contribute to a greater preference for foods with high energy and fat content in individuals, leading to an increase in body mass index (BMI) levels (8). External cues, like food sights or smells, can also trigger overeating (external eating). Emotional and external eating can lead to guilt and shame, potentially causing restrictive eating behaviors in response. Individuals may restrict food intake in the following days to compensate for overeating, creating an unhealthy cycle (9).

Depression is a severe mental disorder that affects more than 264 million people worldwide and represents a type of negative emotion or mood that can trigger food intake by stimulating emotional eating. Research has shown that eating behavior and depression are positively related (10). While individuals with high depressive symptoms report higher emotional eating behavior, it has been shown that depressed individuals tend to prefer foods with high sugar content, which leads to increased body weight (11). Negative emotional states can reduce an individual's ability to control himself while eating, which can lead individuals to choose unhealthy foods (12). As a result, psychological and physiological problems such as obesity, eating disorders, and hormonal problems may arise (13). This study aimed to evaluate the relationship between body mass index and eating behavior, food choice, and depression in adults. It will also contribute to the literature as it is one of the few studies examining the relationship between depression and food choice.

Materials and Methods

Study Design and Sample

This cross-sectional study was conducted in Istanbul Province of Türkiye between Apr and Jun 2022, with random selected adult volunteers. Participants aged 18 and over and residing in Istanbul were included, and those with food allergies, psychiatric disorders, antidepressant medication use and special nutritional needs were excluded from the study. The sample size was determined as at least 186 for 80% power, with $\alpha:0.05$ and $1-\beta:0.95$, using G*Power 3.1.9.4. To enhance reliability, the sample size was increased to 208 individuals for the study's completion.

Data Collection Methods

A questionnaire form, Food Choice Questionnaire (FCQ), Dutch Eating Behavior Questionnaire (DEBQ), and Beck Depression Inventory (BDI) were applied as data collection.

The Survey Form, was prepared by the researcher and information regarding the sociodemographic characteristics of the participants was questioned.

Anthropometric measurements: Height (cm) and body weight (kg) were measured in accordance with anthropometric measurement standards (14).

Body Mass Index (BMI) was calculated using the World Health Organization (WHO) formula (15).

The Food Choice Test (FCQ), developed by Steptoe et al. (16) and validated in Turkish by Dikmen et al. (17), was administered. It comprises 36 items on a 4-point Likert scale, assessing intrinsic and extrinsic motivations behind food choices across nine domains: health, mood, convenience, sensory appeal, natural ingredients, price, weight control, similarity, and ethical concerns.

The Dutch Eating Behavior Test (DEBQ), developed by Van Strein et al. (18) and validated in Turkish by Bozan (19), consists of 33 items assessing restrictive, emotional, and external eating behaviors. Responses are recorded on a 5-point Likert scale, with higher scores indicating more negative eating behaviors.

The Beck Depression Inventory (BDI), developed by Beck et al. (20) and adapted into Turkish by Hisli

(21), was utilized to measure depression levels. It comprises 21 items evaluated on a 4-point Likert scale, with a total score range of 0-63 points. Depressive symptoms are categorized into minimal, mild, moderate, and severe levels based on score ranges.

Ethical Approval

The ethics approval was obtained from the Human Research Ethics Committee of Istanbul Bilgi University (Approval No: 2022-20034-50, Date: 25.03.2022). A voluntary informed consent form was obtained from volunteers.

Statistical Analysis

Data were analyzed using SPSS (ver. 28.0, (IBM Corp., Armonk, NY, USA). Categorical variables are presented as number (n) and percentage (%). Normality was assessed with the Kolmogorov-Smirnov test. Descriptive statistics are mean and standard deviation (SD) for normally distributed data; and median and interquartile range (IQR) for non-normal data. Chi-square tests assessed

group differences in categorical variables. One-way ANOVA or Kruskal-Wallis tests compared means between groups, with post-hoc Tukey or Games-Howell tests for pairwise comparisons. Spearman's or Pearson's correlation analyzed relationships between numerical variables. A 95% confidence interval and $P < 0.05$ significance level was used.

Results

Among study participants, 72.1% were female, 48.1% were married, and 49% had university education. Their average age, weight, and height were 30.84 ± 9.71 yr, 66.50 ± 18.00 kg, and 167.00 ± 9.25 cm, respectively. The mean BMI was 24.58 ± 1.04 kg/m². BMI categories included 9.6% underweight, 48.1% normal, 30.8% overweight, and 11.5% obese. There were correlations between gender, marital status, education, and BMI ($P < 0.049$; $P < 0.001$; $P < 0.001$, respectively) (Table 1).

