ARAŞTIRMA MAKALESİ/RESEARCH ARTICLE

KARYA JOURNAL OF HEALTH SCIENCE

journal homepage: www.dergipark.org.tr/kjhs

THE RELATIONSHIP OF THE INFLAMMATORY POTENTIAL OF DIET WITH EATING ATTITUDES AND APPETITE: A STUDY ON NUTRITION AND DIETETICS STUDENTS

DİYETİN İNFLAMATUVAR POTANSİYELİNİN YEME TUTUMU VE İŞTAH İLE İLİŞKİSİ: BESLENME VE DİYETETİK ÖĞRENCİLERİ ÜZERİNE BİR ÇALIŞMA

Hatice Çolak[1*] (ID), Esra Tansu Sarıyer[1] (ID), Ekin Çevik[1] (ID), Sena Yaşar[1] (ID), Sadakat Zeynep Laçin[1] (ID), Beyzanur Karakaş[1] (ID), Elif Güvenç[1] (ID), Beyzanur Öğütçü[1] (ID), Rumeysa Ülker[1] (ID), Derya Barış[1] (ID), Miray Kılıç[1] (ID), İmran Balcı[1] (ID), Kadriye Küçükkaya[1] (ID), Melike Zehra Uyar[1] (ID), Seda Karakaya[1] (ID), Beyza Tekin[1] (ID), Hasan Ömür İleri[1] (ID), Esra Kıran[1] (ID), Yeşim Tekin[1] (ID), Furkan Kırçiçek[1] (ID), Dilara Bağdaş[1] (ID), Elif Rana Çetin[1] (ID), Ceyda Vargül[1] (ID), Ayşe Çetin[1] (ID), Beyza Nur Savaş[1] (ID)

[1]Department of Nutrition and Dietetic, Faculty of Health Sciences, Üsküdar University, İstanbul, Turkey

ABSTRACT

Objective: The dietary inflammatory index (DII) is an index that examines the effects of dietary components on serum pro-inflammatory and anti-inflammatory indicators. The aim of this study was to examine the relationship between dietary inflammatory potential, eating attitude and appetite of the students of the Department of Nutrition and Dietetics.

Method: Questions including sociodemographic characteristics and nutritional status, EAT-40 to evaluate eating attitudes, Simplified Nutritional Appetite Questionnaire (SNAQ) for assessment of appetite, and a questionnaire containing 3-day dietary recall record were applied to calculate the dietary inflammatory indices of the participants.

Results: The median age of the students was 22 years and 91.9% of them were female. The frequency of the normal weight group was 69.4% and 78.3% of the students skipped meals, the most frequently skipped meal was lunch with 40.5%. Most of the students (92.3) had a normal eating attitude with. It was found that 95.1% of the students with normal eating attitudes were female, 49.3% were 4th-grade undergraduates and 70% were of normal weight. It was found that 91.1% of the students whose appetite status was not impaired were women and 48.9% were 4th-grade undergraduates. Most of the students with anti-inflammatory diet potential were female with 93% and, 45% were 4th-grade undergraduates while 70% of them were of normal weight. No statistically significant correlation was found between the students' EAT-40 scores and BMI, between EAT-40 and DII scores, and between BMI and DII scores (p>0.05).

Conclusion: Dietary inflammatory potential has no relationship between eating attitude and appetite.

Key Words: Appetite, Diet, Nutrition, Eating, Inflammation

ÖZ

Amaç: Diyet inflamatuar indeksi (DII), diyet bileşenlerinin serum pro-inflamatuvar ve anti-inflamatuar göstergeler üzerindeki etkilerini inceleyen bir indekstir. Bu çalışmanın amacı, Beslenme ve Diyetetik Bölümü öğrencilerinde diyetin inflamatuvar potansiyeli, yeme tutumu ve iştah arasındaki ilişkiyi incelemektir.

Yöntem: Katılımcılara sosyodemografik özellikler ve beslenme durumunu içeren sorular, yeme tutumlarını değerlendirmek için Yeme Tutum Testi (YTT-40), iştahı değerlendirmek için Basitleştirilmiş Beslenme İştahı Anketi (SNAQ) ve diyet inflamatuvar indekslerini hesaplamak için 3 günlük besin tüketim kaydını içeren bir anket uygulandı.

Bulgular: Öğrencilerin medyan yaşı 22 olup; %91,9'u kadındı. Öğrencilerin beden kitle indeksleri değerlendirildiğinde %69,4'ünün normal ağırlıkta olduğu bulundu. Öğrencilerin %78,3'ü öğün atlarken, en sık atlanan öğün %40,5 ile öğle yemeğiydi. Öğrencilerin büyük çoğunluğu (%92,3) normal bir yeme tutumuna sahipti. Normal yeme tutumuna sahip öğrencilerin %95,1'inin kadın, %49,3'ünün lisans 4. sınıf ve %70'inin normal ağırlıkta olduğu belirlendi. İştah durumu bozulmayan öğrencilerin %91,1'inin kadın, %48.9'unun 4. sınıf lisans öğrencisi olduğu bulundu. Diyeti anti-inflamatuar potansiyel taşıyan öğrencilerin %93'ü kadın, %45'i 4. sınıf lisans öğrencisi ve %70'i ise normal ağırlıktaydı. Öğrencilerin BKİ değerleri ile EAT-40 puan ortalamaları, EAT-40 ve DII puanları ve BKİ değerleri ile DII puanları arasında istatistiksel olarak anlamlı bir ilişki saptanmadı (p>0.05).

