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ORIGINAL ARTICLE

The relationship between orthorexia nervosa and body composition in female students of the nutrition and dietetics department

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Abstract

This study was carried out to determine the relationship between orthorexia nervosa (ON) and eating disorder and body composition, class level, and place of residence in university students from the Department of Nutrition and Dietetics. The participants ($n = 136$; 20.9 ± 2.0 years) were all female students, whose scores on the Orthorexia Nervosa Questionnaire (ORTO-11) and the Eating Attitudes Test (EAT-40) indicated a prevalence of ON and eating disorder. Assessment of body composition indices (Tanita bioelectrical impedance; SC-330) of the participants showed there to be no significant difference in the EAT-40 and ORTO-11 scores in terms of body composition, class level, and place of residence. A large majority of the participants (70.6%) had high ORTO-11 scores, and a significant negative correlation ($p < 0.05$) was identified between the EAT-40 and ORTO-11 scores. Final results from analysis of the data showed that although abnormal orthorexic tendencies were common among the students from the Department of Nutrition and Dietetics, they were nonetheless able to maintain body composition within normal values.

Level of evidence V, cross-sectional descriptive study.

Keywords Orthorexia nervosa · EAT-40 · ORTO-11 · Dietetics

Introduction

A positive change to dietary habits is a key factor in reducing the risk of chronic diseases and maintaining overall health [1]. In recent years, there has been greater social awareness on the benefits of healthy eating, which in turn has affected eating attitudes and behaviors; yet, there are still individuals who develop extreme eating habits for the purpose of maintaining or improving overall health, curing a disease, or losing weight [2]. A number of personal, behavioral, social, and environmental factors play a key role in changing eating attitudes and behaviors [3]. The risk of acquiring an eating disorder increases for individuals who are unhappy with their body weight or who are overweight/obese, as well as for those who follow a strict diet, are under high stress or have low self-esteem, and this risk is especially high among

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women [4]. Up to 90% of eating disorders are seen in individuals aged 25 or younger [5], meaning that the college and university years are critical, as it is a time when people are exposed to the greater risk associated with unhealthy changes in eating habits [3]. This risk can be attributed to the changes in eating habits among students that result from such factors as moving to a different city, entering into a new social environment, and leaving home [6]. As eating attitudes and behaviors constitute a common health problem among university students, there is a need for more comprehensive studies to determine the frequency of eating disorders and to identify ways of overcoming the problem [7]. Moreover, the need to increase the number of such studies is supported by the fact that the habits formed during university years shape an individual's behaviors in later life [8].

Several studies have reported that eating disorders, or the behavioral risks associated with eating disorders, are more common [9–11] and are seen at a higher rate among nutritionists (81.9%) [12] and among students of nutrition and dietetics departments (88.7%) [13]. On the other hand, there have been studies reporting that although irregular eating habits are more common among the students of nutrition and dietetics departments, the differences are not significant when compared to students from other departments [14, 15], and were even lower when compared to pre-med students [16]. These inconsistencies in the results of different trials highlight the need for additional studies involving students of nutrition and dietetic departments.

While no specific definition exists in the Diagnostician Statistical Manual of Mental Disorders (DSM) criteria [17], Orthorexia Nervosa (ON) can be considered as both an eating attitude and a behavioral disorder. ON is defined as the avoidance of foods that are considered unhealthy, which, as a consequence, can develop into an obsession for consuming only healthy food [18]. Individuals with ON prefer organic, natural products that do not contain preservatives, and they are generally more interested in the content of food than in the amount [19, 20]. In seeking perfection, individuals with ON tend to gradually limit their diet, and due to the physical, psychosocial, and social consequences of doing this, this eating behavior is believed to represent a psychological disorder [18]. An extreme attachment to such an eating behavior significantly reduces nutritional diversity and can lead to malnutrition, osteopenia, anemia, hyponatremia, metabolic acidosis, pancytopenia, testosterone deficiency, and bradycardia [21]. Moreover, the obsessive behavior demonstrated by individuals with ON prevents them from eating outside their own home, which reduces their social interactions and results in an increase in their obsessive over-concern with food [22].

It has been argued that because nutritionists are seen as role models by their clients, they feel pressured to maintain a certain body weight and to develop healthy eating habits, expectations which start in their university years [23]. This sense of pressure can potentially increase the tendency of students from nutrition and dietetics departments to develop ON [24]. ON was found to be a common eating behavior disorder among female nutritionists, with some women who had ON preferring to be a nutritionist for this very reason [25].

