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The role of mindful eating, and intuitive eating on the relationship with orthorexia nervosa in University Students: a cross-sectional study

O papel da alimentação consciente e da alimentação intuitiva na relação com a ortorexia nervosa em estudantes universitários: um estudo transversal

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ABSTRACT

Objective
The study aimed to determine the relationship between mindful eating, intuitive eating, eating attitudes, and orthorexia nervosa in university students.

Methods
In the current cross-sectional study, 320 students (59.4% female) were enrolled. An online questionnaire including demographic characteristics, Orthorexia Nervosa Questionnaire-11, Eating Attitudes Test-40, Intuitive Eating Scale–2nd edition, and Mindful Eating Questionnaire was performed. Additionally, some anthropometric measurements (body weight, height, waist, and hip circumferences) were taken with the participants' declaration. Data were analyzed using IBM®SPSS® 24.0.

Results
In participants with orthorexia nervosa , the scores of "eating discipline" and "interference" scores, which are *Mindful Eating Questionnaire* sub-factors, were higher than those who do not have orthorexia nervosa ($p<0.05$). There was a negative correlation between *Mindful Eating Questionnaire* and Orthorexia Nervosa Questionnaire-11 scores (r = −0.137; p:0.014). Additionally, the one-point increase in the Orthorexia Nervosa Questionnaire-11 scores of participants led to a 0.101 increase in Eating Attitudes Test-40 scores (B: 0.101, SE: 0.024, $p<0.001$), and a 1.667 decrease in *Mindful Eating Questionnaire* scores (B: -1.667, SE: 0.667, p:0.014). The body mass index, Eating Attitudes Test-40, and *Mindful Eating Questionnaire* scores affected Orthorexia Nervosa Questionnaire-11 scores by 6.3% (R2: 0.063).

Conclusion
Our study demonstrated a negative correlation between the Orthorexia Nervosa Questionnaire-11 and *Mindful Eating Questionnaire* total scores, whereas no correlation was found between Orthorexia Nervosa Questionnaire-11 and Intuitive Eating Scale–2nd edition scores. However, further research is needed to classify orthorexia nervosa as a separate eating disorder and to establish criteria for diagnosis and treatment.

Keywords: Eating attitudes. Eating disorders. Intuitive eating. Mindful eating. Orthorexia nervosa.

RESUMO

Objetivo

O objetivo do estudo foi determinar a relação entre o mindful eating, o comer intuitivo, as atitudes alimentares e a ortorexia nervosa em estudantes universitários.

Métodos

No presente estudo transversal, foram inscritos 320 estudantes (59,4% do sexo feminino). Foi realizado um questionário online que incluía características demográficas, Orthorexia Nervosa Questionnaire-11, Eating Attitudes Test-40, Intuitive Eating Scale-2nd edition *e* Mindful Eating Questionnaire. *Adicionalmente, foram tomadas algumas medidas antropométricas (peso corporal, altura, circunferências da cintura e da anca) com a declaração dos participantes. Os dados foram analisados através do IBM®SPSS® 24.0.*

Resultados

Nos participantes com ortorexia nervosa, as pontuações de "disciplina alimentar" e "interferência", que são subfactores do Mindful Eating Questionnaire, foram mais elevadas do que naqueles que não possuíam ortorexia nervosa (p<0,05). Houve uma correlação negativa entre os escores do Mindful Eating Questionnaire *e do* Orthorexia Nervosa Questionnaire-11 *(r = -0,137; p:0,014). Além disso, o aumento de um ponto nas pontuações do Orthorexia Nervosa Questionnaire-11 dos participantes levou a um aumento de 0,101 nas pontuações do* Eating Attitudes Test-40 *(B: 0,101, SE: 0,024, p<0,001) e a uma diminuição de 1,667 nas pontuações do* Mindful Eating Questionnaire *(B: -1,667, SE: 0,667, p:0,014). As pontuações do índice de massa corporal, do* Eating Attitudes Test-40 *e do* Mindful Eating Questionnaire *afetaram as pontuações do* Orthorexia Nervosa Questionnaire-11 *em 6,3% (R2: 0,063).*

