

A Study on the Role of Eating Attitudes and Depression on Dietary Inflammatory Index: Cross-Sectional Study

Yeme Tutumu ve Depresyonun Diyet İnflamatuar İndeksi Üzerindeki Rolü Üzerine Bir Çalışma: Kesitsel Çalışma

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This research is derived from a master thesis.

ABSTRACT Objective: It was aimed to investigate the relationship between the eating behavior disorder and depression risks of adults and the inflammatory load of the diet. **Material and Methods:** This cross-sectional study was conducted during the lockdown period for the coronavirus disease-2019 pandemic- September 2020 and April 2021. Power analysis required to calculate the size of the sample number to participate in the study was performed with G*POWER 3.1 version. Effect size was taken as $1-\beta=0.95$, and statistical significance was taken as $p<0.05$. As a result of the power analysis, it was determined that 176 samples were needed. In the current study, sufficient participation was achieved with a sample of 200. Participants depression risk were examined by using the CES-Depression Scale and eating attitudes were determined by the Eating Attitude Test via online questionnaire. Three-day food consumption records of the participants were taken with the food consumption record form sent to their e-mail addresses. The results were analyzed in the BeBiS program and then Diet Inflammatory Index (DII) scores were calculated. SPSS version 25.0 was used for statistical analysis. **Results:** DII scores of individuals ranged from -0.7 to 5.85. A negative correlation between the bodyweight of the individuals and the DII score has been observed. On the other hand, no correlation was found between eating attitude, depression, and DII score. **Conclusion:** We found that having low body weight is negatively correlated with DII. We found no correlation between eating attitude, depression, and DII score. Considering that the increase in the DII score is associated with many chronic diseases, it is thought that an increase in studies to understand the factors affecting DII score will contribute to the literature in terms of suggesting solutions.

Keywords: Eating; attitude; depression; inflammation

ÖZET Amaç: Bireylerdeki yeme davranış bozukluğu ve depresyon riskinin diyetin inflammatuar yükü ile arasındaki ilişkinin araştırılması amaçlanmıştır. **Gereç ve Yöntemler:** Bu kesitsel çalışma, koronavirüs hastalığı-2019 salgını nedeniyle karantina döneminde (Eylül 2020 ve Nisan 2021) gerçekleştirilmiştir. Çalışmaya katılacak örneklem sayısının büyüklüğünün hesaplaması için gerekli Güç analizi G*POWER 3.1 sürümü ile yapılmıştır. Etki büyüklüğü $1-\beta=0.95$, istatistiksel anlamlılık $p<0.05$ alınmıştır. Yapılan güç analizi sonucunda, 176 örnekleme ihtiyacı olduğu belirlenmiştir. Mevcut çalışmada 200 örneklem ile yeterli katılım sağlanmıştır. Katılımcıların depresyon riski ve yeme tutumları çevrim içi anket aracılığıyla CES-Depresyon ve Ölçeği Yeme Tutum Testi kullanılarak belirlenmiştir. Katılımcıların 3 günlük besin tüketim kayıtları, e-posta adreslerine gönderilen besin tüketim kaydı formu ile alınmıştır. Sonuçlar BeBiS programında analiz edilmiştir ve daha sonra Diyet İnflamatuar İndeksi (Dİİ) puanları hesaplanmıştır. İstatistiksel analiz için SPSS 25.0 versiyonu kullanılmıştır. **Bulgular:** Bireylerin Dİİ puanları -0,7 ile 5,85 arasında değişmektedir. Bireylerin vücut ağırlığı ile Dİİ puanı arasında negatif bir korelasyon gözlenmiştir. Öte yandan yeme tutumu ile depresyon ve Dİİ puanı arasında ilişki bulunamamıştır. **Sonuç:** Düşük vücut ağırlığına sahip olmanın Dİİ ile negatif ilişkili olduğu bulunmuştur. Yeme tutumu, depresyon ve Dİİ puanı arasında bir ilişki bulunamamıştır. Dİİ puanının artmasının birçok kronik hastalıkla ilişkili olduğu dikkate alındığında Dİİ puanına etki eden faktörlerin anlaşılmasına yönelik çalışmaların artmasının çözüm önerileri açısından literatüre katkı sağlayacağı düşünülmektedir.

Anahtar Kelimeler: Yeme; tutum; depresyon; inflamasyon

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Peer review under responsibility of Türkiye Klinikleri Journal of Health Sciences.

Received: 10 Nov 2023

Received in revised form: 12 Feb 2024

Accepted: 13 Feb 2024

Available online: 14 Mar 2024

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Inflammation is defined as the local response developed by the immune system against tissue damage in the body.³ Chemical molecules and cytokines [tumor necrosis factor- α , interleukin (IL)-6, IL-1] produced by some cells in the body or originating from various plasma proteins can initiate the inflammation process.⁴ It has been reported that chronic low-grade inflammation may cause the development of many chronic diseases such as metabolic syndrome, Type 2 diabetes mellitus, cardiovascular diseases, and non-alcoholic steatohepatitis, cancer, asthma, and depression.⁵ Given the prevalence of chronic diseases, it is important to understand how to improve inflammation. Dietary intake is an important therapeutic target to regulate inflammation and reduce the risk of chronic disease.^{3,8} To calculate the inflammatory load of the diet, the Diet Inflammatory Index (DII) was developed in 2009 by Cavicchia et al. by examining the effects of different nutrients on inflammatory cytokines and in 2014, DII was updated by Shivappa et al.^{1,2} DII is a literature-based index that evaluates the impact of the proinflammatory and anti-inflammatory markers in the diet.