Sonuç: Diyetin inflamatuar potansiyelinin yeme tutumu ve iştah arasında ilişki bulunamamıştır.

Anahtar Kelimeler: İştah, Diyet, Beslenme, Besin Alımı, Inflamasyon

*Sorumlu yazar/Corresponding author: Üskudar University, Faculty of Health Science, Department of Nutrition and Dietetic, İstanbul, Turkey

[1*]Email:hatice.colak@uskudar.edu.tr, [2]Email:esratansu.sariyer@uskudar.edu.tr, [3]Email:ekin.cevik@uskudar.edu.tr, [4]Email:sena.yasar@st.uskudar.edu.tr, [5]Email:lzeynep767@gmail.com, [6]Email:beyzanur.karakas00@gmail.com, [7]Email:guvencelif699@hotmail.com, [8]Email:beyzaog1999@gmail.com, [9]Email:rumeysaa.ulkerr29@gmail.com, [10]Email:drybrs.99@gmail.com, [11]Email:mirayboran06@gmail.com, [12]Email:imran.blci99@gmail.com, [13]Email:kadriyeckky0@gmail.com, [14]Email:melikeuyarrr@gmail.com, [15]Email:seda.krky19@hotmail.com, [16]Email:beyza.tekin@windowslive.com, [17]Email:hasanomur_1998_56@hotmail.com, [18]Email:esrakiraan@hotmail.com, [19]Email:yesimtekin2605@gmail.com, [20]Email:dytfurkankircicek@gmail.com, [21]Email:dilara.bagdas.95@gmail.com, [22]Email:elifcemrecet@outlook.com, [23]Email:vargulceyda@gmail.com, [24]Email:ayse.cetin@st.uskudar.edu.tr, [25]Email:beyza.savas@hotmail.com

INTRODUCTION

Inflammation, an important component of dorial correlation, is a local response to cellular damage, which includes increased blood flow, capillary dilatation, leukocyte infiltration or elimination and repair of toxic agents [1]. The chronic course of inflammation with harmful and/or beneficial effects causes the formation of many diseases such as diabetes, cancer, metabolic syndrome, non-alcoholic fatty liver disease, cardiovascular diseases (CVD), depression, obesity [2].

Studies show that the diet, which has anti or pro-inflammatory effects, is a regulator of the inflammatory process [3,4]. Studies examining the relationship between nutrition and inflammation are usually aimed at nutrients and/or diet, and dietary inflammatory index (DII) has been developed to reflect the inflammatory potential of the diet due to the fact that the results of studies on a single such nutrient or food group are not sufficient to generalize to all populations [5] DII, which is created with data obtained from the scientific literature by evaluating the nutritional status of high-population human studies, is an index that examines the effects of dietary components on serum pro-inflammatory and anti-inflammatory indicators IL-1β, IL-4, IL-6, IL-10, TNF-α and C-reactive protein.

Studies show an association between anti-inflammatory diet and body mass index (BMI) [6,7]. In a meta-analysis study, the anti-inflammatory diet was associated with a lower risk of obesity [8]. Alam et al., in another study to examine the relationship between anti-inflammatory diet and nutrition, found significant correlations between DII score and BMI, waist-to-hip ratio and body fat percentage [9]. In another large cohort study on this subject, significant negative associations were found between DII scores and BMI and waist circumference [10]. In a randomized case-control study conducted by Kendel et al., anti-inflammatory diet intervention resulted in a significant reduction in BMI, waist circumference, total and visceral adipose tissue [11].

The diet and eating attitude, which is the main determinant of global public health and plays a role in the rapidly increasing chronic disease burden etiology, make an important contribution to the rates of morbidity and mortality caused by chronic disease [12,13]. Eating attitude is defined as belief, thought, emotion and behaviors towards food [14], although it is the basis of motor, cognitive, social and emotional development, but is considered a complex phenomenon regulated by environmental factors [15]. Eating attitudes also influence dietary inflammatory processes, for example, a 2021 study found that individuals with impaired eating attitudes had high DII scores [16]. Similarly, in studies on this subject, DII scores were found to be high in individuals with impaired eating attitudes [17,18].

Appetite, which has a significant effect on eating attitude and is effective on the desire of individuals to eat due to both physiological and psychological factors, is defined as the desire to consume nutrients [19,20]. Studies point to the relationship between dietary inflammatory potential and appetite [21,22]. Burrows et al. found a significant corral between decreased appetite and DII scores in depressed individuals [23]. In another similar study, it was observed that the presence of inflammation and nutrient intake decreased [24].

Studies that examine the relationship between dietary inflammatory potential, eating attitude and appetite in the literature are very few and limited. Therefore, this study is a guide for future studies on this subject. In addition, by supporting the health policies of countries' health policies to fight healthy living and preventing chronic diseases, it is capable of contributing to the formation of healthy population generations and contributing to the reduction of social burden.