Conclusão

O estudo demonstrou uma correlação negativa entre as pontuações totais do Orthorexia Nervosa Questionnaire-11 *e do* Mindful Eating Questionnaire*, enquanto que não foi encontrada qualquer correlação entre as pontuações do* Orthorexia Nervosa Questionnaire-11 *e do* Intuitive Eating Scale-2nd. *No entanto, é necessário maior investigação para classificar a ortorexia nervosa como uma perturbação alimentar distinta e para estabelecer critérios de diagnóstico e tratamento.*

Palavras-chave: *Atitudes alimentares. Distúrbios alimentares. Alimentação intuitiva. Alimentação consciente. Ortorexia nervosa.*

INTRODUCTION

Today, there are guidelines that define what a healthy and balanced diet is and its principles. However, some people follow a diet based on their own personal ideas of what constitutes a healthy diet [1]. Orthorexia Nervosa (ON) is defined as having an unhealthy obsession with trying to eat healthy. The term is derived from the Greek word ortho (meaning "proper") and orexi, meaning "appetite", and is a coining by Steven Bratman [2]. The Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) does not yet recognize ON as a psychiatric disorder [3]. However, studies have reported the criteria for defining ON as obsession or pathological preoccupation with healthy eating characterized by anxiety/exaggerated emotional distress, emotional consequences and self-punishment when dietary guidelines are not followed, including compensatory behaviors, and significant clinical or psychosocial impairment related to healthy eating [1,4-6]. Although there seems to be a consensus on the importance of ON, its clinical significance and whether it should become an accepted diagnosis continue to be hotly debated [7]. Identifying the psychological factors of orthorexic eating habits is critical when considering the clinical significance of ON.

One of the important points is that there is a relationship between ON and disordered eating symptoms (such as restraint, preoccupations about body weight, etc.) and Disordered Attitudes (DEA) [8,9]. The DEAs are defined as unhealthy behaviors. They range from dieting to maintain weight to severe food restriction [10]. The Eating Attitude Test has been developed to measure abnormal eating behaviour, with the latter being able to predict orthorexic behaviors. Studies showed that The Eating Attitude Test was related to ON among the general population [11], and university students [12,13].

Adaptive eating styles have been identified as Mindful Eating (ME) and Intuitive Eating (IE) [14]. ME is defined as a nonjudgmental awareness of physical and emotional sensations while eating or in a food-related environment [15]. More specifically, it is an approach that encourages a mindful and conscious approach to the eating process. Its main aim is to enable individuals to fully focus on their physical and emotional experiences while eating, thereby developing a healthier and more balanced eating behaviour [14]. ME also reduces overeating behaviour by identifying the emotional or external triggers that cause people to eat [16]. Therefore, ME techniques appear helpful in the treatment/or prevention of eating disorders [16,17], and weight management efforts [18].

Intuitive eating is defined as eating in response to physical cues of hunger and satiety, rather than situational and emotional cues, and is associated with positive mental health outcomes [19]. At the same time, IE rejects dieting. Instead of dieting, it emphasizes relying on internal cues of hunger and satiety and giving oneself unconditional permission to eat when hungry [20]. In previous studies, increased IE was found to be associated with lower Body Mass İndex (BMI), less disordered eating, and higher self-esteem and well-being [21-23]. The emotional processes that may be associated with orthorexic behaviour have been explored in only a few studies [24]. However, the link between eating disorders, ME, and IE is currently unknown. Therefore, the aim of this study was to determine the relationship between ON, eating attitudes, ME, and IE in university students. Additionally, we analyzed body weight status, major study programs, and the status of taking nutrition courses with these parameters.

METHODS

Study Design and Participants

This decriptive and cross-sectional study was conducted on undergraduate students between January to May 2023 at a private university, Istanbul. The sample was calculated with the EpiInfo programme. The sample size was determined as 228 when the frequency of occurrence was taken as 50%, the level of error as 5%, the pattern effect as one and the confidence interval as 95%. Accordingly, the total number of participants was determined as a minimum of 228. Exclusion criteria were: age <18 years, pregnancy, hormone replacement therapy, chronotropic medication, active infection, or some disease such as adrenal, thyroid, or inflammatory.