Nutrition, mental health, and depression are associated with the release of proinflammatory cytokines.⁶ Proinflammatory cytokines cause changes in mood by affecting the synthesis and release of neurotransmitter substances.⁷ Besides, elevated high-sensitivity C-reactive protein (hs-CRP) levels are associated with an increased risk of depression and anxiety.⁸ It is also emphasized that negative emotions arise from anxiety and depressive symptoms, disordered eating behaviors, and circulating inflammatory cytokine levels decrease with a healthy diet.^{9,10} Eating behavior disorders are occasions in which eating behaviors are regularly disrupted, weight gain and excessive preoccupation with food consumption are observed, and have a lifetime prevalence of over 10%.^{11,12} According to a study, the incidence of eating disorders was found to be 2.3% in Türkiye.¹³ It is stated that, as depressive symptoms increase, disordered eating attitudes also increase. In addition, it is reported that a disordered eating attitude can trigger depression.¹⁴

Studies examining the association between eating attitudes, depression and inflammatory status of

the diet are limited. Because of that, this study aimed to investigate the relationship between adults' depression risks, eating attitudes and DII scores. We aimed to contribute to the literature by examining the relationship between disordered eating behavior and inflammatory nutrition in adults.

MATERIAL AND METHODS

SAMPLE SELECTION OF THE RESEARCH

The survey study was designed as a "non-experimental quantitative research" and the scanning method was used according to the way it was implemented. In the study, "survey model (field scanning)" was used to collect data from the sample. In the field survey model, the survey method, which is a data collection method in which the opinions of the participants are collected in written form, was applied. This research was carried out between September 2020 and April 2021 on 200 volunteer adults aged 18-65 living in İstanbul. Participants' inclusion criteria were 18-65 and using the internet and computer enough to fill out the questionnaire. The exclusion criteria were; pregnancy or lactation period, alcohol or drug addiction. Ethical approval for this study was obtained from the Non-Interventional Ethics Committee of İstanbul Medipol University (dated 03.09.2020, decision number 663) and was performed in accord with the ethical standards of the Declaration of Helsinki. Due to the pandemic, the study was conducted with an online questionnaire. When the online survey link reaches the participants, they first receive an informative consent form. The research continued with those who agreed. As a result of the power analysis for the relationship analysis, it was determined that 115 samples were needed, and 176 samples were needed for the group difference analysis. In the study, sufficient participation was achieved with 200 samples. Power analysis was made by the G*POWER 3.1 version. Effect size was taken as $1-\beta=0.95$, and statistical significance was taken as $p<0.05$.

DATA COLLECTION AND ANALYSIS

The data were obtained with an online questionnaire within 2 phases. In addition, general information, Eating Attitude Test-26 (EAT-26), and CES-Depres-

sion (CES-D) Scale was applied in the first stage. In contrast, forms for food consumption record were sent to the participants' e-mail addresses in the second stage of the study.

GENERAL INFORMATION

In this part of the questionnaire, participants' age, gender, body weight, height, marital status, education level smoking and alcohol consumption, and physical activity status were collected. Anthropometric measurement information of the participants was taken through their self-reports. The body mass index (BMI) value was calculated by the researcher.

EAT-26

The eating attitudes of the participants were evaluated with EAT-26, which can be used to screen for the risk of eating disorders.¹⁵ The EAT-40, developed by Garner and Garfinkel, was later transformed into a short form with 26 questions by Garner et al.^{16,17} A score between 0 and 53 can be obtained from the test; however, 20 points are used as the cut-off point for EAT-26. A score ≥ 20 is defined as disordered eating behavior, while a score < 20 is considered as normal eating behavior. The Turkish validity and reliability study of the test was carried out by Ergüney Okumuş and Sertel Berk.¹⁵

CES-D SCALE

The CES-D Scale was developed by Radloff in 1977 to determine the depressive symptoms of the general population.¹⁸ The scale consists of 20 items questioning feelings and thoughts about the past week. The items in the questionnaire are evaluated on a 4-point Likert scale as 0: Never-Rarely (less than one day), 1: A little-A few times (1-2 days), 2: Occasionally-Sometimes (3-4 days), and 3: Often-Most Often (5-7 days). Items 4, 8, 12, and 16 on the scale are scored in reverse. A score between 0 and 60 can be obtained, and a score ≥ 16 is considered a symptom of depression.¹⁹ Tatar and Saltukoglu carried out the Turkish adaptation of the scale in 2010.²⁰

