Original article

A Cross-Sectional Study: Orthorexia Nervosa In Regular Exercising Individuals For Healthy Life

Ozge Yesildemir, Nilufer Acar Tek
Department of Nutrition and Dietetics, Faculty of Health Sciences, Gazi University, Ankara, Turkey

Abstract. This study was conducted to determine the prevalence of orthorexia nervosa (ON) among males and females who exercise regularly and to define the factors associated with ON. A total of 206 individuals (102 males and 104 females) who exercise regularly at least twice a week were included in the study. Anthropometric measurements were taken and body composition was measured by bioelectrical impedance analyzer (BIA). Also, energy and nutrient intake was done through a 24-hour dietary recall and the ORTO-15 test was applied to the participants. Orhtorexia was more prevalent among participants who exercise regularly (81.6%). There was no statistically significant relationship between orthorexic tendency or gender, marital status, education, and income. The mean exercise frequency was significantly higher in individuals with ON than in non-ON individuals. Total dietary energy intake and the percentage of energy from carbohydrates were higher in males with ON than in non-ON males. The percentage of energy from protein was higher in females with ON. Body weight, percentage of body fat, and body mass index (BMI) were higher in orthorexic females than in non-orthorexic females, while there was no difference in anthropometric measurements and body composition in relation to ON in males. As a result, it was determined that individuals who exercise regularly were a risk group in terms of ON.

Key words: Orthorexia nervosa, exercise, healthy eating obsessions, nutrition, body composition

Introduction

The combination of optimal nutrition and physical activity has potentially positive effects on health (1). As the importance of nutrition and physical activity is emphasized for the prevention and treatment of diseases in addition to the improvement of health, awareness towards this issue is increasing in society. In this context, orthorexic individuals adopt eating habits for the purposes of protecting and improving health, treating diseases, or losing weight. However, these eating habits, which ultimately affect the lives of the individuals, can lead to health-threatening nutritional deficiencies and even eating behavior disorders (2).

Orthorexia nervosa (ON) is not currently recognized by the American Psychiatric Association's Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) as an eating disorder (3). However, ON is closely related to the restrictive type of anorexia nervosa and to avoidant/restrictive food intake disorder which requires and dietary restrictions that can result in both significant weight loss and dangerous nutritional deficiencies (4). Individuals with ON have self-defined dietary restrictions and only consume food that they consider healthy. As time goes on, these restrictions can go to extreme levels and violations of these restrictions give rise to strong feelings of shame and personal impurity (5, 6). In addition, these obsessive behaviors and restrictions are associated more with "the content of food" than "the amount of food" (7). Dunn and Bratman identified ON tendencies due to behaving compulsively, struggling with

mental preoccupation, adding increasing restrictions that lead to health problems and interpersonal distress, and depending on self-defined healthy eating behavior (8). Orthorexia, also known as "healthy eating obsession", has recently begun to attract the interest of many clinicians (9). Orthorexia is more frequent in individuals who have an obsession with weight and body image, models, dancers, gymnasts, doctors, dietitians, anxious individuals, and obsessive compulsive individuals (10).

Daily life activities are defined as the total physical activity of the individual. Regular exercise is defined as planned and repetitive physical activities aimed at protecting or improving one or more components of physical fitness. Both physical activity and exercise are associated with physical and psychological well-being (11). Active life style may be an important part of health. Regular exercise should become part of life to maintain and improve health (12).

The potential role of exercise is not included in the criteria of ON and only a few recent studies investigated the possible impact of exercise on ON (5, 13). Studies show that ON is common in professional athletes (14, 15) and in fitness participants (16). However, little is known about the prevalence of ON among individuals who are not athletes but who exercise regularly for a healthy lifestyle. The extension of healthy eating obsessions in this group was not examined sufficiently. Based on studies to determine the prevalence of ON in athletes, we anticipated that among with high ON tendency, exercise play a prominent role which manifests in more regular and longer exercise sessions. For this reason, the prevalence of ON and the factors associated with ON were evaluated in both males and females who exercise regularly but not that of professional athletes in this study.

Methods

Participants

This is a cross-sectional study conducted between April-June 2017. Based on G-Power statistical software, the sample size was found to be 110-196 individuals in an 85-95% confidence interval.

A total of 206 volunteers, 102 male and 104 female, exercisers were included in the study. During the study, subjects who were admitted to the sports center and did not meet the exclusion criteria were included in the study. In this study; being under 19 years of age, having a physical or mental disability, psychoactive drug use in the last 6 months, involuntary weight loss, malnutrition due to any disease, pregnancy or lactation status, and the absence of continuing with a regular exercise program (at least twice a week and at least 30 minutes in 1 session) are defined as exclusion criteria.