An online questionnaire including demographic characteristics (gender, age, study program, physical activity status, sleep duration, dietary habits, etc.), Orthorexia Nervosa Questionnaire (ORTO-11), Eating Attitudes Test (EAT-40), Mindful Eating Questionnaire (MEQ), and Intuitive Eating Scale – 2nd edition (IES-2) was performed. Some anthropometric measurements were self-reported by the participants (weight, height, waist and hip circumference). BMI was calculated for each participant as a person's weight in kilograms divided by the square of the person's height in meters (kg/m^2).

All procedures followed the tenets of the Declaration of Helsinki. The study was approved (Approval number: 2022-18) by the Istanbul Gelisim University Non-Interventional Clinical Research Ethics Committee on 14.12.2022. All subjects provided written and verbal informed consent.

Orthorexia Nervosa Questionnaire (ORTO-11)

The ORTO-11 scale was used to determine the risk of ON. The scale was developed by Donini et al. [25]. The Turkish validity and reliability of ORTO-11 were determined by Arusoglu

et al. [26]. The scale is 4-point Likert type (never, sometimes, often, or always), and 11 questions regarding selection, purchase, and preparation of food, as well as respondent behavior concerning the consumption of food they evaluated as "healthy". A score <24 indicates a risk of ON, whereas a score of ≥24 is defined as no risk of ON [26]. The Cronbach's alpha value for this study was found to be 0.755.

Eating Attitudes Test (EAT-40)

The EAT-40 test was used to identify eating disorders. The scale was developed by Garner and Garfinkel [27]. The validity and reliability study of the Turkish version of EAT-40 was determined by Savasır and Erol [28]. The scale is a 6-point Likert type, and consists of 40 questions [27]. The answers to items 1, 18, 19, 23, 27, and 39 are reverse scored. A score ≥ of 30 points is defined as high risk (abnormal eating behavior), 21 to 30 as moderate risk, and <21 as low risk [27]. The Cronbach's alpha value for this study was found to be 0.795.

Intuitive Eating Scale – 2nd edition (IES-2)

The IES-2 was used to assess participants' intuitive eating behaviours. The scale was developed by Tylka and Kroon Van Diest [29]. The validity and reliability study of the Turkish version of IES-2 was determined by Bas et al. [30]. The scale includes 23 items and 4 sub-scales: "Unconditional Permission to Eat", "Eating for Physical rather than Emotional Reasons", "Reliance on Hunger and Satiety Cues", and "Body-Food Choice Congruence". The scale is a 5-point Likert type, and items 1, 2, 3, 6, 7, 8, and 9 are reverse scored. The higher the score on the scale, the higher the level of intuitive eating behavior. The Cronbach's alpha value for this study was found to be 0.795.

Mindful Eating Questionnaire (MEQ)

The MEQ was used to determine the participant's mindful eating behavior. The scale was developed by Framson et al. [15]. The validity and reliability study of the Turkish version of MEQ was determined by Köse et al. [31]. This Likert-5 type scale (1: never, 2: rarely, 3: sometimes, 4: often, 5: always) contains 30 items and 7 subscales: "Eating without Thinking", "Emotional Eating", "Eating Control", "Awareness, Eating Discipline", "Conscious Nutrition", and "Interference". Items 1, 7, 9, 11, 13, 15, 18, 24, 25, and 27 in the scale are scored straight, while the other questions are reverse scored. The higher the score on the scale the higher the eating awareness. The Cronbach's alpha value for this study was found to be 0.778.

Data were analyzed using IBM®SPSS® version 24.0. Categorical data (chronic disease, regular physical activity, active smoker, alcohol use, place of residence, major study program, nutrition course taking, etc.) were expressed as the percentage, and differences were analyzed using Fisher's exact test (when including any expected p-value ≤0.05) or the chi-square test. The Kolmogorov-Smirnov test was used to assess the normality of the data distribution. The Student's t-test was used to compare the measured variables between two parameters for those with a normal distribution and the Mann-Whitney U-test for those without a normal distribution. The ANOVA test was used to compare the means of data from groups with a normal distribution, while the Kruskal-Wallis test was used to compare data from more than two groups that did not have a normal distribution. Multiple linear regression was used to identify predictors of the ON risk. A p-value of <0.05 was considered statistically significant for all statistical tests.