FOOD CONSUMPTION RECORD

The form for the food consumption record was sent to the participants via the e-mail addresses they specified in the online questionnaire. There was brief in-

formation on the document explaining the food consumption record details. Individuals were asked to record all the foods and beverages they consumed on a three-day food consumption record form, two days during the week (consecutive) and one day on the weekend. The energy, macro, and micronutrient values that individuals consumed daily according to their three-day food consumption records were analysed by BeBiS program. Web-based self-reported dietary intake methods are frequently used in nutritional epidemiological studies.³⁶

EVALUATION OF THE DII

Data obtained from the food consumption record form were analysed by BeBiS program, and DII scores were calculated by DII calculation method developed by Shivappa et al.² Researchers determined an inflammatory effect score, mean daily global intake, and standard deviation value for the 45 nutrient parameters associated with inflammation. In our study, 38 nutritional parameters in the BeBiS program were evaluated. Eugenol, flavan-3-ol, flavones, flavonols, flavanones, anthocyanidin, and isoflavones were not included in the evaluation in this study as they could not be calculated on the BeBiS program.²¹

After each individual's DII calculation was made, the individuals were divided into quartiles according to the DII value. The DII quartiles were named Q1, Q2, Q3, and Q4 from lowest to highest. While the first quartile (Q1) represents the anti-inflammatory diet, the inflammatory load of the diet increases as you go from the 1st quartile to the 4th quartile.

STATISTICAL EVALUATIONS

SPSS version 25.0 was used for statistical analysis. In the study, the significance level was determined as $p < 0.05$. While evaluating the data in the study and descriptive statistical methods (mean, standard deviation, median, frequency, ratio, minimum, maximum), the distribution of the data was evaluated with the Shapiro-Wilk Test. Analysis of variance was used to compare three or more groups with the normal distribution of quantitative data, and the Kruskal-Wallis test was used in cases where it did not show normal distribution. The student-t-test was used to

compare two groups with the normal distribution of quantitative data, and the Mann-Whitney-u test was used in cases where it did not show normal distribution. To determine the relationship between the quantitative data, Pearson correlation analysis was used if it showed normal distribution, and Spearman correlation analysis was used if it did not show normal distribution.

RESULTS

This study was conducted with 200 participants, and general information of participants are presented in Table 1. It was determined that, 29.5% of the participants had disordered eating behavior, and 37% were in the depression risk group (Table 2).

The score values for the DII scores were Q1; -0.7-1.76, Q2; 1.81-3.34, Q3; 3.35-4.27, and Q4; 4.32-5.85. The individuals' body weights and education levels showed a significant difference between the

DII quartile groups ($p<0.001$ and $p=0.037$). It was determined that the relevant difference in body weight was caused by the Q1 group and the undergraduate group in education level (Table 3).

It was determined that there was a significant negative correlation between body weight and participants' DII score ($r=-0.172$, $p<0.000$). When the relationship between the participants' EAT-26 and CES-D Scale scores and DII scores was examined, it was found that there was no statistically significant relationship (Table 4).

No statistically significant correlation was found between the EAT-26 and CES-D Scale scores of the participants according to the DII quartiles (Table 5).

DISCUSSION

It has been shown that depressive patients have increased IL-6, IL-1 β , and CRP.^{22,23} A healthy diet can be effective in mental health disorders with its anti-

TABLE 1: Distribution of participants' various information according to CES-D and EAT-26 cut-off points.

VARIABLES		(CES-D<16) % (n)	(CES-D \geq 16) % (n)	EAT-26 p value	(EAT-26<20) % (n)	(EAT-26 \geq 20) % (n)	p value
Gender	Female	46.0 (58)	56.8 (42)	0.144 ^a	44.0 (62)	64.4 (38)	0.009 ^{*a}
	Male	54.0 (68)	43.2 (32)		56.0 (79)	35.6 (21)	
BMI (kg/m ²)	Underweight	4.8 (6)	2.7 (2)	0.929 ^b	2.8 (4)	6.8 (4)	0.094 ^b
	Normal	53.2 (67)	56.8 (42)		60.3 (85)	40.7 (24)	
	Overweight	31.7 (40)	28.4 (21)		27.7 (39)	37.3 (22)	
	Obese	10.3 (13)	12.2 (9)		9.2 (13)	15.3 (9)	
Marital status	Married	46.0 (58)	32.4 (24)	0.060 ^a	39.7 (56)	44.1 (26)	0.569 ^a
	Single	54.0 (68)	67.6 (50)		60.3 (85)	55.9 (33)	
Education	Primary school	4.0 (5)	1.4 (1)	0.094 ^b	0.7 (1)	8.5 (5)	0.010 ^{*b}
	High school	17.5 (22)	9.5 (7)		9.9 (14)	25.4 (15)	
	College grad	61.1 (77)	67.6 (50)		70.2 (99)	47.5 (28)	
	Postgraduate	17.5 (22)	21.6 (16)		19.1 (27)	18.6 (11)	
Income	< Expenses	7.9 (10)	8.1 (6)	0.221	9.2 (13)	5.1 (3)	0.820
	= Expense	42.9 (54)	52.7 (39)		44.0 (62)	52.5 (31)	
	> Expenses	49.2 (62)	39.2 (29)		46.8 (66)	42.4 (25)	
Smoking status	Yes	31.0 (39)	32.4 (24)	0.828 ^a	34.8 (49)	23.7 (14)	0.127 ^a
	No	69.0 (87)	67.6 (50)		65.2 (92)	76.3 (45)	
Alcohol consumption	Yes	23.0 (29)	24.3 (18)	0.834 ^a	29.1 (41)	10.2 (6)	0.004 ^{*a}
	No	77.0 (97)	75.7 (56)		70.9 (100)	89.8 (53)	
Physical activity	Low	42.9 (54)	52.7 (39)	0.082 ^b	44.0 (62)	52.5 (31)	0.347 ^b
	Moderate	39.7 (50)	39.2 (29)		41.8 (59)	33.9 (20)	
	High	17.5 (22)	8.1 (6)		14.2 (20)	13.6 (8)	