Increased nutritional knowledge has been shown to be associated with a slightly healthier diet and food choice [24], but, knowledge on health and illness can exert an influence on orthorexic tendency [26].

It has been stated that the risk of developing ED can increase as a result of being knowledgeable on food, weight control, and body composition, especially for female students from dietetics and nutrition departments [15]. Therefore, it is important to take precautions for the future health of nutrition and dietetic students by demonstrating the relationship between increased ON tendency and different factors.

Body composition is used to identify the percentages of fat, bone, water, and muscle in human bodies, and these elements are commonly used to assess an individual's health, nutritional, and physical status [27]. Evaluation of body composition is an important part of assessing nutritional status and provides an opportunity to monitor the effects of nutrition-related disease progression and nutritional intervention [28]. It has been suggested that changes in student habits before and after starting university may influence students' body composition. Among the students in nutrition and dietetics departments, the high level of nutritional knowledge they have is believed to have an impact on their body compositions and weight control [15].

While some studies have focused on investigating the relationship between ON and body mass index (BMI) [29], other studies have examined the association between ON and anthropometric measurements [1]. With regards to these different studies, it is important to note that BMI cannot differentiate between body muscle and fat ratio and, therefore, is unreliable as a measure of changes in body composition [30]. Given that the relationship between ON and eating disorder behaviors and the components of body composition has still not been clearly demonstrated, particularly in students from nutrition and dietetics departments (who have a high level of knowledge on nutrition), there is a clear need for additional studies on this subject. In light of the available information, the present study aims to demonstrate the relationship between ON and ED behaviors and (a) body composition [lean body mass (LBM), body fat mass (BF) and percent body fat (BF%) and total body water], (b) the student's place of residence and (c) their class level, in female students from the Department of Nutrition and Dietetics of a university.

Materials and methods

Sample and procedure

The sample of this descriptive study included first, second, and third year female students of the Health Sciences Faculty, Department of Nutrition and Dietetics of a private university in Istanbul, the largest city in Turkey. A total of 470 students were registered in the Department of Nutrition and Dietetics, of which 435 were female and 35 were male. In terms of class levels, 138 students were in their first, 171 were in their second, 88 were in their third and 62 were in their fourth year. To achieve a 90% confidence interval, it was determined that 172 students be included in the study; however, due to various reasons, the final number of participants ended up being 136 female students.

On account of their very limited numbers, males and fourth-year students were excluded from the study. Thus, class level was divided into first, second and third year. Regarding the place of residence, the participants were classified into three categories: lives with family, lives in dormitory, and lives in private residence.

Those who were pregnant, undergoing hormone replacement therapy, taking chronotropic active medication, fitted with an implantable pacemaker, had an active infection, or had a thyroid, adrenal, or inflammatory disease were excluded from the study.

All participants voluntarily agreed to participate in the study with their signed informed consent after being informed about the aim and course of the research. The study was conducted in accordance with the principles of the Helsinki Declaration related to conducting clinical trials on humans, and the research proposal was approved by the Ethics Committee of the University of Bahcesehir.

Data collection

The class level, place of residence, body composition, eating attitudes and ON status of the participants were determined, and the relationships between these parameters were investigated.

The study was conducted between March 2017 and May 2017. The participants visited the faculty laboratory two times for the collection of study data (demographic characteristics, EAT-40 and ORTO-11 scales) and for a body composition analysis. All of the study data were collected from the participants between the same hours of the day (i.e., 09.00–11.00 h), under the same environmental conditions, and in the same order.

During their first laboratory visit, the participants were asked to complete a questionnaire to obtain their demographic data (gender, age, class level, place of residence) and medical history, and to fill out the EAT-40 and ORTO-11 scales. On the second day, the participants visited the anthropometrics laboratory to undergo a body composition measurement.