RESULTS

The demographical characteristics of students are shown in Table 1. A total of 320 students (59.4% female, and 40.6% male) with a mean age of 23.65±5.21 years participated in the study. Most of the participants (61.9%) lived with their families. Regarding major study programs, 31.3% of the participants studied dietetics/nutritional sciences, 29.1% studied health-related programs, and 39.7% studied non-health-related programs (p<0.001). The mean BMI of the participants was 22.11±3.67 kg/m^2 and most of them (75.3%) were in the normal range according to BMI classification. The mean number of main meals was 2.49±0.56, and the mean number of snacks was 1.53±0.64. Among the participants who skipped meals, 62.5% skipped breakfast, 25.4% skipped lunch, and 12.1% skipped dinner (p:0.700).

Table 1 – Demographic Characteristics, (n=320). Istanbul (Turkey), 2023.

Parameters	Male (n=130)	Female (n=190)	Total (n=320)	p-value
Age (mean±SD)	23.82±5.88	23.53±4.71	23.65±5.21	0.758
Chronic Disease, n (%)	34 (26.2)	50 (26.3)	84 (26.3)	1.000
Sleep Duration (hour/day) (mean±SD)	8.03±2.45	7.87±2.10	7.94±2.25	0.122
Regular Physical Activity, n (%)	34 (26.2)	36 (11.3)	70 (21.9)	0.132
Active Smoker, n (%)	33 (25.4)	38 (20.0)	71 (22.2)	0.275
Alcohol use, n (%)	9 (6.9)	16 (8.4)	25 (7.8)	0.677
Place of residence , n (%)				0.583
Living with family	76 (58.5)	122 (64.2)	198 (61.9)	
Living in a private residence	28 (21.5)	35 (18.4)	63 (19.7)	
Dormitory	26 (20.0)	33 (17.4)	59 (18.4)	
Major study program, n (%)				<0.001**
Dietetics/nutritional sciences	39 (30.0)	61 (32.1)	100 (31.3)	
Health-related	52 (40.0)	41 (21.6)	93 (29.1)	
Non-health related	39 (30.0)	88 (46.3)	127 (39.7)	
Nutrition Course Taking, n (%)	41 (31.5)	60 (31.6)	101 (31.6)	1.000
Height (cm)	167.39±9.11	164.57±6.24	165.71±7.66	
Body weight (kg)	64.41±15.38	58.77±10.70	61.06±13.09	
BMI (kg/m^2)	22.77±3.83	21.66±3.50	22.11±3.67	
BMI Classification, n (%)				0.015*
<18.50 kg/m^2	10 (7.7)	18 (9.5)	28 (8.8)	
18.50-24.99 kg/m^2	90 (69.2)	151 (79.5)	241 (75.3)	
≥ 25.00 kg/m^2	30 (23.1)	21 (11.0)	51 (15.9)	
Waist Circumference (cm)	69.00±13.71	68.32±14.51	68.56±14.20	
Hip circumference (cm)	86.68±20.03	92.22±15.91	90.22±17.67	
Number of main meals	1.61±0.76	2.43±0.62	2.49±0.56	0.353
Number of snacks	1.50±0.60	1.56±0.89	1.53±0.64	0.645
Skipped main meals, n (%)				0.700
Breakfast	62 (60.2)	88 (64.2)	150 (62.5)	
Lunch	29 (28.2)	32 (23.4)	61 (25.4)	
Dinner	12 (11.6)	17 (12.4)	29 (12.1)	

Note: *p<0.05, **p<0.001. Differences between age and sleep duration were determined using the Mann-Whitney U test. Categorical data was analyzed using chi-square test. BMI: Body Mass İndex; SD: Standard Deviation..

The relationship between some characteristics of participants, and ORTO-11, IES-2, EAT-40, and MEQ is shown in Table 2. There were statistical differences between BMI classification and ORTO-11, IES-2, EAT-40, and MEQ scores (p:0.049, p:0.010, p<0.001, and p:0.003, respectively). Skipped main meals showed a statistical difference with ORTO-11, and EAT-40 (p:0.017, and p:0.033,

respectively). There was a statistical difference between the major study program and ORTO-11 and MEQ (p:0.026, and p<0.001, respectively). Similar results were found for taking nutrition courses (p:0.008, and p:0.001, respectively). EAT-40 showed a statistical difference between genders (p:0.005), and MEQ showed a statistical difference between doing regular physical activity (p:0.044).