* $p<0.05$; ^aMann-Whitney-U test; ^bKruskal-Wallis test; BMI: Body mass index; CES-D: CES-Depression Scale; EAT-26: Eating Attitude Test.

TABLE 2: Distribution of participants according to the CES-D and EAT-26 cut-off points.

Scale	Cut off points	% (n)
EAT-26	Normal eating behavior (EAT-26<20)	70.5 (141)
	Disordered eating behavior (EAT-26≥20)	29.5 (59)
CES-D	Normal group (CES-D<16)	63.0 (126)
	Depression risk group (CES-D≥16)	37.0 (74)

* p<0.05; CES-D: CES-Depression Scale; EAT-26: Eating Attitude Test.

inflammatory properties.²⁴ Also the presence of risk of depression is one of the crucial parameter affecting eating behavior. This study was conducted to determine the relationship between eating attitude and depression risk and DII in adults.

EAT-26 can be used to screen for the risk of eating disorders. The incidence of eating disorders in our country has been reported as 2.3%.¹⁶ Our study observed that 29.5% of participants had disordered eating behavior according to their EAT 26 scores.

Affecting more than 300 million people worldwide, depression is characterized by low mood, loss of interest or pleasure in life, and sleep or appetite disturbance.¹⁹ Globally, it is estimated that 5.0% of adults suffer from depression.¹⁹ The CES-D Scale determines the depressive symptoms of the general population, and a score ≥16 is considered a symptom of depression.^{18,20} In a study, it was determined that 37.0% of the participants had a risk of depression and the authors emphasized that eating disorders are associated with depression.¹⁴ According to a study, an eating disorder is a risk factor for depression, and depression is also a risk factor for an eating disorder. It has been stated that, along with not reaching the ideal body physically, attempts to control body weight (such as dieting, restriction, cutting eating) and calorie restriction practices may cause depression in individuals with eating disorders; however, eating disorders may also be observed in individuals with depression.²⁶ In a study, it is stated that; people who

TABLE 3: Distribution of various data by DII quartiles of participants.

	Q1 (n=50)		Q2 (n=49)		Q3 (n=50)		Q4 (n=51)		p value
	$\bar{X} \pm SD$	Median (Min-Max)	$\bar{X} \pm SD$	Median (Min-Max)	$\bar{X} \pm SD$	Median (Min-Max)	$\bar{X} \pm SD$	Median (Min-Max)	
DII (score)	0.80±0.66	1.00 (-0.7-1.76)	2.66±0.42	2.72 (1.81-3.34)	3.74±0.26	3.71 (3.35-4.27)	4.95±0.42	4.97 (4.32-5.85)	0.000 ^{aa}
Age (year)	30.24±9.98	27.00 (17.00-64.00)	31.16±10.33	27.00 (19.00-63.00)	31.08±7.65	29.00 (20.00-50.00)	30.41±8.11	29.00 (20.00-61.00)	0.638 ^a
Weight (kg)	79.50±14.38	79.00 (52.00-122.00)	69.97±15.44	70.00 (43.00-105.40)	70.90±16.51	68.65 (45.00-115.00)	68.01±14.97	65.00 (43.00-114.00)	0.001 ^{aa}
BMI (kg/m ²)	25.93±4.60	25.02 (19.54-42.21)	23.50±3.43	23.60 (17.86-31.82)	24.86±4.92	24.30 (16.94-39.79)	24.35±3.92	23.63 (17.22-33.31)	0.067 ^a
Marital status		% (n)		% (n)		% (n)		% (n)	0.375 ^b
Married % (n)		32.0 (16)		38.8 (19)		34.0 (17)		45.1 (23)	
Single % (n)		68.0 (34)		61.2 (30)		66.0 (33)		54.9 (28)	
Education		% (n)		% (n)		% (n)		% (n)	
Primary school % (n)		16.7 (1)		33.3 (2)		33.3 (2)		16.7 (1)	0.037 ^b
High school % (n)		13.8 (4)		31.0 (9)		27.6 (8)		27.6 (8)	
College grad % (n)		32.3 (41)		23.6 (30)		21.3 (27)		22.8 (29)	
Postgraduate % (n)		10.5 (4)		21.1 (8)		34.2 (13)		34.2 (13)	
Smoking status		% (n)		% (n)		% (n)		% (n)	0.347 ^b
Yes % (n)		40.0 (20)		24.5 (12)		34.0 (17)		27.5 (14)	
No % (n)		60.0 (30)		75.5 (37)		66.0 (33)		72.5 (37)	
Alcohol consumption		% (n)		% (n)		% (n)		% (n)	
Yes % (n)		20.0 (10)		28.6 (14)		22.0 (11)		23.5 (12)	0.509 ^b
No % (n)		80.0 (40)		71.4 (35)		78.0 (39)		76.5 (39)	