Instruments

ORTO-11

The ORTO-11 scale, which was first developed by Donini et al. [20], based on Bratman's test in Italy, and originally named ORTO-15, was used to assess ON risk. The Turkish adaptation of the ORTO-11 scale was carried out by Arusoglu et al. [17]. The 11-item version of the scale, referred to as ORTO-11, was thought to have statistically satisfactory properties for the Turkish version. The Cronbach's alpha coefficient of the Turkish version of the scale was calculated to be 0.62, which indicates that the internal consistency was statistically satisfactory [17]. ORTO-11 was used to examine the effect of orthorexic tendency on eating attitude [17]. Each response option item was scored a point of 1, 2, 3 or 4, with items reflecting an orthorexic tendency being scored as 1, and items reflecting a tendency toward normal eating behavior scored as 4. Only one item was reversely coded. Lower scores indicate an orthorexic tendency. Total possible scores for ORTO-11 range between 0 and 44 points.

Following the example of previous research [31], in the first step, the mean and median of the ORTO-11 scores were calculated, which were found to be 27 and 26.6, respectively. A logistic model was devised based on this reference category, where those who scored less than 27 points on the ORTO-11 test were assigned a "1" and those who scored more than 27 points on the test were assigned a "0". Thus, for the purposes of this study, the mean score of the ORTO-11 (27 points) was used as the cut-off point, with scores lower than this value being considered an indication of orthorexic tendency [17]. Based on this cut-off point, participants were divided into two groups, orthorexic individuals and normal individuals.

Eating attitudes test (EAT-40)

EAT-40, originally developed by Garner and Garfinkel [32], is widely used for self-report measures of eating disorders. It is a psychological measure of anorexic/bulimic-like attitudes and beliefs. While EAT-40, as a self-reporting scale, is able to identify individuals who can clinically be considered "patients", it was developed primarily for use as an indicator of a tendency related to this disorder [33]. This 6-point Likert-type scale features 40 questions, where the response options are "always", "very often", "often", "sometimes", "rarely" and "never". Higher scores indicate an increased

risk of eating disorder. The 6-point Likert-type format was the result of a second revision to the EAT-40. Grading was performed based on the total scores [34]. As in previous research [32, 35, 36], the cut-off score of the EAT-40 scale for the present study was determined to be 30. A score of 30 or above is commonly used as the cut-off score of the EAT-40 scale to identify individuals with eating disorders. The total score is directly related to the level of psychopathology. In the EAT-40 risk profiles, the total scores are classified as follows: 30 and above are high risk (abnormal eating behavior), between 21 and 30 are moderate risk, and below 21 are low risk [32, 35, 36]. Savasir and Erol [34] determined the reliability and validity of the EAT-40 for the Turkish population. The Cronbach's alpha coefficient of internal consistency was used to confirm the reliability of the questionnaire. Results of the validity test for the EAT-40 showed a Cronbach's alpha score of 0.84, which was considered acceptable for the EAT-40 in the present study.

Anthropometric measurements

The anthropometric variables included body height (BH), body weight (BW), BMI, and the body composition variables of lean body mass (LBM), body fat mass (BF) and percent body fat (BF%), and total body water ratio. Anthropometric data were collected from each participant using standardized protocols [37]. Body height was measured using the Harpenden anthropometer (Holtain Ltd, Croswell, UK), accurate to the nearest 0.1 cm, while the body weight and body composition measures of LBM, BF, BF% were assessed using foot-to-foot bioelectrical impedance tetrapolar analysis (Tanita BC 330, Tokyo, Japan). All of the measurements were collected at the faculty laboratory, and one of the authors of the present study assessed the anthropometric and body composition measurements.

Statistical analyses

Descriptive statistics (arithmetic mean, standard deviation, percentage, and frequency) were calculated to determine the status of ON and eating attitudes among the female students of the Department of Nutrition and Dietetics. Each of the scores obtained from the ORTO-11 and EAT-40 scales were compared according to class level and place of residence using ANOVA (F-test), and the two groups, which were formed as orthorexic and normal, based on the scores from the ORTO-11 scale [17], were compared in terms of the parameters of body composition (BMI, BF%, BF, LBM, LBM% and total body water ratio) using the t test. The study sample was divided into three groups, which were defined as low, moderate, and high risk, based on the EAT-40 scale scores [32]. The ANOVA (F test) was used to compare the differences in body composition parameters (BMI, BF%, BF, LBM and total body water ratio) between the three groups, while a Pearson Correlation analysis was performed to investigate the relationship between the body composition parameters and EAT-40 and ORTO-11 scale scores. The accumulated data were analyzed using SPSS (version 20.0, Chicago, IL, USA) software developed for Windows, and the level of significance was set to $p < 0.05$ in all statistical tests.