An approval was obtained from the Gazi University Ethics Committee under approval number 2017-133. The participants were notified about the study with an informed consent form. They also stated that they were volunteers for this study. The demographic characteristics and the data on the exercise status of the participants were collected with face-to-face interviews via the questionnaire form.

Data Collection

Food Consumption

The 24-Hour Dietary Recall Form was recorded by the researcher. The "Food Photo Catalog: Measures and Quantities" book was used to determine the portion sizes of foods (17). The energy and nutrient intake were analyzed by the Computer Aided Nutrition Program, Nutrition Information System 7.2 (18).

The ORTO-15 Questionnaire

The ORTO-15 questionnaire was developed in 2005 to identify healthy eating obsession. The Turkish version of the questionnaire was adopted by Arusoglu et al. (19). In the questionnaire, individuals are asked to specify how often they feel in some situations regarding orthorexic tendencies by choosing "always," "frequently," "sometimes", and "never" options. The ORTO-15 consists of 15 items with Likert-type response categories ranging from "1-associated with ON" to "4-associated with normal eating behavior." The minimum score is 15 and the maximum score is

60. In the evaluation of the questionnaire, the increase in the score indicates that the risk of ON is decreasing. Subjects whose scores are under 40 are defined as orthorexic, and their eating behavior reaches more normalises as their scores increase (19).

Anthropometric Measurements

The body weight (kg), body mass index (BMI) (kg/m^2), body fat percentage (%), fat mass (kg), total body water (kg), and fat free mass (kg) of participants were determined by using a Tanita BC-418 bioelectrical impedance analyzer (BIA).

Height was measured to the nearest 0.1 cm in the standing position without shoes, using a stadiometer. Waist circumference, hip circumference, neck circumference were measured by a non-stretching tape in accordance with the procedure (20-22). The waist/hip ratio was calculated by dividing the waist circumference (cm) by the hip circumference (cm) (23). The waist/height ratio was calculated by dividing the waist circumference (cm) by the height circumference (cm) (20).

Statistical Analysis

Numerical variables were expressed as mean ($\bar{X}$), standart deviation (SD) and categorical variables were expressed as number (n) and percentage (%). The Kolmogorov Smirnov test was used to determine if the variables were normally distributed. The differences between categorical variables were evaluated using the chi-squared test. An independent Student's t-test or Mann-Whitney U test were used to compare mean values, while a Pearson correlation coefficient test was applied to determine the relationships between variables. All statistical analyses were performed using SPSS software (version 15.0) (24). In all analyses, the significance level was taken as $p<0.05$.

Results

This study was carried out on a total of 206 individuals, 102 male and 104 female, between the ages of 19 and 55 year who exercise regularly in a sports center. The average age was 25.8±7.86 year for males and 26.5±9.07 year for females.

The mean score of ORTO-15 in the overall sample was 36.8±4.14. There was no significant difference between male (37.1±3.90) and female ORTO-15 scores (36.5±4.36) ($p>0.05$) (Table 1).

In males, 85 out of 102 (83.3%) had a score indicating ON. In females, 83 out of 104 (79.8%) had a score indicating ON. The difference between male and female ORTO-15 scores was not statistically significant ($p>0.05$) (Table 1).

When evaluated in terms of marital status, 83.3% of orthorexic individuals were single, while 84.2% of non-orthorexic individuals were single. In addition, 68.4% of orthorexic individuals had a university or upper degree, while 73.7% of non-ON individuals had a university or upper degree. Of the subjects with ON, 16.7% had low, 74.4% had moderate, and 8.9% had

Table 1. The mean and standard deviation values of individuals ORTO-15 scores, and their distribution according to their ON status

	Male (n=102)		**Female (n=104)**		**Total (n=206)**			
	$\bar{X}$	**SD**	$\bar{X}$	**SD**	$\bar{X}$	**SD**	**p**[a]	
ORTO-15 Total score	37.1	3.90	36.5	4.36	36.8	4.14	0.342	
	S	**%**	**S**	**%**	**S**	**%**	X^2	**p**[b]
≤40 (ON)	85	83.3	83	79.8	168	81.6		
							0.425	0.514
>40 (non-ON)	17	16.7	21	20.2	38	18.4		

[a]Student's t testi, [b]Chi-squared test
The p[b] value shows the difference between males and females

high income levels. Of non-ON subjects, 28.9% had low, 57.9% had moderate and 13.2% had high income levels. No significant differences were found between orthorexic tendency and marital status or education status and income status (p>0.05) (Table 2).

Exercise frequency was higher among the orthorexic (3.4±1.27 d/wk) than in non-orthorexic individuals (3.0±1.34 d/wk) (p<0.05). On the contrary, exercise duration did not significantly differ between the orthorexic (250.9±130.75 min/wk) and the non-orthorexic (229.0±132.97 min/wk) (p>0.05) (Table 3).