*p<0.05; ^aAnalysis of variance; ^bChi-square test; Q: quartile; SD: Standard deviation; DII: Dietary Inflammatory Index; BMI: Body mass index.

TABLE 4: Correlation between participants' DII scores and age, body weight, BMI, mean scores of EAT-26 and CES-D scales.

Variables	DII score Total (n=200)	
	r value	p value
Age (year)	0.059	0.223
Weight (kg)	-0.172*	0.000
BMI (kg/m ²)	-0.053	0.267
EAT-26 score	-0.052	0.280
CES-D score	0.023	0.638

Pearson Correlation Test; BMI: Body mass index; CES-D: CES-Depression Scale; EAT-26: Eating Attitude Test; DII: Dietary Inflammatory Index.

have eating disorders also have a risk of depression. In that study, participants' depression symptoms were associated with eating disorders.²⁷ Considering this bilateral interaction between eating behavior and depression, in this study we determine the relationship between eating attitude and depression risk and DII scores in adults.

The DII is an index developed by Shivappa et al. to investigate the relationship between nutritional parameters and inflammation.² A high DII score indicates that the diet is proinflammatory, while a low score means that the diet is an anti-inflammatory diet.² In studies conducted in Türkiye, Kocamış calculated the DII values between -3.32 and 4.74, and Oğuzmert between 0.87 and 5.83.^{28,29} Our study found the DII score range between -0.7 and 5.85. It should not be overlooked that the DII score may vary depending on the sample group and various parameters (such as socioeconomic status), seasonal changes, and the food parameters to be included in the calculation.

In a cohort study, individuals were followed for an average of 8 years to determine the relationship between body weight gain and DII score; and it was determined that body weight gain was statistically

significantly higher in the quartile with a higher DII score than in the lower quartile ($p<0.05$).³⁰ In contrast with that result, in our study, there was statistically differences between the bodyweight of the participants and the DII quartile groups, and the Q1 group caused this difference. Moreover, a negative correlation ($r=-0.172$, $p<0.000$) was found between DII scores and body weights. Our findings are similar with the results from MacDonald et al., who reported a significant inverse association between dietary inflammatory index and obesity.³¹ These results may be due to that, thin individuals limit their calorie intake and lose weight or protect their weight with an unhealthy diet which is poor in macro and micronutrients compared to the diets of normal-weight individuals. It was observed that individuals who are obsessed with healthy eating could be overweight or obese.³² In the current study, the reason may be because of the thin participants' calorie restrictions instead of eating healthy. Individuals obsessed with healthy nutrition have a high body weight because they only pay attention to a healthy diet without calorie restriction.

Eating attitude is one of the most critical factors affecting the food preferences of individuals. Dietary components significantly affect inflammation. It is stated that balanced nutrition, which is one of the most significant markers of inflammation, can reduce inflammation in the body.³³ When we examined the relationship between the eating behaviors of individuals and their DII scores, there were no significant differences ($p>0.05$). The majority (70.5%) of the individuals who participated in the study had normal eating behavior, which may have attributed to this result.

Nutrition, mental health, and depression are associated with the release of proinflammatory cytokines and inflammation.⁶ Proinflammatory

TABLE 5: The relationship between EAT-26 and CES-D Scale scores according to participants' DII quartiles.

	Q1 (n=50)		Q2 (n=49)		EAT-26 Q3 (n=50)		Q4 (n=51)		Total (n=200)	
	r value	p value	r value	p value	r value	p value	r value	p value	r value	p value
CES-D Scale	0.232	0.105	-0.085	0.557	0.037	0.795	0.028	0.841	0.049	0.487

Pearson Correlation Test; EAT-26: Eating Attitude Test; CES-D: CES-Depression Scale; Q: quartile.

cytokines cause changes in mood by affecting the synthesis and release of neurotransmitter substances.^{7,15} According to a study, the risk of depression increased in individuals from the anti-inflammatory group (1st quintile) to the pro-inflammatory group (5th quintile).³⁴ In another study evaluating the relationship between depressive symptoms and DII tertiles, the rate of showing depressive symptoms in the 3rd tertile was found to be 2.29 times (odds ratio 2.29, 95% CI 1.49-3.51, $p<0.001$) lower in females compared to the 1st tertile ($p<0.05$).³⁵ In our study, however, no significant correlation was found between the DII scores and the CES-D Scale scores ($r=0.023$) ($p>0.05$). It is anticipated that this result may be due to the low mean scores of the participants in the current study on the CES-D Scale.