Results

The study sample included 136 female students in their first ($n = 43$; 31.6%), second ($n = 54$; 39.7%) and third ($n = 39$; 28.7%) year of education in the Department of Nutrition and Dietetics. Among the participants, 47.8% ($n = 65$) were living with their family, 23.5% ($n = 32$) were living in a private residence, and 28.7% ($n = 39$) were staying in a dormitory.

Based on the ORTO-11 scores, 70.6% of the students were found to be orthorexic and 29.4% to be normal. The EAT-40 scores indicated that 70.6%, 10.3%, and 3.7% of the students were in the low-, moderate- and high-risk groups, respectively.

Comparison of ORTO-11 (orthorexic and normal) cut-off points for the anthropometric measurements, body composition, and ORTO-11 and EAT-40 scores for all participants is shown in Table 1. According to the t test results, no statistically significant difference ($p > 0.05$) was found in the comparison of the body composition parameters (BMI, BF%, BF, LBM, total body water ratio) of the two groups based on the ORTO-11 scores (Table 1).

The comparison of EAT-40 (low-, moderate-, high-risk groups) cut-off points for the anthropometric measurements, body composition, and ORTO-11 and EAT-40 scores for all participants are summarized in Table 2. According to the ANOVA test, no statistically significant difference ($p > 0.05$) was found in the comparison of the anthropometric (age, height, and weight) and body composition parameters (BMI, BF%, BF, LBM, total body water) of the three groups based on the EAT-40 scores (Table 2).

The scores on the ORTO-11 and EAT-40 scales did not change significantly in terms of class level (Table 3) or place of residence (Table 4) (ANOVA F *test*) ($p > 0.05$). Finally, a negative correlation was found between the EAT-40 and ORTO-11 scale scores ($r = -0.248$, $p < 0.01$) (Fig. 1).

Discussion

The present study analyzed the overall relationship between ON and eating attitudes and behaviors, as well as this relationship in terms of body composition, place of residence and class level, in female students from the Department of Nutrition and Dietetics of a university. While the majority of

Table 1 Comparison of ORTO-11 cut-off points according to the body composition variables

Body composition variables	All participants mean ± SD (min–max)	Risk estimates for ORTO-11 mean ± SD (min–max)		*t*	*p* value *
	Total (*N* = 136)	Orthorexic (*n* = 96)	Normal (*n* = 40)		
Age (year)	20.97 ± 2.00 (18–30)	20.83 ± 1.81 (18–29)	21.30 ± 2.39 (19–30)		
Height (cm)	163.22 ± 5.91 (149–181)	163.47 ± 5.71 (151–181)	162.63 ± 6.39 (149–179)		
Body weight (kg)	58.44 ± 11.83 (38.8–105.7)	58.05 ± 11.05 (42.1–105.7)	59.37 ± 13.64 (38.8–93.9)		
Body mass index (kg/m^2)	21.91 ± 4.20 (15.7–39.6)	21.67 ± 3.70 (16.2–37.0)	22.49 ± 5.22 (15.7–39.6)	− 1.042	0.299
Percent body fat (%)	22.80 ± 8.36 (3.0–46.3)	22.69 ± 7.61(6.0–45.2)	23.07 ± 10.04 (3.0–46.3)	− 0.245	0.807
Body fat mass (kg)	14.18 ± 8.57 (1.2–47.8)	13.85 ± 7.80 (3.0–47.8)	14.96 ± 10.27 (1.2–43.5)	− 0.687	0.493
Lean body mass (kg)	44.15 ± 3.71 (37.6–57.9)	44.05 ± 3.68 (38.5–57.9)	44.41 ± 3.81 (37.6–53.8)	− 0.507	0.613
Total body water (%)	54.05 ± 5.23 (39.2–67.8)	54.10 ± 4.69 (40.4–64.1)	53.93 ± 6.41 (39.2–67.8)	0.167	0.868
ORTO-11[a] score (points)	26.79 ± 3.25 (18–33)	23.20 ± 2.27 (18–26)	28.63 ± 1.63 (27–33)		
EAT-40[b] score (points)	12.30 ± 9.05 (1–67)	13.38 ± 9.88 (1–67)	9.73 ± 6.03 (3–29)		