Table 2 – The relationship between some characteristics of participants, and Orthorexia Nervosa Questionnaire-11, Intuitive Eating Scale – 2nd edition, Eating Attitudes Test-40, and Mindful Eating Questionnaire, (n=320). Istanbul (Turkey), 2023.

Parameters	ORTO-11	IES-2*	EAT-40	MEQ
	X±SD	X±SD	X±SD	X±SD
Gender				
Male (n=130)	30.57±5.99	3.26±0.50	31.43±13.05*	3.20±0.43
Female (n=190)	30.28±5.13	3.26±0.54	27.43±11.65	3.15± 0.47
Regular Physical Activity				
No	30.19±5.77	3.24±0.52	28.44±11.55	3.15±0.46*
Yes	31.17±4.37	3.36±0.51	31.69±14.94	3.26±0.44
Place of residence				
Living with family	30.25±5.91	3.31±0.53	28.75±12.65	3.17±0.47
Living in a private residence	30.36±5.04	3.18±0.48	30.87±13.27	3.17±0.43
Dormitory	30.93±4.69	3.19±0.51	28.55±10.70	3.17±0.43
Major study program				
Dietetics/nutritional sciences	31.61±4.65*	3.30±0.50	28.85±12.21	3.28±0.42**
Health-related	29.91±5.64	3.30±0.50	29.43±13.27	3.20±0.45
Non-health related	29.49±6.07	3.20±0.55	29.22±11.95	3.02±0.46
Nutrition Course Taking				
No	29.68±5.88*	3.24±0.53	29.34±12.60	3.11±0.46**
Yes	31.61±4.60	3.30±0.49	28.82±12.12	3.28±0.42
BMI Classification				
<18.50 kg/m^2	29.09±5.76*	3.16±0.70*	27.80±11.92**	3.13±0.52*
18.50-24.99 kg/m^2	30.27±5.18	3.31±0.49	28.09±11.33	3.22±0.42
≥ 25.00 kg/m^2	32.28±7.07	3.08±0.52	37.32±16.58	2.86±0.49
Skipped main meals				
Breakfast	29.81±5.47*	3.24±0.50	28.03±11.59*	3.15±0.46
Lunch	30.81±5.62	3.32±0.53	28.39±10.80	3.26±0.45
Dinner	32.62±4.93	3.12±0.53	36.51±16.86	3.09±0.43

Note: *p<0.05, **p<0.001. IES-2: Intuitive Eating Scale – 2nd edition; EAT-40: Eating Attitudes Test; MEQ: Mindful Eating Questionnaire; ORTO-11: Orthorexia Nervosa Questionnaire.

The relationship between ORTO-11 and EAT-40 classification, and IES-2 and MEQ subscales are shown in Table 3. "Reliance on Hunger and Satiety Cues", "Body–Food Choice Congruence", "Total IES-2 scores", "Eating discipline", and "Interference" were significantly higher than no risk of ON compared to the risk of ON according to ORTO-11 classification (p:0.007, p:0.003, p:0.008, p:0.003, and p:0.007, respectively). Based on EAT-40 classification, "Unconditional Permission to Eat", "Reliance on Hunger and Satiety Cues", "Total IES-2 scores", "Eating without thinking", "Emotional eating", "Eating control", "Interference", and "total MEQ scores" were significantly higher in low risk of abnormal eating behavior group (p<0.001 for all parameters).

Table 4 shows the correlation between age, BMI, body weight, sleep duration, ORTO-11, IES-2, EAT-40, and MEQ scores. A moderate positive correlation was found between IES-2 and MEQ (r: 0.511, p<0.001). The EAT-40 scores showed a moderate negative correlation with MEQ scores (r: -0.341 p<0.001), and IES-2 scores (r: -0.330 p<0.001). There was a weak positive correlation with BMI and ORTO-11- and EAT-40 scores (r: 0.228 p<0.001, r: 0.261 p<0.001, respectively), while there

was a weak negative correlation with BMI and IES-2 and MEQ scores (r: -0.193 p<0.001, and r: -0.247 p<0.001, respectively). A weak negative correlation existed between body weight and IES-2 and MEQ scores (r: -0.154 p:0.006, and r: -0.235 p<0.001, respectively). However, body weight showed a weak positive correlation with EAT-40 scores (r: 0.211 p<0.001). ORTO-11 showed a weak positive correlation with EAT-40 scores (r: 0.297, p<0.001), while it showed a weak negative correlation with MEQ scores (r: -0.137, p:0.014).