FUTURE PERSPECTIVE

What we eat can cause inflammation, but it can be an eating disorder or depression that determines what we eat and leads to inflammatory eating patterns. Eating disorders can affect the inflammation of the diet, but the DII score may be high even if the individual does not have an eating disorder. At the same time, the individual's depression can also increase the DII score. Therefore, this trio may need to be handled better, and individuals with depression may need to pay more attention to the foods they will consume during this period.

STRENGTHS AND LIMITATIONS OF THE STUDY

There is limited study examining the relationship between eating attitude and DII in the literature. However, our study contains some limitations, and they should be taken into consideration these limitations while interpreting the results. First, the number of participants with disordered eating behavior is low. Second, it contains general limitations arising from the 3-day food consumption record, seasonal changes, and recorded days that don't reflect general nutrition, common in all food consumption record studies. Measuring dietary intake is difficult and no single method can assess dietary intake perfectly, three-day food consumption records were difficult to obtain and there were limitations due to food consumption registration. The third is that DII was created with 45 parameters in the original article,

whereas 38 nutrient parameters were used in the study. The remaining seven nutritional parameters, such as commonly consumed flavonoids, which we did not include in the calculation (because national-based content data could not be reached), had to be ignored. In addition, our study was done online and was in two stages. There were participants who filled out the questionnaire in the first stage of the study and did not fill out the food consumption record in the second stage.

The fact that it was made during the coronavirus disease-2019 period may have caused some changes in the diet of individuals at that time. Participants' body weight and height information was also obtained by asking them via an online survey. It is a limitation that anthropometric measurements were not taken by the same person with a single device. With the proliferation of the Internet, web-based surveys have become a convenient way to collect research data. There is also increasing interest in using the web to evaluate diet records. Web-based nutritional assessment methods may be more cost-effective and increase ease of use for participants.³⁷

CONCLUSION

Eating attitudes and behaviors could have significant effects on health. Disordered eating behavior is a process that can cause depression, and depression is shown as one of the factors affecting eating attitude. In our study, which we conducted based on this information, no relationship was found between eating attitude, depression, and DII. However, a negative correlation ($r=-0.172$, $p<0.000$) was found between DII scores and body weights. It is thought that studies with more extensive participation would be helpful to know the effect of eating attitude on the inflammatory load of the diet. Considering that the inflammatory load of the diet is associated with many chronic diseases, it is thought that an increase in studies on the factors affecting DII will contribute to the literature in terms of proposed solutions.

Our primer outcomes are that; we found no significant association between eating attitude, depression, and DII quartiles. This result may be due to the low depression risk score and the low number of par-

ticipants with disordered eating behavior. We think that studies on this subject are limited and it is important to reveal the inflammatory load of the diets of individuals with eating disorders with further studies.

Our second outcome is that; we found a negative correlation between body weight and DII. There are conflicting results on this issue in the literature. In general, it is stated that DII and body weight are positively related. However, similar to our study, there are also studies that found a negative relationship between weight parameters (waist circumference, BMI) and DII. For this reason, we think that the unclear information about the pro-inflammatory diet tendency of obese individuals or that individuals with pro-inflammatory diets are more overweight should be tested in large studies.

Source of Finance

During this study, no financial or spiritual support was received neither from any pharmaceutical company that has a direct con-

nection with the research subject, nor from a company that provides or produces medical instruments and materials which may negatively affect the evaluation process of this study.

Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

Authorship Contributions

Idea/Concept: Rüken Aslınur Samancı, Serap Andaç Öztürk; **Design:** Rüken Aslınur Samancı, Serap Andaç Öztürk; **Control/Supervision:** Serap Andaç Öztürk; **Data Collection and/or Processing:** Rüken Aslınur Samancı; **Analysis and/or Interpretation:** Rüken Aslınur Samancı, Serap Andaç Öztürk; **Literature Review:** Rüken Aslınur Samancı, Serap Andaç Öztürk; **Writing the Article:** Rüken Aslınur Samancı, Serap Andaç Öztürk; **Critical Review:** Rüken Aslınur Samancı, Serap Andaç Öztürk; **References and Fundings:** Rüken Aslınur Samancı, Serap Andaç Öztürk; **Materials:** Rüken Aslınur Samancı, Serap Andaç Öztürk.