SD standard deviation

[a]ORTO-11 = orthorexia nervosa

[b]EAT-40 = eating attitude test

*p value calculated from independent samples t tests to determine the risk for ORTO-11 in orthorexic and normal groups ($p > 0.05$)

Table 2 Comparison of EAT-40 cut-off points according to the body composition variables

Body composition variables	All participants mean ± SD (min–max)	Risk estimates for eating attitude test-40 mean ± SD (Min–max)			*F*	*p* value *
	Total (*N* = 136)	Low risk (*n* = 117)	Moderate risk (*n* = 14)	High risk (*n* = 5)		
Age (year)	20.97 ± 2.00 (18–30)	20.99 ± 2.06 (18–30)	20.64 ± 1.74 (19–25)	21.40 ± 1.34 (20–23)		
Height (cm)	163.22 ± 5.91 (149–181)	163.23 ± 6.09 (149–181)	162.64 ± 2.92 (157–168)	164.60 ± 8.26 (153–172)		
Body weight (kg)	58.44 ± 11.83 (38.8–105.7)	58.36 ± 11.80 (38.8–105.7)	59.56 ± 13.24 (44.3–92.3)	56.96 ± 10.56 (46.6–73.5)		
Body mass index (kg/m^2)	21.91 ± 4.20 (15.7–39.6)	21.89 ± 4.26 (15.7–39.6)	22.40 ± 4.27 (17.3–32.7)	20.94 ± 2.78 (17.6–25.2)	0.227	0.797
Percent body fat (%)	22.80 ± 8.36 (3.0-46.3)	22.75 ± 8.34 (3.0-46.3)	23.65 ± 9.09 (11.7–44.3)	21.60 ± 8.20 (15.4–34.2)	0.124	0.883
Body fat mass (kg)	14.18 ± 8.57 (1.2–47.8)	14.12 ± 8.53 (1.2–47.8)	15.15 ± 9.70 (5.2–40.9)	12.88 ± 7.67 (7.2–25.2)	0.149	0.862
Lean body mass (kg)	44.15 ± 3.71 (37.6–57.9)	44.13 ± 3.74 (37.6–57.9)	44.43 ± 3.85 (39.1–51.4)	44.00 ± 3.26 (39.4–48.4)	0.045	0.956
Total body water (%)	54.05 ± 5.23 (39.2–67.8)	54.08 ± 5.23 (39.2–67.8)	53.54 ± 5.61 (40.6–61.1)	54.72 ± 5.05 (46.9–58.3)	0.109	0.897
ORTO-11[a] score (points)	26.79 ± 3.25 (18–33)	25.04 ± 3.22 (19–33)	23.57 ± 3.16 (18–29)	22.40 ± 3.05 (18–26)		
EAT-40[b] score (points)	12.30 ± 9.05 (1–67)	9.51 ± 4.78 (1–20)	25.36 ± 3.25 (21–30)	41.00 ± 14.71 (31–67)		

SD standard deviation

[a]ORTO-11 = orthorexia nervosa

[b]EAT-40 = eating attitude test

*p value calculated from ANOVA F tests to determine the risk for ORTO-11 in orthorexic and normal groups ($p > 0.05$)

Table 3 The comparison of ORTO-11 and EAT-40 Scores according to the class level

Subgroup	*n*	ORTO-11[a]			EAT-40[b]		
Class level		Mean ± SD (min–max)	*F*	*p* value*	Mean ± SD (min–max)	*F*	*p* value*
1st year	43	24.28 ± 3.26 (18–31)			13.65 ± 10.77 (2–67)		
2nd year	54	25.13 ± 3.46 (19–32)	0.847	0.431	11.80 ± 8.56 (2–37)	0.707	0.495
3rd year	39	24.90 ± 2.92 (19–33)			11.51 ± 7.59 (1–36)		
Total	136	24.79 ± 3.24 (18–33)			12.30 ± 9.05 (1–67)		

SD standard deviation

[a]ORTO-11 = orthorexia nervosa

[b]EAT-40 = eating attitude test

*p value calculated from ANOVA F tests ($p > 0.05$)

Table 4 The comparison of ORTO-11 and EAT-40 scores according to place of residence