METHOD

This study was conducted with first, second, third and fourth year students studying at Üsküdar University Health Faculty, Nutrition and Dietetic Department (N:325) and voluntarily accepting to participate in the study. The sample of the study was obtained by simple random sample selection. While determining the number of samples, the sample formula ($n = Nt^2pq/[d^2(N-1)+t^2pq]$) with a definite universe was used. In the sample calculation, the p significance value was accepted as 0.05 at the 95% confidence interval. As a result of the calculation, the number of samples was calculated as 175 people. In addition, when the p significance value was calculated as 0.05 at the 95% confidence interval for a population of 500 people; The participation of 217 students is adequate. [25]. Questionnaire consisting of questions about demographic characteristics, anthropometric measurements, Eating Attitude Test-40 (EAT-40), Simplified Nutritional Appetite Questionnaire (SNAQ) for assessment of appetite, and 3-day dietary recall food record were voluntarily administered online to 235 participants after the consent form was obtained. This study was carried out after the approval of the Üsküdar University Non-Interventional Research Ethics Committee under the number 61351342/2022-08.

Anthropometric Measurements

The weight, height, waist, and hip circumference of the participants were asked in the online questionnaire form. While all the men answered the questions regarding anthropometric measurements, 5 out of 216 women made incomplete statements.

Eating Attitude Test (EAT-40): It was developed by Garner and Garfinkel to determine the presence of an eating disorder attitude in individuals and Turkish validity and reliability was done by Savaşır and Erol [26, 27]. It is a self-report scale consisting of 40 items with 6 points (Always, Very Often, Often, Sometimes, Rarely, Never) Likert-type responses. The cutoff point is 30 points. The scores obtained from each item of the scale are summed to obtain the total score of the scale. As the score obtained from the scale increases, the eating attitude deteriorates and >30 indicates having high pathology of an eating disorder.

Three Day Food Record: Participants were asked to record all the food and beverages they consumed in the last 3 days (2 weekdays-1 day on weekends) on the '3-Day Food Consumption Record Form'. The obtained data were analyzed with Nutrition Information Systems (BeBiS 8.2). BEBIS is a data bank of more than 20,000 foods and is a computer program used to calculate the nutritional values of foods, recipes and diet plans created with more than 130 nutrient analyses (bebis.com.tr).

Dietary Inflammatory Index (DII): This index has been developed based on human, animal and cell culture studies examining the effects of different nutritional components, including nutrients, nutrients, and flavonoids, on inflammation. It is a literature-based index created by examining the effects of dietary components on serum pro-inflammatory and anti-inflammatory indicators IL-1β, IL-4, IL-6, IL-10, TNF-α and CRP. Dietary inflammatory index was calculated from food consumption record data. Shivappa et al. by reaching various national nutrition research data in different parts of the world, it determined the average daily consumption amounts and standard deviation values of 31 nutritional parameters. For the DII calculation, the daily consumption amounts of individuals were subtracted from the global average consumption amount of each food, and then the z score was calculated by dividing it by the standard deviation value determined for that food. After the calculated z score was converted into a percentile score, this score was multiplied by the "food-specific full inflammatory effect score" and the DII score was found according to the consumption of that food. The same procedure was applied to 31 determined foods, and the individual's total DII score was obtained [28]. Based on the DII values, the quartile was calculated and the cut-off was decided. As the result of quartile calculation, there is no value corresponding to the range of q2 and q3, a cut-off is presented in binary form. Quartile values calculated as [(q1<= -18); (-18<q2<=9); (-9<q3<=-3); (-3>q4)].

Simplified Nutritional Appetite Questionnaire (SNAQ): SNAQ which was developed by Wilson et al. and Turkish validity and reliability

were performed by Ilhan et al, is a 4-question 5-point Likert-type questionnaire. In each question, a=1, b=2, c=3, d= 4 and e=5 points. The questionnaire is in the range of 4-25 points and is a total of 20 points. It shows that individuals with a total score of 14 and below at the end of the survey have a risk of losing 5% of their body weight within six months [29, 30].

Analysis of Data

Descriptive statistics for categorical variables (demographic characteristics) are presented as frequency and percentage. The conformity of the numerical variables to the normal distribution was checked with the "Shapiro-Wilk Test". The "Mann-Whitney U Test" was used for the comparison of two independent groups that did not have a normal distribution, and the "Kruskal-Wallis H Test" was used for the comparison of more than two groups. The results of multiple comparison tests were expressed as letters next to the averages. Examination of the relationships between the scales was determined by "Spearman's Rank Differences Correlation Coefficient". "Regression Analysis" was used to test the effect between variables. In all calculations and interpretations, the statistical significance level was considered as $p < 0.05$ and hypotheses were established as bidirectional. Statistical analysis of the data was performed with the SPSS v26 (IBM Inc., Chicago, IL, USA) statistical package program.

RESULTS

The descriptive characteristics of the participants are given in Table 1. In the study, 48.9% of the students were 4th-grade undergraduates. In the terms of BMI, 70.4% of female students, 57.9% of male students and 69.4% of all students were of normal weight. Half of the students (50.6%) consumed 1-2lt/day of water, and 52.3% of them were female while 31.6% of them were male. The frequency of skipping meals was higher among female students (78.7%) compared to male students (73.7%); found to be 78.3% among all participants (Table 1).