REFERENCES

1. Cavicchia PP, Steck SE, Hurley TG, Hussey JR, Ma Y, Ockene IS, et al. A new dietary inflammatory index predicts interval changes in serum high-sensitivity C-reactive protein. *J Nutr.* 2009;139(12):2365-72. PMID: 19864399; PMCID: PMC2777480.
2. Shivappa N, Steck SE, Hurley TG, Hussey JR, Hébert JR. Designing and developing a literature-derived, population-based dietary inflammatory index. *Public Health Nutr.* 2014;17(8):1689-96. PMID: 23941862; PMCID: PMC3925198.
3. Yıldırım B, Andaç-Öztürk S. Postmenopozal kadınlarda diyet inflammatuar indeksi ve kırık insidansı ilişkisi [Relationship between dietary inflammatory index and fracture incidence in postmenopausal women]. *İstanbul Sabahattin Zaim Üniversitesi Fen Bilimleri Enstitüsü Dergisi.* 2020;2(3):13-8. <https://doi.org/10.47769/izufbed.750439>
4. Deledda A, Annunziata G, Tenore GC, Palmas V, Manzin A, Velluzzi F. Diet-derived antioxidants and their role in inflammation, obesity and gut microbiota modulation. *Antioxidants (Basel).* 2021;10(5):708. PMID: 33946864; PMCID: PMC8146040.
5. Huang T, Tobias DK, Hruby A, Rifai N, Tworoger SS, Hu FB. an increase in dietary quality is associated with favorable plasma biomarkers of the brain-adipose axis in apparently healthy US women. *J Nutr.* 2016;146(5):1101-8. PMID: 27075907; PMCID: PMC4841930.
6. Corley J, Shivappa N, Hébert JR, Starr JM, Deary IJ. Associations between Dietary Inflammatory Index scores and inflammatory biomarkers among older adults in the lothian birth cohort 1936 study. *J Nutr Health Aging.* 2019;23(7):628-36. PMID: 31367727; PMCID: PMC6675764.
7. Chu AL, Hickman M, Steel N, Jones PB, Davey Smith G, Khandaker GM. Inflammation and depression: a public health perspective. *Brain Behav Immun.* 2021;95:1-3. PMID: 33882327.
8. Dionysopoulou S, Charmandari E, Bargiota A, Vlahos N, Mastorakos G, Val-
9. Karabekir M. Tıp fakültesi öğrencilerinde yeme tutumu ile depresyon, anksiyete ve dürtüsellik arasındaki ilişki [Tıpta uzmanlık tezi]. Ankara: Başkent Üniversitesi; 2020. (Erişim linki ve erişim tarihi eklenmelidir.)
10. Bonaccio M, Pounis G, Cerletti C, Donati MB, Iacoviello L, de Gaetano G; MOLI-SANI Study Investigators. Mediterranean diet, dietary polyphenols and low grade inflammation: results from the MOLI-SANI study. *Br J Clin Pharmacol.* 2017;83(1):107-13. PMID: 26935858; PMCID: PMC5338145.
11. American Psychiatric Association. Diagnostic and Statistical Manual of Mental Disorders DSM-5. 5th ed. Washington DC: American Psychiatric Publishing; 2013. <https://doi.org/10.1176/appi.books.9780890425596>
12. Claudino AM, Pike KM, Hay P, Keeley JW, Evans SC, Rebello TJ, et al. The classification of feeding and eating disorders in the ICD-11: results of a field study comparing proposed ICD-11 guidelines with existing ICD-10 guidelines. *BMC Med.* 2019;17(1):93. PMID: 31084617; PMCID: PMC6515596.
13. Şener N. Yeme bozuklukları ile kişilik inançları arasındaki ilişki: çocukluk çağı travmaların aracı rolü [Yüksek lisans tezi]. İstanbul: İstanbul Kent Üniversitesi; 2021. <https://hdl.handle.net/20.500.12780/404> (Erişim tarihi eklenmelidir.)
14. Peleg O, Tzischinsky O, Spivak-Lavi Z. Depression and social anxiety mediate the relationship between parenting styles and risk of eating disorders: a study among Arab adolescents. *Int J Psychol.* 2021;56(6):853-64. PMID: 34132397.
15. Ergüney-Okumuş FE, Sertel-Berk HÖ. Yeme tutum testi kısa formunun (YTT-26) üniversite örnekleminde Türkçeye uyarlanması ve psikometrik özelliklerinin değerlendirilmesi [The psychometric properties of the eating attitudes test short form (EAT-26) in a college sample]. *Studies in Psychology.* 2020;57-78. doi: 10.26650/SP2019-0039