Table 3 – The relationship between Orthorexia Nervosa Questionnaire-11 and Eating Attitudes Test-40 classification, and Intuitive Eating Scale – 2nd edition,and Mindful Eating Questionnaire subscales, (n=320). Istanbul (Turkey), 2023.

Parameters	ORTO-11 Classification			EAT-40 classification			
	<24 scores (Risk of ON) (n=39)	≥24 scores (No risk of ON) (n=281)	p-value	<21 scores (Low Risk) (n=93)	21-30 scores (Moderate Risk) (n=93)	≥30 scores (High Risk) (n=134)	p-value
IES-2							
Unconditional Permission to Eat	3.00±0.64	3.12±0.74	0.340	3.35±0.67	3.20±0.70	2.86±0.72	<0.001[a,**]
Eating for Physical Rather Than Emotional Reasons	3.22±0.42	3.27±0.35	0.398	3.27±0.31	3.31±0.40	3.24±0.35	0.363[a]
Reliance on Hunger and Satiety Cues	3.00±1.25	3.46±0.97	0.007*	3.66±0.96	3.55±1.00	3.13±1.00	<0.001[a,**]
Body–Food Choice Congruence	2.99±1.04	3.44±0.85	0.003*	3.38±0.90	3.54±0.90	3.27±0.85	0.077[a]
Total IES-2 scores	3.05±0.60	3.29±0.50	0.008*	3.41±0.50	3.37±0.50	3.08±0.50	<0.001[a,**]
MEQ							
Eating without thinking	3.45±0.95	3.22±0.94	0.247	3.65±0.77	3.36±0.89	2.88±0.95	<0.001[b,**]
Emotional eating	3.42±1.00	3.14±1.07	0.172	3.60±0.86	3.27±0.99	2.82±1.12	<0.001[b,**]
Eating control	3.60±0.80	3.66±0.88	0.490	3.83±0.72	3.86±0.87	3.40±0.89	<0.001[b,**]
Awareness	3.13±0.38	3.15±0.43	0.955	3.15±0.45	3.16± 0.37	3.14±0.45	0.900[b]
Eating discipline	2.66±0.97	2.97±0.80	0.003*	2.78±0.84	3.01±0.83	2.98±0.81	0.101[b]
Conscious nutrition	2.99±0.42	2.99±0.53	0.892	3.04±0.48	2.92±0.52	3.00±0.54	0.373[b]
Interference	0.92±0.73	1.27±0.61	0.007*	0.90±0.57	1.27±0.56	1.42±0.63	<0.001[b,**]
Total MEQ scores	3.22±0.40	3.19±0.46	0.866	3.35±0.38	3.26±0.44	3.04±0.47	<0.001[b,**]

Note: *p<0.05, **p<0.01. [a]: value calculated from Student t test; [b]: value calculated from Mann Whitney U test. IES-2: Intuitive Eating Scale – 2nd edition; EAT-40: Eating Attitudes Test; MEQ: Mindful Eating Questionnaire; ORTO-11: Orthorexia Nervosa Questionnaire.

Table 4 – Correlation between age, body mass index, body weight, sleep duration, Orthorexia Nervosa Questionnaire-11, Intuitive Eating Scale – 2nd edition, Eating Attitudes Test -40, and Mindful Eating Questionnaire scores. Istanbul (Turkey), 2023.