Table 1. Descriptive statistics of demographic and nutritional findings of university students

Variables	Female		Male		Total	
	n	%	n	%	n	%
Grade						
1st grade	39	18.1	1	5.3	40	17.0
2nd grade	28	13.0	2	10.5	30	12.8
3th grade	48	22.2	2	10.5	50	21.3
4th grade	101	46.7	14	73.7	115	48.9
BMI						
Underweight (<18.5 kg/m^2)	41	19.0	1	5.3	42	17.9
Normal (18.5-24.9 kg/m^2)	152	70.4	11	57.9	162	69.4
Obese (25.0-29.9 kg/m^2)	23	10.6	7	36.8	31	12.7
Daily Water Consumption						
Less than 1 liter	32	14.8	0	0.0	32	13.6
Between 1-2 liters	113	52.3	6	31.6	119	50.6
Between 2-3 liters	71	32.9	13	68.4	84	35.8
Meal Skip Status						
Yes	170	78.7	14	73.7	184	78.3
No	46	21.3	5	26.3	51	21.7
Skipped Meal						
Breakfast	28	15.9	5	35.8	33	17.4
Lunch	74	42.0	3	21.4	77	40.5
Dinner	2	1.1	0	0.0	2	1.1
Mid-morning	59	33.5	3	21.4	62	32.6
Afternoon	9	5.2	3	21.4	12	6.3
Night	4	2.3	0	0.0	4	2.1

The mean age of the students were 22 years, the median age of men [23 (18-46)] was higher than women [21 (18-47)] (U=1451; $p < 0.05$). When the anthropometric data were analyzed the median BMI of men [23,4] (7.9-28.8)] was higher than women [20.3 (16.1-33.2)] (U=982; $p < 0.001$), median waist circumference of men [79 (35-140)] was higher than women [68 (0-100)] (U=1371.5; $p < 0.05$), and the median waist/hip ratio of men [0.83 (0.64-1.13)] compared to women [0.73 (0-1.5)] was found to be statistically higher (U=910; $p < 0.001$) (Table 2).

It was found that 77.8% of the students with impaired eating attitudes were female, 44.4% were 4th-grade undergraduates and 61.1% were of normal weight. It was found that 95.1% of the students with normal eating attitudes were female, 49.3% were 4th-grade undergraduates and 70% were of normal weight. It was found that 92.1% of the students who did not have an appetite were female, 48.9% were 4th-grade undergraduates, and 68.9% were normal weight. It was found that 91.1% of the students with appetite were female, 48.9% were 4th-grade undergraduates and 71.1% were normal weight. It was found that 93% of the students with anti-inflammatory diet potential were female, 45% were 4th-grade undergraduates, and 70% were normal weight. It was found that 85.7% of the students with pro-inflammatory diet potential were female, 71.4% were 4th-year undergraduate students and 65.7% were normal weight (Table 3).

In EAT-40 scores, the median score of male students [22 (12-78)] was found to be statistically higher than female students [15 (5-52)] (U=1021.5; $p < 0.001$). It was found that there was no statistically significant difference in the SNAQ scores according to students' demographics, nutritional status, eating attitude, and diet inflammatory index ($p > 0.05$). In DII scores, the median score of the 4th-grade undergraduate students [-6.42 (-44.04-8.2)] was higher compared to the 3rd-grade undergraduate students [-14.02 (-54.56-7.85)] (H=21.005; $p < 0.001$) and the median score of students with impaired eating attitudes [-5.28 (-20.26-5.01)] was higher compared to students with normal eating attitudes [-10.54 (-54, 2-8.2)] (U=1387; $p < 0.05$) (Table 4).

The correlation between the EAT-40, SNAQ, and DII scores of the university students participating in the study is given in Table 5. It was found that there was no statistically significant correlation ($p > 0.05$) between the students' EAT-40 scores and SNAQ scores, between EAT-40 scores and DII scores, and between SNAQ scores and DII scores. The effect of university students' EAT-40 and SNAQ scores on DII scores was given in Table 5. It was found that the EAT-40 scores of the students did not significantly affect the DII scores ($p > 0.05$) and the SNAQ scores did not significantly affect the DII scores ($p > 0.05$) (Table 5).

DISCUSSION

Inflammation is the result of the immune system's response to an acute infection or disease and the production of various pro-inflammatory cytokines, and when these pro-inflammatory cytokines are constantly increasing in the body, they can cause changes in appetite by acting on the brain and neural centers [21]. In this study, the majority of the students were found to have normal BMI levels. Similarly, Öcalan et al. found that 79% of university students had normal BMI levels [31]. This may be due to the high awareness and knowledge level of the students in our study due to nutrition education. In addition, male students in this study have higher BMI values than female students. Similarly, in a cross-sectional study conducted by McCarthy et al., BMI values were found to be higher in male students in university [32]. This may be because female students give more importance to their appearance and, accordingly, to body weight control. Most of the students participating in this study consume 1-2lt/day of water. In another study conducted with university students, 8-10 glasses of water the consumption every day is to be found among 55.4% of female and 69.1% of male students. In order to maintain the body's water balance, it is recommended to consume 1.200-1.500 ml of water as a beverage, and 1.000 ml of water with food and beverages every day [33].