16. Garner DM, Garfinkel PE. The Eating Attitudes Test: an index of the symptoms of anorexia nervosa. *Psychol Med.* 1979;9(2):273-9. PMID: 472072.
17. Garner DM, Olmsted MP, Bohr Y, Garfinkel PE. The eating attitudes test: psychometric features and clinical correlates. *Psychol Med.* 1982;12(4):871-8. PMID: 6961471.
18. Radloff LS. The Ces-D scale: a self-report depression scale for research in the general population. *Appl Psychol Meas.* 1977;1(3):385-401. <https://conservancy.umn.edu/bitstream/handle/11299/98561/v01n3p385.pdf>
19. Lassale C, Batty GD, Baghdadli A, Jacka F, Sánchez-Villegas A, Kivimäki M, et al. Healthy dietary indices and risk of depressive outcomes: a systematic review and meta-analysis of observational studies. *Mol Psychiatry.* 2019;24(7):965-86. Erratum in: *Mol Psychiatry.* 2018. Erratum in: *Mol Psychiatry.* 2021;26(7):3657. PMID: 30254236; PMCID: PMC6755986.
20. Tatar A, Saltukoglu G. The adaptation of the CES-depression scale into Turkish through the use of confirmatory factor analysis and item response theory and the examination of psychometric characteristics. *Psychiatry and Clinical Psychopharmacology.* 2010;20(3):213-27. <https://psychiatry-psychopharmacology.com/en/the-adaptation-of-the-ces-depression-scale-into-turkish-through-the-use-of-confirmatory-factor-analysis-and-item-response-theory-and-the-examination-of-psychometric-characteristics-161062>
21. BeBiS [Internet] © 2008-2021 BeBiS [Erişim tarihi:]. Erişim linki: www.bebis.com.tr (Erişim tarihi eklenmelidir.)
22. Tayab MA, Islam MN, Chowdhury KAA, Tasnim FM. Targeting neuroinflammation by polyphenols: a promising therapeutic approach against inflammation-associated depression. *Biomed Pharmacother.* 2022;147:112668. PMID: 35104696.
23. Shelton RC, Miller AH. Inflammation in depression: is adiposity a cause? *Dialogues Clin Neurosci.* 2011;13(1):41-53. PMID: 21485745; PMCID: PMC3181969.
24. Marx W, Lane M, Hockey M, Aslam H, Berk M, Walder K, et al. Diet and depression: exploring the biological mechanisms of action. *Mol Psychiatry.* 2021;26(1):134-50. PMID: 33144709.
25. World Health Organization [Internet] © 2024 WHO [Cited: February 7, 2022]. Depressive disorder (depression). Available from: <https://www.who.int/news-room/fact-sheets/detail/depression> Erişim tarihi:07.02.2022
26. Puccio F, Fuller-Tyszkiewicz M, Ong D, Krug I. A systematic review and meta-analysis on the longitudinal relationship between eating pathology and depression. *Int J Eat Disord.* 2016;49(5):439-54. PMID: 26841006.
27. Martín J, Arostegui I, Loroño A, Padierna A, Najera-Zuloaga J, Quintana JM. Anxiety and depressive symptoms are related to core symptoms, general health outcome, and medical comorbidities in eating disorders. *Eur Eat Disord Rev.* 2019;27(6):603-13. PMID: 31020754.
28. Kocamış RN. Yetişkin bireylerde diyetin inflamatuvar indeksi ile beslenme durumları arasındaki ilişkinin saptanması [Yüksek lisans tezi]. Ankara: Başkent Üniversitesi; 2018. (Erişim linki ve erişim tarihi eklenmelidir.)
29. Oğuzmert S. Tip 1 diyabetli çocuk hastalarda diyetin inflamatuvar indeksi ile bazı biyokimyasal parametreler arasındaki ilişkinin incelenmesi [Yüksek lisans tezi]. Ankara: Hacettepe Üniversitesi; 2016. (Erişim linki ve erişim tarihi eklenmelidir.)
30. Ramallal R, Toledo E, Martínez JA, Shivappa N, Hébert JR, Martínez-González MA, et al. Inflammatory potential of diet, weight gain, and incidence of overweight/obesity: The SUN cohort. *Obesity (Silver Spring).* 2017;25(6):997-1005. PMID: 28544794.
31. MacDonald CJ, Laouali N, Madika AL, Mancini FR, Boutron-Ruault MC. Dietary inflammatory index, risk of incident hypertension, and effect modification from BMI. *Nutr J.* 2020;19(1):62. PMID: 32586324; PMCID: PMC7315510.
32. Scarff JR. Orthorexia nervosa: an obsession with healthy eating. *Fed Pract.* 2017;34(6):36-9. PMID: 30766283; PMCID: PMC6370446.
33. Childs CE, Calder PC, Miles EA. Diet and immune function. *Nutrients.* 2019;11(8):1933. PMID: 31426423; PMCID: PMC6723551.
34. Bergmans RS, Malecki KM. The association of dietary inflammatory potential with depression and mental well-being among U.S. adults. *Prev Med.* 2017;99:313-9. PMID: 28342730; PMCID: PMC5484161.
35. Phillips CM, Shivappa N, Hébert JR, Perry IJ. Dietary inflammatory index and mental health: a cross-sectional analysis of the relationship with depressive symptoms, anxiety and well-being in adults. *Clin Nutr.* 2018;37(5):1485-91. PMID: 28912008.
36. Naska A, Lagiou A, Lagiou P. Dietary assessment methods in epidemiological research: current state of the art and future prospects. *F1000Res.* 2017;6:926. PMID: 28690835; PMCID: PMC5482335.
37. Alawadhi B, Fallaize R, Franco RZ, Hwang F, Lovegrove J. Web-based dietary intake estimation to assess the reproducibility and relative validity of the eatwellq8 food frequency questionnaire: validation study. *JMIR Form Res.* 2021;5(3):e13591. PMID: 33650974; PMCID: PMC7967232.
38. Calle MC, Andersen CJ. Assessment of dietary patterns represents a potential, yet variable, measure of inflammatory status: a review and update. *Dis Markers.* 2019;2019:3102870. Erratum in: *Dis Markers.* 2019;2019:5454602. PMID: 30805036; PMCID: PMC6360584.