Subgroup	*n*	ORTO-11[a]			EAT-40[b]		
Place of residence		mean ± SD (min–max)	*F*	*p* value*	mean ± SD (min–max)	*F*	*p* value*
With family	65	25.15 ± 3.17 (18–33)			12.17 ± 10.49 (2–67)		
Student house	32	24.16 ± 2.77 (19–30)	1.027	0.361	11.22 ± 6.73 (1–29)	0.525	0.593
Dormitory	39	24.72 ± 3.70 (18–32)			13.41 ± 8.16 (2–31)		
Total	136	24.79 ± 3.25 (18–33)			12.30 ± 9.05 (1–67)		

SD standard deviation

[a]ORTO-11 = orthorexia nervosa

[b]EAT-40 = eating attitude test

*p value calculated from ANOVA F tests ($p > 0.05$)

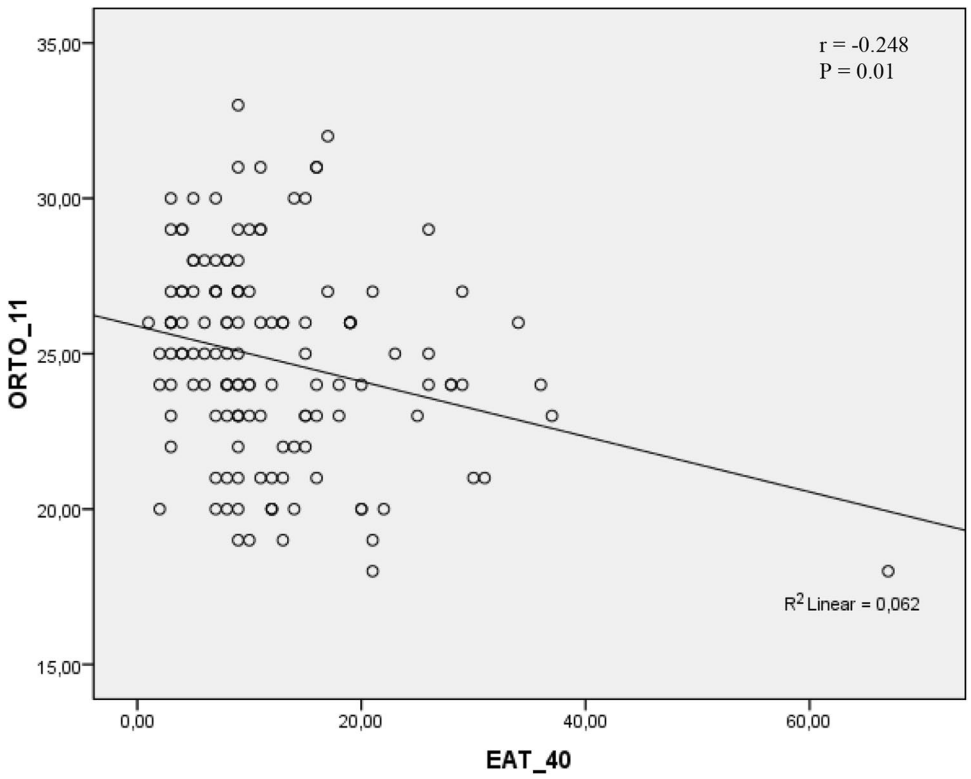

Fig. 1 Correlation between EAT-40 and ORTO-11 scores

study participants exhibited orthorexic characteristics, it was nonetheless concluded that they were at low risk of developing eating behavior disorders. In addition, the ON and EAT scores of the participants did not change significantly according to their body composition, place of residence or class level. In cases of ON, which is defined as an addiction to or settling only for food considered to be healthy [38], individuals develop obsessive–compulsive personality characteristics and "fanatical" healthy eating habits [20].

In the present study, ON was evaluated using the ORTO-11 version, developed by Arusoglu et al. [17], of the ORTO-15 test, at a cut-off value of 27 points. Individuals trained in nutrition are more likely to develop healthy eating behaviors, although an obsession with healthy eating may result in the deterioration of overall health and may, therefore, have a negative impact on psychological and social well-being [29]. It is quite remarkable that the prevalence of ON (70.4%) in the present study was found to be significantly higher than the prevalence of ON in Austrian nutritionists (34.9%) [25], in Turkish nutritionists (41.9% female) [29], and in Italians (6.9%) with professional knowledge and experience in food science and research on eating behavior [20]. In contrast, the frequency identified in this study was somewhat lower than the frequency of ON (74.2%) reported in a study of Hungarians, most of whom were nutritionists, medical students, and healthcare students [39]. The prevalence scores for ON behavior in Brazilian dietitians (81.9%) and nutrition students (88.7%) were also higher than those found in the present study [12, 13]. Given the lack of a reliable assessment tool for evaluating students of nutrition and dietetics, it may be difficult to pinpoint ON prevalence.