Parameters	BMI	Body weight	Sleep duration	ORTO-11	IES-2	EAT-40	MEQ
Age	P: 0.234	R: 0.258	R: -0.220	R: 0.008	R: -0.034	R: 0.043	R: -0.039
	p<0.001**	p<0.001**	p<0.001**	P: 0.886	P: 0.549	P: 0.311	P: 0.487
BMI		R: 0.886	R: -0.021	R: 0.228	R: -0.193	R: 0.261	R: -0.247
		p<0.00**	P: 0.710	p<0.001**	p<0.001**	p<0.001**	p<0.001**
Body weight			R: -0.66	R: 0.086	R: -0.154	R: 0.211	R: -0.235
			P: 0.241	P: 0.124	P: 0.006*	p<0.001**	p<0.001**
Sleep duration				R: -0.66	R: -0.21	R: -0.071	R: -0.021
				P: 0.236	P: 0.703	P: 0.202	P: 0.703
ORTO-11					R: 0.058	R: 0.297	R: -0.137
					P: 0.302	p<0.001**	P: 0.014*
IES-2						R: -0.330	R: 0.511
						p<0.001**	p<0.001**
EAT-40							R: -0.341
							p<0.001**

Note: *p<0.05, **p<0.001. p-value calculated from the Spearman Correlation test. BMI: Body Mass İndex; EAT-40: Eating Attitudes Test; IES-2: Intuitive Eating Scale – 2nd edition; MEQ: Mindful Eating Questionnaire; ORTO-11: Orthorexia Nervosa Questionnaire.

According to the multiple regression analysis, the IES-2 scores did not predict ON risk (B: 0.615, SE: 0.595, p: 0.302). However, BMI increased by 0.293 for every one point increase in participants' ORTO-11 score (B: 0.293, SE: 0.084, *p*: 0.001), a 0.101 increase in EAT-40 scores (B: 0.101, SE: 0.024, *p*< 0.001), and a 1.667 decrease in MEQ scores (B: -1.667, SE: 0.667, *p*: 0.014). The BMI, EAT-40, and MEQ scores affected ORTO-11 scores by 6.3% (R2: 0.063) (Table 5).

Table 5 – Predictors of Orthorexia Nervosa using the regression analysis. Istanbul (Turkey), 2023.

Predictors	B	SE	Beta	T	F	*p*-value
Body mass index	0.293	0.084	0.192	3.498	12.237	0.001*
Intuitive Eating Scale – 2nd edition	0.615	0.595	0.058	1.034	1.069	0.302
Eating Attitudes Test-40	0.101	0.024	0.228	4.171	17.394	<0.001**
Mindful Eating Questionnaire	-1.667	0.677	-0.137	-2.463	6.067	0.014*

Note: *p<0.05, **p<0.001. R: 0.269, R2: 0.063 p<0.001 for body mass index, Eating Attitudes Test-40, and Mindful Eating Questionnaire; B: Beta Coefficient, SE: Standard Error, T-Test Value, F: F-Test Value.

DISCUSSION

To our knowledge, this is the first study to evaluate the relationship between ON, mindful eating, intuitive eating, and eating attitudes in college students in Turkey. There were statistical differences between BMI classification and ORTO-11, IES-2, EAT-40, and MEQ scores. Skipped main meals showed a statistical difference with ORTO-11, and EAT-40. There was a statistical difference between the major study program and ORTO-11 and MEQ. Similar results were found for taking nutrition. Based on EAT-40 classification, "Unconditional Permission to Eat", "Reliance on Hunger and Satiety Cues", "Total IES-2 scores", "Eating without thinking", "Emotional eating", and "total MEQ scores" were significantly higher in low risk of abnormal eating behavior group. Additionally, the EAT-40 score increased by 0.101 and the MEQ score decreased by 1.667 for every one point increase in the ORTO-11 score. The BMI, EAT-40, and MEQ scores affected ORTO-11 scores by 6.3%.

Studies have found that gender [26,32], age [25,33], and BMI [33,34] may contribute to the etiology of ON. Some studies have shown that females experience more eating disorders and have abnormal eating behaviors compared to males [26,32,33], while others have found the opposite pattern [25,35]. According to our findings, there were no statistical differences between gender and ON classification. Additionally, BMI is one of the most important factors influencing the tendency of an individual to become orthorexic [36]. The relationship between ON symptoms and BMI is contradictory [25,34,37-40]. We found that there was a weak positive relationship between BMI and ORTO-11 scores. Additionally, there was a 0.293 increase in BMI for every one point increase in ORTO-11 score. This may be explained by the fact that nutrition education students are more likely to limit their food intake and develop healthy eating habits to ensure weight control.