Table 1: Participants characteristics

Characteristics	BMI Category					P
	Underweight ^a (n=20)	Normal ^a (n=100)	Overweight ^a (n=64)	Obese ^a (n=24)	Total ^b (n=208)	
Age (year \pm SD)	24.00 \pm 4.57 ^{abc}	28.70 \pm 8.36 ^{ade}	34.78 \pm 11.00 ^{bd}	34.92 \pm 8.84 ^{ce}	30.84 \pm 9.71	<0.001 [‡]
Body weight (kg)	45.00[6.00] ^{abc}	61.50[14.00] ^a	74.50[14.00] ^b	90.00[25.00] ^c	66.50[21.00]	<0.001 [‡]
Height (cm)	164.40 \pm 6.97	168.00 \pm 8.27	166.58 \pm 10.05	167.54 \pm 12.18	167.16 \pm 9.25	0.410 [‡]
Gender						
Female	19 (12.7)	74 (49.3)	41 (27.3)	16 (10.7)	150 (72.1)	0.049 ^{††}
Male	1 (1.7)	26 (44.8)	23 (39.7)	8 (13.8)	58 (27.9)	
Marital status						
Married	3 (3.0)	34 (34.0)	43 (43.0)	20 (20.0)	100 (48.1)	<0.001 ^{††}
Single	17 (15.7)	66 (61.1)	21 (19.4)	4 (3.7)	108 (51.9)	
Educational Status						
Primary school	5 (16.7)	21 (70.0)	4 (13.3)	-	30 (14.4)	<0.001 ^{††}
High school	4 (8.5)	14 (29.8)	20 (42.6)	9 (19.1)	47 (22.6)	
University	10 (9.8)	59 (57.8)	24 (23.5)	9 (8.8)	102 (49.0)	
Postgraduate	1 (3.4)	6 (20.7)	16 (55.2)	6 (20.7)	29 (13.9)	

$P < 0.05$, ^aPercentage of rows taken; ^bThe percentage of milk was taken, [‡]Kruskal-Wallis Analysis, [†]Analysis of variance, a-e: The difference between the groups shown with the same superscript in the same row is statistically significant, ^{††}chi-square test (if $n < 5$, fisher's exact test), Arithmetic Mean \pm Standard Deviation, Median [Interquartile Range], number (percentage).

Median weight control sub-dimension score of food choice test was 1.50[0.67] for underweight individuals and 2.00[0.33] for normal weight in-

dividuals ($P = 0.001$). Median scores for restrictive, emotional, and external eating behaviors were 2.70[1.30], 2.19[2.08], and 3.00[1.28], respectively.

Thin individuals had lower restrictive eating scores (1.89 ± 0.73) than normal (2.77 ± 0.91), overweight (2.80 ± 0.76), and obese (2.99 ± 1.01) individuals ($P < 0.001$). Mean BDI score was

12.6 ± 8.47 , with no significant difference between BMI ($P > 0.05$) (Table 2).

Table 2: Scale Scores According to Body Mass Index Category

BMI Category						
	Underweight (n=20)	Normal (n=100)	Overweight (n=64)	Obese (n=24)	Total (n=208)	p
FCQ						
Health	1.91 [0.33]	2.00[0.17]	2.00[0.17]	1.91[0.67]	2.00[0.17]	0.129†
Mood	2.00[0.17]	2.00[0.33]	2.00[0.33]	2.00[0.50]	2.00[0.33]	0.475†
Convenience	2.00[0.25]	2.00[0.20]	2.00[0.20]	2.00[0.40]	2.00[0.20]	0.661†
Sensory Appeal	2.00[0.00]	2.00[0.00]	2.00[0.25]	2.00[0.50]	2.00[0.25]	0.166†
Natural Content	2.00[0.00]	2.00[0.00]	2.00[0.25]	2.00[0.33]	2.00[0.00]	0.478†
Price	2.00[0.25]	2.00[0.00]	2.00[0.00]	2.00[0.33]	2.00[0.33]	0.208†
Weight Control	1.50[0.67] ^{ab}	2.00[0.33] ^a	2.00[0.25] ^b	2.00[0.58]	2.00[0.33]	0.001†
Familiar	1.66[0.33]	2.00[0.33]	2.00[0.33]	2.00[0.67]	2.00[0.33]	0.121†
Ethical Concern	2.30±0.85	2.35±0.87	2.49±1.08	2.19±1.01	1.70±0.36	0.645‡
DEBQ						
Restrained Eating	1.89±0.73 ^{abc}	2.77±0.91 ^a	2.80±0.76 ^b	2.99±1.01 ^c	2.70[1.30]	<0.001‡
Emotional Eating	1.88[1.67]	2.03[2.15]	2.07[1.54]	3.26[2.65]	2.19[2.08]	0.084†
External Eating	3.00±0.75	3.17±0.86	2.96±0.79	3.25±1.00	2.99±0.84	0.204‡
DEBQ-Total						
BDI	13.10±6.87	12.16±8.28	12.37±8.36	15.37±10.52	12.69±8.47	0.531‡