A review of the literature revealed there to be no detailed studies examining the psychometric properties of ORTO-11 [31]; therefore, it could be argued that the high prevalence rates reflect the possibility that ORTO-11 does not measure pathological orthorexic eating behavior but rather healthy eating in general, which is not a pathological condition, especially for students in nutrition and dietetics departments. The main validated diagnostic tool for ON has to be improved, because some items seem to be non-specific, especially among experts of nutrition. With this approach, it is also important to identify the clinical characteristics and diagnostic criteria for ON, and to develop new assessment tools based on valid item construction that involves populations [40] and specific groups, such as dietitians and nutritionists.

The ON scores (24.79 ± 3.25) of the participants in this study substantially differed from those reported by other studies using the ORTO-11 scale in different regions of Turkey [26, 31, 41]. When evaluating an ORTO-11 scale, an increasing trend in total score indicates a decrease in the risk of ON [17]. The mean ON score of the participants in this study was lower than that reported in previous studies involving female students studying in the fields of nutrition and dietetics (30.7 ± 4.45) [22], medicine (27.8 ± 6.4) [31], and nursing and obstetrics (26.88 ± 5.21) [41]. Similarly, the mean ON score of the participants in this study was lower than that of Brazilian nutritionists (26.33 points) [12]. It is important here to note that, despite their intense education in nutrition during their undergraduate studies, almost three-quarters of the study participants were still under the risk of acquiring ON. Many reasons as to why ON is high among this particular part of the population can be argued, including this group's feelings of compulsion to become a healthy role model to others and their high level of education related to nutrition and healthy living [31].

The findings obtained from the present study are supported by the results of other studies showing there to be an obsession for healthy nutrition and eating behaviors among female students of nutrition and dietetics departments [29, 42]. Bo et al. [42] assert that individuals with pathological eating habits may tend to prefer nutrition and dietetics departments for their undergraduate education. The ON score identified in this study, which indicated that the sample of female nutrition and dietetics students had a high tendency to engage in pathological eating behaviors, supports the conclusion of Bo et al. [42].

In the present study, the eating attitudes and behaviors of the participants were also evaluated using the EAT-40 scale, for which the cut-off value was 30. The mean EAT-40 score of all participants (12.30 ± 9.05) was lower than estimated when applying the same method among students in the Healthcare School of Higher Education (18.43 ± 10.56) [41] and nutritionists (14.5 ± 7.1) [29]. Eating attitude and behavior disorder is high in healthy adult women (59.3%) [1] and in medical faculty students (55.9%) [7] but varies between 2.2 and 22.8% in young people in Turkey. The percentage of nutrition education students in Turkey with abnormal eating behaviors was found by different studies to be 6% [29], 4.7% [43] and 9.4% [44].

In the present study, the percentage of students at high risk of developing eating disorder behaviors (3.7%) was lower than that reported in the above-mentioned studies [29, 43, 44].

In line with this, the EAT-40 risk prevalence in this study was lower than that reported among university students [45, 46] and healthy individuals [1] in Turkey. The prevalence rate of EAT-40 in the present study was also lower than that of other studies reporting that the prevalence of disordered eating attitudes was between 9.5 and 24.6% among students in Western societies [43]. These differences could be based on the sensitive behavior toward healthy nutrition of students from the Department of Nutrition and Dietetics [36]. Nutrition and dietetic students may be more exposed to higher demands related to their diet quality, body weight, and physical appearance [12]. However, it was a reassuring

finding that the majority (86%) of participants in this study were considered as low risk, based on their eating behaviors, as this is particularly important for the protection, treatment, and improvement of overall health.

The negative correlation found between the EAT-40 and ORTO-11 scores in this study is in line with the negative correlations reported between EAT-40 and ORTO-15 scores recorded for nutritionists in a study by Asil and Surucuoglu [29], and for university students in a study by Sanlier et al. [36]. Although the majority of participants in this study demonstrated an orthorexic tendency, the low ratio of those in the high-risk group of eating attitudes supports the argument that the students of nutrition and dietetics departments are more likely to develop healthy nutrition and eating behaviors [22]. As the present study lacked a control group, additional studies are required to generalize these findings.