Table 2. Comparison of age, BMI and anthropometric measurements of university students by gender

Variables	Female	Male	Total	U	p
	Median (min-max)	Median (min-max)	Median (min-max)		
Age (years)	21 (18-47)	23 (18-46)	22 (18-47)	1451	0.033*
BMI (kg/m^2)	20.3 (16.1-33.2)	23.4 (7.9-28.8)	20.5 (7.9-33.2)	982	<0.001***
Waist circumference (cm)	68 (0-100)	79 (35-140)	68 (0-140)	1371.5	0.016*
Hip circumference (cm)	93 (0-120)	92 (55-140)	93 (0-140)	1895	0.580
Waist/hip ratio	0.73 (0-1.5)	0.83 (0.64-1.13)	0.74 (0-1.5)	910	<0.001***

*U: Mann-Whitney U Test, *p<0.05; ***p<0.001*

Table 3. Descriptive statistics of EAT-40, SNAQ and DII groups according to demographic data of university students

Variables	EAT-40 Groups				SNAQ Groups				DII Groups			
	Impaired		Normal		Impaired		Normal		Anti-inflammatory		Pro-inflammatory	
	n	%	n	%	n	%	n	%	n	%	n	%
Gender												
Female	14	77.8	202	93.1	175	92.1	41	91.1	186	93.0	30	85.7
Male	4	22.2	15	6.9	15	7.9	4	8.9	14	7.0	5	14.3
Grade												
1st grade	5	27.8	35	16.1	33	17.4	7	15.6	37	18.5	3	8.6
2nd grade	3	16.7	27	12.4	27	14.2	3	6.7	28	14.0	2	5.7
3rd grade	2	11.1	48	22.1	37	19.5	13	28.9	45	22.5	5	14.3
4th grade	8	44.4	107	49.3	93	48.9	22	48.9	90	45.0	25	71.4
BMI												
Underweight (<18.5 kg/m2)	2	11.1	40	18.5	32	16.8	10	22.2	34	17.0	8	22.9
Normal (18.5-24.9 kg/m2)	11	61.1	152	70.0	131	68.9	32	71.1	140	70.0	23	65.7
Obese (25.0-29.9 kg/m2)	5	27.8	25	11.5	27	14.2	3	6.7	26	13.0	4	11.4

EAT-40; Eating Attitude Test, SNAQ; Simplified Nutrition Appetite Questionnaire, DII; Dietary Inflammatory Index

Table 4. Comparison of demographic and nutritional findings of university students with EAT-40, SNAQ and DII scores

Variables		EAT-40	(SNAQ)	DII
		Median (min-max)	Median (min-max)	Median (min-max)
Gender	Female	15 (5-52)	14 (9-16)	-10.24 (-54.2-8.2)
	Male	22 (12-78)	14 (11-15)	-4.65 (-33.99-4.19)
	U	1021.5	2018	1547
	p	<0.001***	0.901	0.075
Grade	1st grade	14 (6-52)	13 (11-16)	-11.69[ab] (-40.08-5.6)
	2nd grade	14 (5-35)	13 (11-16)	-11.37[ab] (-54.20-2.30)
	3rd grade	16 (5-44)	14 (9-16)	-14.02[a] (-54.56-7.85)
	4th grade	17 (6-78)	14 (10-16)	-6.42[b] (-44.04-8.2)
	H	6.412	3.010	21.005
	p	0.093	0.390	<0.001***
BMI	Underweight (<18.5 kg/m^2)	16 (6-38)	13 (11-16)	-9.02 (-33.57-5.01)
	Normal (18.5-24.9 kg/m^2)	15 (5-78)	14 (10-16)	-10.54 (-54.2-8.2)
	Obese (25.0-29.9 kg/m^2)	18 (10-52)	13 (9-16)	-6.97 (-34.81-5.38)
	H	4.515	1.171	1.946
	p	0.105	0.557	0.378
EAT-40 Group	Impaired	-	13 (9-16)	-5.28 (-20.26-5.01)
	Normal	-	14 (10-16)	-10.54 (-54.2-8.2)
	U	-	1617	1387
	p	-	0.208	0.041*
SNAQ Group	Impaired	16 (5-52)	-	-10.63 (54.20-6.05)
	Normal	15 (6-78)	-	-7.59 (-36.79-8.20)
	U	3927.5	-	3934
	P	0.396	-	0.406
DII Group	Anti-inflammatory	15.5 (6-78)	14 (9-16)	-
	Pro-inflammatory	16 (5-50)	14 (11-15)	-
	U	3183	3393	-
	p	0.392	0.764	-

*U: Mann-Whitney U Test, H: Kruskal-Wallis H Test, *p<0.05; ***p<0.001, The difference between medians that do not have a common letter is significant (p<0.05)*

Table 5. The relationship between students' EAT-40, SNAQ, DII scores and the effect of EAT-40 and SNAQ on DII scores

Correlation			EAT-40			SNAQ	
SNAQ	s		-0.071			1.000	
	p		0.279			.	
DII	s		0.089			-0.014	
	p		0.173			0.830	
	Model	β	SH	t	p	F	p
DII	(Invariant)	-13.805	1.570	-8.791	<0.001***	3.023	0.083
	EAT-40	0.138	0.079	1.739	0.083		
R=0.113; R²=%1.3 Corrected R²=%0.9							
DII	(Invariant)	-6.233	8.598	-0.725	0.469	0.361	0.548
	SNAQ	-0.381	0.634	-0.601	0.548		
R=0.039; R²=%0.2 Corrected R²=%0.3							

*EAT-40:Eating Attitude Test, SNAQ:Simplified Nutrition and Appetite Questionnaire, DII:Dietary Inflammatory Index, s:Spearman's Rank Differences Correlation, ***p<0.001*

In our study, it was observed that the students generally followed this recommendation.