$P < 0.05$, †Kruskal-Wallis Analysis, ‡Analysis of variance, a-c: The difference between the groups shown with the same superscript in the same row is statistically significant, Arithmetic Mean±Standard Deviation, BMI: Body Mass Index, Median [Interquartile Range], FCQ: Food Choice Questionnaire, DEBQ: Dutch Eating Behaviour Questionnaire, BDI: Beck Depression Inventory

Food choice subscale appropriateness score was significantly lower in minimal depression individuals (2.54 ± 0.81) compared to mild (2.81 ± 0.76) and moderate (2.89 ± 0.82) depression ($P = 0.018$). Mean restrictive eating behavior score was lower in mild depression (2.40 ± 0.81) compared to moderate (2.93 ± 0.95) and severe (3.43 ± 0.83)

depression ($P < 0.001$). Emotional eating behavior mean score was 2.17 ± 1.14 in minimal depression and 2.96 ± 1.42 in moderate depression ($P = 0.001$). Mean external eating behavior score was lower in minimal depression (2.92 ± 0.76) than moderate depression (3.35 ± 0.92) ($P = 0.018$) (Table 3).

Table 3: Scale Scores According to Depression Levels

Depression Levels					
	Minimal (n=89)	Mild (n=59)	Moderate (n=35)	Severe (n=25)	P
FCQ					
Health	2.00[0.17]	2.00[0.33]	2.00[0.17]	2.00[0.00]	0.753†
Mood	2.00[0.42]	2.00[0.33]	2.00[0.17]	2.00[0.67]	0.475†
Convenience	2.54±0.81 ^{ab}	2.81±0.76 ^a	2.89±0.82 ^b	2.83±0.88	0.018†
Sensory Appeal	2.00[0.13]	2.00[0.00]	2.00[0.13]	2.00[0.33]	0.337†
Natural Content	2.00[0.00]	2.00[0.00]	2.00[0.33]	2.00[0.33]	0.324†
Price	2.00[0.33]	2.00[0.33]	2.00[0.00]	2.00[0.33]	0.123†
Weight Control	2.00[0.33]	2.00[0.67]	2.00[0.33]	2.00[0.00]	0.267†
Familiar	2.00[0.33]	2.00[0.33]	2.00[0.33]	1.66[0.33]	0.355†
Ethical Concern	2.41±0.92	2.35±0.97	2.31±0.98	2.42±1.07	0.817‡
DEBQ					
Restrained Eating	2.72±0.86	2.40±0.81 ^{ab}	2.93±0.95 ^a	3.43±0.83 ^b	<0.001‡
Emotional Eating	2.17±1.14 ^a	2.40±1.11	2.96±1.42 ^a	3.16±1.49	0.001‡
External Eating	2.92±0.76 ^a	3.11±0.86	3.35±0.92 ^a	3.38±0.75	0.018‡

$P<0.05$, Median [Interquartile Range], †Kruskal-Wallis Analysis, ‡Analysis of variance, a-b: The difference between the groups shown with the same superscript in the same row is statistically significant, Arithmetic Mean± Standard Deviation, FCQ: Food Choice Questionnaire, DEBQ: Dutch Eating Behaviour Questionnaire, BDI: Beck Depression Inventory

There were correlations between restrictive eating behavior and health, mood, and ethical concern (r : 0.250, r : 0.155, r : 0.166, respectively) and a moderate correlation with weight control (r : 0.430) ($P<0.05$). Emotional eating behavior had low positive correlations with mood and appropriateness (r : 0.262, r : 0.142) ($P<0.05$). External eating behavior had low significant correlations

with appropriateness and mood (r : 0.142, r : 0.228) ($P<0.05$). There was a low negative correlation between natural ingredients and external eating behavior (r : -0.153; $P<0.05$). BDI scores correlated positively with restrictive, emotional, and external eating behaviors (r : 0.162; r : 0.287; r : 0.242; $P<0.05$) (Table 4).