To the best of the knowledge of the researchers in the present study, the relationship between body composition, ON risk, and EA behavior has, to date, not been subjected to investigation, although there have been studies addressing the relationship between eating attitudes and behaviors and the risk of ON using different factors. Eating behaviors are influenced by gender, social and cultural factors, religious beliefs, the media, and education [35]. The effects of gender [17, 47, 48], age [20, 31, 48], BMI [20, 31, 35, 39], and level of education [20, 35] on the risk of ON have been previously demonstrated. Furthermore, there have been other studies investigating the relationship between the eating behaviors of students of nutrition and dietetics departments and anxiety and depression [49], as well as gender, BMI, and the field of study [36].

BMI is one of the key factors affecting an individual's orthorexic tendency [22, 24], and ON tendency may be associated with medical status, diet, and nutritional habits [17]. In a study by Gezer and Kabaran [22], it was found that ON risk was significantly higher in those with a low BMI (≤ 18.5 kg/m^2) when compared to other BMI groups. The authors [22] suggested that lower BMI values seen in those with a high risk of ON could be attributed to the tendency of students educated on nutrition to limit food intake and to develop healthy eating habits as part of weight-control efforts. On the other hand, while the participants in this study were at high risk of ON, their BMIs, as well as their body-fat ratios, were within the normal limits for women (20–32%) [50], indicating that they had a healthy body composition.

It was further found in the present study that the ON and EAT-40 scores had no correlation with BMI and body composition parameters (body fat %, fat mass, and muscle mass), the results of which are in line with those from previous studies showing that BMI was not associated with ORTO-15 scores among physicians [26] university students [36], and adults [51].

The present study also found that there was no relationship between the place of residence and class level of the participants and their ON risk and eating disorder behaviors. One study reported that class level was the strongest predictor of nutrition knowledge in nutrition and dietetic students [52], while another showed that increase in knowledge of proper nutrition appeared in the later semesters [24]. In the present study, the students' scores on the ORTO-11 and EAT-40 scales did not change significantly between class levels, from which it can be concluded that students in nutrition and dietetics departments develop a high level of awareness related to healthy eating from the first year of their education. Nonetheless, it was still found that even with the increased amount of education, orthorexia tendencies did not change. Looked at from this perspective, the results of this study also have educational implications, from which it can be suggested that to reduce nutrition and dietetics students' orthorexia tendencies, more attention should be given to curriculum programs in schools.

An understanding of the eating behaviors by class level of the nutrition and dietetic students can help educators to tailor curriculum design. In this case, longitudinal, prospective studies of the same cohorts of students would be necessary to draw conclusions about the development of eating behavior and related attitudes during the course of the study program.

The present findings also showed that the scores of the ORTO-11 and EAT-40 scales did not change significantly in terms of place of residence. Although not statistically significant, a considerably elevated risk of ON was noted among students residing in private residences or dormitories when compared to those living with their families. This finding supports the results of a previous study investigating the effect of studying nutrition on the risk of developing ON, which reported a lower ON risk among students who resided with their families than those living in dormitories or private residences [49].

An understanding of the nutrition knowledge of students undertaking studies in ND can allow educators to tailor curriculum design and delivery to address nutrition misconceptions and personal views at the commencement of their degree, and develop an early understanding of an evidenced-based approach to dietetic practice. The major limitations of this study include the low number of study participants, and the absence of male students and a control group.

Conclusion

While the risk of eating behavior disorders was found to be low among female university students in the Department of Nutrition and Dietetic in this study, the majority of these students still had an orthorexic tendency; however, body

composition parameters indicated that these students had a healthy body structure. It was also observed that the scores indicating ON and eating disorder behaviors were not influenced by body composition, place of residence or class level. It is believed that the findings of this study can contribute to the body of scientific knowledge, particularly insofar as revealing the relationship between ON tendency and eating disorder behaviors and body composition in students of nutrition and dietetics departments, which was lacking in previous studies on this topic. Studies on large cohorts are needed to clarify the prevalence of ON and its pathophysiological consequences.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical approval The research proposal was approved by the Ethics Committee of the University of Bahcesehir. All procedures performed were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Informed consent Informed consent was obtained from all participants included in the study.

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