Skipping meals was common among most participants, and the most skipped meal was lunch. Differently, in a large cohort study on university students by Yamamoto et al., the most frequently skipped meal was found to be breakfast [34]. In a recent cross-sectional study on university students, more than half of the students skipped breakfast and this was associated with longer sleep time, being away from family, lack of breakfast habit,s and financial reasons [35].

Waist circumference was higher in male students than in females in this study. Another study conducted with university students, it was found that male students had higher waist circumference values [36]. This situation can be explained by the high BMI values of male students in our study.

Women and 4th-grade undergraduates had the most disordered eating attitudes and a greater appetite. Contrary to our study, in a study conducted on university students, it was found that male students have more eating attitude disorders than females [37]. According to Din et al., no significant difference was found between male and female students in terms of eating attitudes [38]. Similarly, in a cross-sectional study conducted with nutrition and dietetics students, it was found that the incidence of deterioration in eating attitudes decreased as the undergraduate degree increased [39]. In a different study, no significant difference was found between the eating attitudes of different undergraduate groups [40]. This can be explained by the fact that the number of female students in this study is higher than the number of male students, the senior undergraduate students have a higher internship and workload, and their eating attitudes deteriorate due to reasons such as skipping meals or snacking.

In this study, female students and 4th-grade undergraduates were the groups with the highest appetite. In another study conducted in a different way, it was determined that the appetite status of female students was not different from male students [41]. This can be explained by the fact that the number of female students in the study is higher.

Diets of women and 4th-grade students were potentially more pro-inflammatory than men. This can be explained by the fact that the number of female students in the study is higher. Other studies had found no difference between the DII scores of male and female university students according to education degrees [42,43].

It was found that the majority of students with normal appetite were normal weight in terms of BMI. In one study, an increase in appetite deterioration was observed in women as BMI values increased. Individuals with normal BMI values have a significantly lower EAT-40 score than overweight and obese individuals. This shows that appetite has a significant effect on BMI values, and impaired appetite may lead to obesity [44].

Similarly, a study found that there was a low level of positive correlation between the DII score of adolescents and BMI and upper-middle arm circumference values [45]. Similarly, in a study conducted on adolescents in 2018, it was seen that obesity causes higher hs-CRP levels, and the increase in hs-CRP is associated with less vegetable/legume intake frequency [46]. On the other hand, another similar study showed the relationship between the presence of obesity and higher hs-CRP levels [47,48].

Finally, no statistically significant relationship was found between dietary inflammatory index, eating attitude, and appetite in this study. The DII scores of individuals with impaired eating attitudes were high in different studies [16-18]. Again, in a different study, it was reported that inflammation was higher in individuals with a worse appetite according to the SNAQ results. Differently, it was observed that the presence of inflammation decreased food intake [24]. Chronic overproduction of cytokines such as TNF-α and IL-6 in the circulation may reduce appetite and cause anorexia. This can be explained by the fact that obesity is triggered by an increase in appetite, which may cause inflammation in the body through the increase of inflammatory cytokines such as IL-6 and TNF-α, while the decrease in the levels of adiponectin has an anti-inflammatory function [22].

Limitations

Since the population of this study consisted of nutrition and dietetics students, the number of men was small. This limits the generalization of gender-specific data to this age group. In addition, since the study was conducted online, anthropometric measurements were based on statements and were not taken by the researchers may have caused bias in the study results. Another limitation is that inflammatory biomarkers were not studied in our study. Although the literature point to the relationship between DII and serum inflammatory markers, no significant relationship was found in our study. Evaluation of inflammatory biomarkers in this age group may strengthen the study.

CONCLUSION

As far as we know, this study; is the first study to evaluate eating attitude, appetite status, and inflammatory potential of diet among university students. Accordingly, the dietary inflammatory level of university students is not affected by the individuals' eating attitudes and appetite. The DII calculation used in this study may not be objective because it is based on the 3-day food recall of individuals and is not supported by biochemical parameters. In addition, because our study included a sample of university students, it may not reflect the general population. More comprehensive studies are needed to reveal the relationship between the inflammatory potential of diet, appetite, and eating attitude.