Table 4: Interscale Correlations

DEBQ						
Variable	Restrained Eating		Emotional Eating		External Eating	
	r	P	r	P	r	P
FCQ						
Health	0.250	<0.001†	0.058	0.409	0.062	0.375
Mood	0.155	0.025 ‡	0.262	<0.001‡	0.228	<0.001‡
Convenience	-0.045	0.519	0.142	0.041‡	0.142	0.040‡
Sensory Appeal	0.048	0.488	0.066	0.345	0.125	0.072
Natural Content	0.079	0.257	-0.086	0.219	-0.153	0.027†
Price	-0.025	0.716	0.117	0.092	0.053	0.444
Weight Control	0.430	<0.001‡	0.122	0.079	-0.054	0.440
Familiar	0.118	0.090	0.074	0.286	0.010	0.882
Ethical Concern	0.166	0.017‡	0.023	0.746	-0.033	0.638
BDI	0.162	0.019‡	0.287	<0.001‡	0.242	<0.001‡

$P<0.05$, †Spearman Correlation Analysis, ‡ Pearson Correlation Analysis, FCQ: Food Choice Questionnaire, DEBQ: Dutch Eating Behaviour Questionnaire, BDI: Beck Depression Inventory

Discussion

Emotional, external, or restrictive eating behaviors are a broad concept that can cause problems such as obesity and eating disorders by affecting food choices and diet motivations in individuals (22). The concept of emotional eating refers to the tendency of food intake in response to negative emotions such as anxiety, depression, and stress (23). Emotional hunger occurs only in response to affect, thus influencing individuals' food choice preferences (5). This study was conducted with 208 volunteer individuals with a mean age of 30.84 ± 9.21 yr to evaluate the relationship between eating behavior, food choice, and depression in adult individuals in different BMI classes.

Body weight is associated with a preference for foods with high energy density (24). In Poland, a study in adults with an average BMI of 25.6 ± 4.7 kg/m², the mean scores of health, mood, convenience, sensory appeal, natural ingredients, price, weight control, familiarity, and ethical issues from the FCQ subscales were also similar to our study (25). In another study, the median values of price, sensory appeal, convenience, mood, health, familiarity, natural content, ethical concerns, and weight control scores of individuals with 67.2% normal body weight in food selection were 4.30, 4.25, 4.20, 4.17, 4.00, 4.00, 4.00, 3.67, 3.67, 3.53, respectively. The relationship between FCQ sub-dimension sensory appeal and BMI was found to be low-level negative, and significance was determined (26). In this study, the median weight control score of the FCQ sub-dimension was lower in underweight individuals than in normal and overweight individuals. No significant difference was found between normal, overweight, or obese individuals according to body weight classification. In a different study conducted in adults, no significance was found between the food choice test sub-dimensions and BMI classes (27). When the scientific literature is examined, the results of the studies examining the relationship between BMI and FCQ sub-dimensions

differ. The reason for this situation is the presence of individual and environmental confounding factors such as age, gender, and psychological status that affect the food choices of individuals.

For obese individuals, food may become a coping mechanism to suppress hunger and emotional stress, learned through past experiences (28). In our study, the mean restrictive eating scores of underweight individuals were lower than those of normal, overweight, and obese individuals. In addition, although the emotional and externalizing eating scores of obese individuals were higher than the others, it was not statistically significant. Similar to our study, in a study in which emotional and external eating attitudes of Algerian adults were examined with DEBQ, obese individuals had more emotional and external eating behaviors than normal individuals, and as a result of the study, emotional and external eating was shown to be effective on BMI (29). In a study examining the relationship between eating behaviors and BMI, the mean scores of emotional eating and restrictive eating behaviors of obese individuals were found to be higher than those of individuals with normal body weight (9). There are many studies showing that individuals with normal body weight and obese individuals have high emotional and restrictive eating scores in response to negative emotions (2, 30). In our study, although emotional eating scores increased as body weight increased, this relationship was not found to be statistically significant. Similarly, in a study conducted with 721 female and 750 male participants, in both genders, obese and overweight individuals had higher restrictive and emotional eating behaviors compared to normal and lean individuals (31). However, in the same study, lean and normal-weight individuals were found to have lower extrinsic eating behavior compared to obese and overweight individuals.