Although nutrition and dietetics students (including those taking nutrition courses) are more likely to have eating disorders or behavioural risks associated with eating disorders, the results of studies on this subject are contradictory [39,41,42]. In this study, The ORTO-11 score was found to be higher in students taking nutrition courses and in dietetics/nutrition students, and the results were statistically significant. Increased efforts to eat healthily and changes in food choices are associated with improved nutritional knowledge [43]. Considering that the majority of students in this study did not have a risk of ON, the results may have been like this.

ON is characterized by an obsession with eating healthy food. The food must be "natural and healthy" for ON individuals [44]. In contrast, ME refers to the practice of paying attention to the present moment and being fully aware of the eating experience [45]. There is evidence to suggest a relationship between ON and ME. A study found that there was a relationship between mindfulness and healthy orthorexia. By contrast, there was a negative relationship between the pathological obsession with healthy eating ON and mindfulness [1]. Another study found that ON was significantly negatively associated with ME (especially eating, hunger and satiety, and eating with awareness) [46]. The "eating with awareness" facet of the mindful eating behavior scale demonstrated a significant relationship with ON, in a negative direction. A further regression analysis revealed ME to predict orthorexic tendencies [47]. A study demonstrated that participants with ON had higher scores for emotional eating and conscious eating, MEQ subfactors, and total MEQ scores than those without ON. Additionally, there was a negative correlation between ORTO-15 and MEQ scores. There was a 0.094 decrease in MEQ scores and a 0.175 decrease in EAT-26 scores for every one point increase in ORTO-15 scores [44]. We found that "eating discipline", and "interference" scores, which were subfactors of MEQ, were significantly higher in individuals with no risk of ON. ORTO-11 showed a weak negative correlation with MEQ. Additionally, MEQ scores decreased by 1.667 for every one point increase in ORTO-11 scores. There appears to be an association between ON and mindful eating. Individuals who are more mindful may be more likely to engage in healthy eating behaviors, while those with ON may have lower levels of mindful eating behaviors.

Individuals with ON strongly desire to control food intake and are preoccupied with the quality and purity of food [25]. On the other hand, intuitive eating is a concept that promotes a healthy relationship with food by listening to one's body's hunger and fullness cues and rejecting dieting and restrictive eating patterns [23]. It was found that when people with ON felt nervous, excited, happy or guilty, they had a strong or uncontrollable desire to eat [25]. A study showed that higher levels of ON behaviors were significantly associated with lower levels of three of the IES-2 subscales ("Unconditional Permission to Eat", "Eating for Physical Rather Than Emotional Reasons," and "Reliance on Hunger and Satiety Cues") among women [48]. We found that "Reliance on Hunger and Satiety Cues", and "Body–Food Choice Congruence", and total IES-2 scores were significantly higher in individuals with no risk of ON Additionally, there was no relationship between ORTO-11 and IES-2 scores. This may be because there were few participants with ON risk in this study.

In the literature, ON tendencies and behaviors have been significantly associated with higher levels of eating disorders. An inverse relationship between ORTO-11/ORTO-15 and EAT-40 scores has been found in studies [34,40,49]. Additionally, a study showed that increasing ORTO-15 scores by one point led to a 0.175 reduction in EAT-26 scores [44]. However, we found that ORTO-11 scores showed a weak positive correlation with EAT-40, and EAT-40 scores increased by 0.101 for every one point increase in ORTO-11 scores. In our study, the results may have been the opposite according to the literature, due to very few participants (12.1%) with ON risk being found.

There are several limitations to the study. Firstly, we used the questionnaire forms rather than a clinical interview to determine ON risk, eating attitudes, IE and ME. Secondly, the present findings result from correlational research, not causal inference. Third, the available data were collected from university students and the majority of them were female (59.4%). Therefore, the results cannot be generalized. Fourth, the study was cross-sectional. Therefore, no direct cause and effect relationship can be established. However, the strength of the study is that it can shed light on studies evaluating the relationship between ON, eating attitudes, IE and ME.

CONCLUSION

The prevalence of ON is increasing day by day in all age groups, especially in young adults. Our study demonstrated a negative correlation between the ORTO-11 and MEQ total scores, whereas no correlation was found between ORTO-11 and IES-2 scores. However, in order to establish criteria for diagnosis and treatment, and to classify ON as an eating disorder in its own right, further studies are needed.

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