REFERENCES

1. Calder PC, Ahluwalia N, Albers R, et al. A consideration of biomarkers to be used for evaluation of inflammation in human nutritional studies. Br J Nutr. 2013;109(S1):1-34.
2. Minihane AM, Vinoy S, Russell WR, et al. Low-grade inflammation, diet composition and health: current research evidence and its translation. Br J Nutr. 2015;114(7):999-1012.
3. Shin D, Lee KW, Brann L, Shivappa N, Hébert JR. Dietary Inflammatory Index is positively associated with serum high-sensitivity c-reactive protein in a Korean adult population. Nutr. 2019;63:155-161.
4. Tolkien K, Bradburn S, Murgatroyd C. An anti-inflammatory diet as a potential ıntervention for depressive disorders: A systematic review and meta-analysis. Clin Nutr. 2019;38:2045-2052.
5. Hébert JR, Shivappa N, Wirth MD, Hussey JR, Hurley TG. Perspective: the Dietary Inflammatory Index (DII)-lessons learned, improvements made, and future directions. Adv Nutr. 2019;10(2):185-195.
6. Kenđel Jovanović G, Mrakovcic-Sutic I, Pavičić Žeželj S, Šuša B, Rahelić D, Klobučar Majanović S. The efficacy of an energy-restricted anti-inflammatory diet for the management of obesity in younger adults. Nutrients. 2020;12(11):3583.
7. Wang YB, Shivappa N, Hébert JR, Page AJ, Gill TK, Melaku YA. Association between dietary inflammatory index, dietary patterns, plant-based dietary index and the risk of obesity. Nutrients. 2021;13(5):1536.
8. Kord Varkaneh H, Fatahi S, Tajik S, Rahmani J, Zarezadeh M, Shab-Bidar S. Dietary inflammatory index in relation to obesity and body mass index: A meta-analysis. Nutr Food Sci. 2018;48(5):702-721.
9. Alam I, Shivappa N, Hebert JR, Pawelec G, Larbi A. Relationships between the inflammatory potential of the diet, aging and anthropometric measurements in a cross-sectional study in Pakistan. Nutr Healthy Aging. 2018;4(4):335-343.
10. Alkerwi AA, Shivappa N, Crichton G, Hébert JR. No significant independent relationships with cardiometabolic biomarkers were detected in the observation of cardiovascular risk factors in Luxembourg study population. Nutr Res. 2014;34(12):1058-1065.
11. Kenđel Jovanović G, Mrakovcic-Sutic I, Pavičić Žeželj S, et al. Metabolic and hepatic effects of energy-reduced anti-inflammatory diet in younger adults with obesity. Can J Gastroenterol Hepatol. 2021;2021:6649142.
12. Laddu D, Hauser M. Addressing the nutritional phenotype through personalized nutrition for chronic disease prevention and management. Prog Cardiovasc Dis. 2019;6 (1):9-14.
13. World Health Organization, Diet, nutrition and chronic diseases in context, https://www.who.int/nutrition/topics/4_dietnutrition_prevention/en/ (Avaliable Date: 22 Dec 2020).
14. Pereira RF, Alvarenga M. Disordered eating: identifying, treating, preventing, and differentiating it from eating disorders. Diabetes Spectr. 2007;20(3):141-148.
15. Koçhan NZ, Arslan M. Mevsimsel değişimin duygusal iştah ve yeme tutumu üzerine ilişkisinin incelenmesi: üniversite öğrencileri üzerine bir çalışma. Batı Karadeniz Tıp Dergisi. 2021;5(2):210-217.
16. Patsalos O, Dalton B, Kyprianou C, et al. Nutrient intake and dietary inflammatory potential in current and recovered anorexia nervosa. Nutrients. 2021;13(12):4400.
17. Tabrizi FPF, Farhangi MA. Is there any mediatory association between health-related quality of life and eating behaviors to affect dietary inflammatory index (DII) among reproductive-aged women? A structural equation modeling approach. Nutr Clin et Métab. 2021;35(4):288-296.
18. Wirth MD, Hébert JR, Shivappa N, et al. Anti-inflammatory Dietary Inflammatory Index scores are associated with healthier scores on other dietary indices. Nutr Res. 2016;36(3):214-219.
19. Müftüoğlu S, Kızıltan G, Akçil Ok M. Majör depresyon hastaları için "Aşırı Besin İsteği" Ölçeğinin Türk kültürüne uyarlanması: geçerlilik ve güvenirlilik çalışması. Turkiye Klinikleri J Health Sci. 2017;2(1):13-22.
20. Köse S, Şanlıer N. Hedonik açlık ve obezite. Turkiye Klinikleri J Endocrin. 2015;10(1):16-23.
21. Dent E, Yu S, Visvanathan R, et al. Inflammatory cytokines and appetite in healthy people. J Ageing Res Clin Pract. 2012;1(1):40-43.
22. Ellulu MS, Patimah I, Khaza'ai H, Rahmat A, Abed Y. Obesity and inflammation: the linking mechanism and the complications. Archives of medical science: AMS. 2017;13(4):851.
23. Burrows K, Stewart JL, Antonacci C, et al. Association of poorer dietary quality and higher dietary inflammation with greater symptom severity in depressed individuals with appetite loss. J affect disord. 2020;263:99-106.
24. Sieske L, Janssen G, Babel N, Westhoff TH, Wirth R, Pourhassan M. Inflammation, appetite and food intake in older hospitalized patients. Nutrients. 2019;11(9):1986.