Depression not only reduces quality of life and motivation, but also disrupts food choices, potentially contributing to obesity (32). In a study conducted with 203 individuals aged 20-64 yr with major depression, there was a low positive

correlation between the duration of depression and FCQ score (33). In our study, no relationship was found between the sub-dimensions of the food choice test and depression levels. Similarly, this is related to the fact that the depression level of the individuals participating in our study was found to be minimal.

Emotional eating may result from various mechanisms, such as food intake to cope with negative emotions or confusing emotional hunger with physiological changes (6). In this study, restrictive, external, and emotional eating behaviors of individuals with minimal depression were found to be lower than individuals with moderate and severe depression. Emotional eating behaviors increase depressed mood (34). Goldschmidt et al. (35) investigated the effect of depression on emotional eating in obese individuals, and at the end of the study, individuals with high depressive symptoms showed more emotional eating behaviors. In a study in which 85 female individuals with negative and normal moods were included, no relationship was found between restrictive, emotional, and external eating behaviors from the DEBQ sub-dimensions and mood (36).

There was a low level of positive relationship between the restrictive eating behavior of the individuals participating in our study and the sub-dimensions of health, mood, and ethical anxiety from the food choice test, and a moderate statistically significant positive relationship with weight control. In one study, a positive relationship was found between mood and restrictive eating behavior, but this relationship was not statistically significant (37). The young adults who participated in the study consciously showed restricted eating behaviors in response to health, mood, ethical concerns, or weight control thoughts.

A low-level positive relationship was found between emotional eating behavior and mood and convenience, which are sub-dimensions of the food choice test. Similar to the results of our study, a study involving 800 individuals showed that the relationship between emotional eating and mood, convenience, price, and familiarity was significant (4). Convenience, one of the sub-dimensions of the food choice test, measures

easy accessibility to food. Individuals who experience emotional eating attacks are expected to prefer foods that they can easily access. In a study (38), individuals with emotional eating behavior consumed more snacks and fast-food foods. As a result of a study examining the stress level and emotional eating behaviors of university students during the COVID-19 pandemic, individuals who showed emotional eating behavior under high stress had easily accessible food preferences such as candy, cake, cookies (39).

The relationship between the BDI score and restrictive, emotional, and external eating behaviors of the individuals were found to be low-level positive. Similar to our study, a moderate positive correlation was found between the BDI score and emotional eating and a weak positive correlation with externalizing eating in 127 obese adults (40). In a study of 442 morbid obese individuals were found between depression and emotional eating at a moderate positive level, with restrictive eating at a weak negative level and with external eating at a weak positive level (41).

Our study has limitations. The sample predominantly comprised females and individuals with higher education levels, potentially limiting generalizability to the broader Turkish population. Moreover, most participants were either normal or overweight, with minimal representation from underweight and obese individuals. The low prevalence of severe depression might restrict generalizability to populations with higher depression rates. Future research should aim for a more diverse sample, encompassing broader demographics and varying degrees of depression severity.

Conclusion

Obesity and depression are significant health threats, with their prevalence rising steadily. Emotional eating often arises in cases of anxiety, depression, and stress, impacting individuals' food choices and overall health. Both depression and emotional eating influence individuals' dietary habits, contributing to weight gain or loss.

Our study found that individuals with minimal depression exhibited fewer restrictive emotional and external eating behaviors compared to those with moderate depression. Furthermore, individuals with mild depression displayed fewer restrictive eating behaviors than those with moderate or severe depression. Additionally, there was a positive correlation between depression scores and eating behaviors. Negative emotional states, such as depression, can impair an individual's ability to control their eating habits, leading to unhealthy food choices. To address this, awareness programs and guidance strategies should be developed to enhance problem-solving and coping skills among individuals with depressive symptoms. Increasing awareness of emotional eating may offer a novel perspective for psychological and obesity treatments.

Journalism Ethics considerations

Ethical issues (Including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by the authors.

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Conflict of Interest

The authors have no conflicts of interest to declare.

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