25. Yazıcıoğlu Y, Erdoğan S. SPSS uygulamalı bilimsel araştırma yöntemleri. Ankara: Detay Yayıncılık. 2004.
26. Garner DM, Garfinkel PE. The Eating Attitudes Test: An index of the symptoms of anorexia nervosa. Psychol Med. 1979;9(2):273-279.
27. Savaşır I, Neşe Erol. Yeme tutum testi: Anoreksia nervosa belirtiler indeksi. Türk Psikoloji Dergisi. 1989;7:19-25.
28. Shivappa N, Steck SE, Hurley TG, Hussey JR, Hébert JR. Designing and developing a literature-derived, population-based dietary inflammatory index. Public health nutrition. 2014;17(8):1689-1696.
29. Wilson MMG, Thomas DR, Rubenstein LZ, et al. Appetite assessment: simple appetite questionnaire predicts weight loss in community-dwelling adults and nursing home residents. AJCN. 2005;82(5):1074-1081.
30. İlhan B, Bahat G, Oren MM, Kiliç C, Durmazoglu S, Karan MA. Reliability and validity of Turkish version of the Simplified Nutritional Appetite Questionnaire (SNAQ). J Nutr Health Aging. 2018;22(9):1039-1044.
31. Öcalan D, Ceylantekin Y, Kunduracılar Z, Doğan T. Üniversite öğrencilerinde beden kütle indeksi, tükenmişlik düzeyi ve iyilik hâli arasındaki ilişkinin incelenmesi. Türkiye Diyabet ve Obezite Dergisi. 2020;4(3):270-278.
32. Arslan SA, Daşkapan A, Çakır B. Üniversite öğrencilerinin beslenme ve fiziksel aktivite alışkanlıklarının belirlenmesi. TAF Preventive Medicine Bulletin. 2016;15(3):171-180.
33. McCarthy C, Warne J. Gender differences in physical activity status and knowledge of Irish University staff and students. Sport Sciences For Health. 2022;1-9.
34. Yamamoto R, Tomi R, Shinzawa M, et al. Associations of skipping breakfast, lunch, and dinner with weight gain and overweight/obesity in university students: a retrospective cohort study. Nutrients, 2021;13(1):271.
35. Biswas S, Alam SS, Sayem AH, Hossain M. Breakfast skipping and associated factors: Experience from students at Public University in Noakhali District, Bangladesh. Examines Phy Med Rehab. 2020;3(1).
36. Çil MA, Caferoğlu Z, Bilgiç P. Üniversite öğrencilerinde diyet kalitesinin ve yeme davranışının antropometrik ölçümler ile ilişkisi. Acıbadem Üniversitesi Sağlık Bilimleri Dergisi. 2020;11(1):61-67.
37. Ali SM. Disturbed eating attitudes among male and female university students. Journal of Social Sciences and Humanities. 2018;57(1):45-60.
38. Din Z, Iqbal K, Khan I, et al. Tendency towards eating disorders and associated sex-specific risk factors among university students. Archives of Neuropsychiatry. 2019;56(4):258.
39. Rocks T, Pelly F, Slater G, Martin LA. Eating attitudes and behaviours of students enrolled in undergraduate nutrition and dietetics degrees. Nutrition & Dietetics. 2017;74(4):381-387.
40. Alkan ŞB, Solak R, Gürbüz E, et al. Beslenme ve diyetetik bölümü öğrencilerinde yeme davranış bozukluğu ve beden algısı: kesitsel bir çalışma. Necmettin Erbakan Üniversitesi Sağlık Bilimleri Fakültesi Dergisi. 2019;2(2):38-44.
41. İbrahimova A. Üniversite öğrencilerinin yeme farkındalığına göre aşırı besin isteği, iştah ve beslenme durumlarının değerlendirilmesi (Master's thesis, Sağlık Bilimleri Enstitüsü). 2020.
42. Masaad AA, Yusuf AM, Shakir AZ, et al. Sleep quality and Dietary Inflammatory Index among university students: a cross-sectional study. Sleep Breath. 2021;25(4):2221-2229.
43. Kim Y, Chen J, Wirth MD, Shivappa N, Hebert JR. Lower dietary inflammatory index scores are associated with lower glycemic index scores among college students. Nutrients. 2018;10(2):182.
44. Öztaynıcı N, Açıkgöz Pınar A, Akal Yıldız E, Gökmen Özel H. Farklı beden kütle indeksi değerine sahip yetişkin kadınların sosyo-demografik özellikleri ile yeme tutumlarının değerlendirilmesi. J Nutr Diet. 2022;49:48-57.
45. Kurklu NS, Torun NK, Kucukcetin IO, Akyol A. Is there a relationship between the dietary inflammatory index and metabolic syndrome among adolescents? J Pediatr Endocr Met. 2020;33(4):495-502.

46. Cabral M, Araújo J, Lopes C, Ramos E. Food intake and high-sensitivity C-reactive protein levels in adolescents. Nutr Metab Cardiovasc Dis. 2018;28(10):1067-1074.
47. Klisic A, Vasiljevic N, Simic T, Djukic T, Maksimovic M, Matic M. Association between C-reactive protein, anthropometric and lipid parameters among healthy normal weight and overweight postmenopause women in Montenegro. Lab Med. 2014;45:12-16.
48. Kawamoto R, Kusunoki T, Abe M, Kohara K, Miki T. An association between body mass index and high-sensitivity C-reactive protein concentrations is influenced by age in community-dwelling persons. Ann Clin Biochem. 2013;50:457-464.