Dietary energy, thiamin, folic acid, vitamin B_{12}, phosphor, zinc, cholesterol, riboflavin, and niacin intake were higher in males with ON than in non-ON males (p<0.05). The percentage of energy from carbohydrates was lower in orthorexic males than in non-orthorexic males (p<0.05). The mean percentage of energy from protein was higher in females with ON (18.3±5.45%) than in non-ON females (15.1±2.87%) (p<0.05) (Table 4).

There was no statistically significant difference in the anthropometric measurements and body composition between orthorexic and non-orthorexic males (p>0.05). Body weight, percentage of body fat, fat mass, hip circumference, and waist-to-height ratio were higher in females with ON than in non-ON females (p<0.05). The mean BMI was higher in females with ON (24.0±4.65 kg/m^2) than in non-ON females (21.1±4.23 kg/m^2) (p<0.05) (Table 5).

Table 2. Distribution of the individuals' regarding the general characteristics

General Characteristics	≤40 (ON)		>40 (non-ON)		
	S	%	S	%	p
Marital status					
Married	28	16.7	6	15.8	0.895
Single	140	83.3	32	84.2	
Education status					
Primary school	1	0.6	0	0	0.915
High school	52	31.0	10	26.3	
University	96	57.1	24	63.2	
Master's or upper	19	11.3	4	10.5	
Income status					
Low	28	16.7	11	28.9	0.121
Middle	125	74.4	22	57.9	
High	15	8.9	5	13.2	

Chi-squared test

Discussion

Despite not having been categorized as a disease, the issue of ON attracts the attention of researchers. There is a limited number of studies on the determination of the prevalence of ON in individuals who exercise regularly, and the majority of these studies were conducted on university students, health professionals, as well as on nutrition and dietetics students (25-29). Information on the prevalence of ON in the general population is controversial and is shown to vary from a low percentage to 50% of the population (30, 31). In a study conducted by Segura-Garcia et al (14), an orthorexic tendency was found in 28% of athletes. The prevelance of ON in 2.130 university students and 696 university personnel in Italy was found to be 32.7% (32). In another study, 81.8% of opera artists had ON (33). In a study conducted by Dalmaz and Yurtdas (25), the mean score of the ORTO-15 scale was found to be 35.3±6.86 in individuals who exercise in sports centers (n:100). In the present study, the mean ORTO-15 score was found to be 36.8±4.14 in total. The prevalence of ON was found to be 81.6% in this study (Table 1). The high prevalence of ON in

Table 3. Distribution of the individuals regarding the exercise frequency and duration

	≤40 (ON)		>40 (non-ON)		
	$\bar{X}$±SD	Min-Max	$\bar{X}$±SD	Min-Max	p
Exercise frequency (d/wk)	3.4±1.27	2-7	3.0±1.34	2-7	0.027*
Exercise duration (min/wk)	250.9±130.75	90-720	229.0±132.97	120-630	0.191

Mann-Whitney U test, *p<0.05

Table 4. Energy, macronutrients, and micronutrients intake of individuals regarding ON

	≤40 (ON)		>40 (non-ON)			
	Male (n:85) X±SD	**Female (n:83) X±SD**	**Male (n:17) X±SD**	**Female(n=21) X±SD**	**p (M-M)**	**p (F-F)**
Energy(kcal)	2077.0±774.68	1177.1±488.93	1562.1±679.75	1265.0±469.64	0.017*[a]	0.460[b]
Protein (%)	18.8±6.31	18.3±5.45	16.4±2.85	15.1±2.87	0.112[a]	0.003*[a]
Carbohydrate (%)	39.5±12.17	40.3±12.46	46.0±10.52	43.8±10.65	0.042*[b]	0.250[b]
Total lipid (%)	41.0±9.69	40.9±10.00	37.7±9.10	39.7±9.56	0.190[b]	0.614[b]
Saturated fatty acids (%)	14.9±4.79	14.5±5.52	14.2±5.91	15.2±5.62	0.611[b]	0.576[b]
Monounsaturated fatty acids (%)	14.4±4.74	13.7±4.50	12.6±3.96	13.1±4.63	0.129[b]	0.579[b]
Polyunsaturated fatty acid (%)	8.9±4.12	9.5±4.56	8.4±3.54	9.4±5.59	0.7335[a]	0.777[a]
Cholesterol (mg)	491.2±305.53	266.5±174.93	272.2±189.14	236.3±154.44	0.003*[a]	0.579[a]
Dietary fiber (g)	19.5±12.95	11.8±6.09	17.1±7.95	11.3±5.06	0.861[a]	0.757[b]
Vitamin A (mcg RE)	1201.9±1403.4	664.1±529.84	830.5±394.73	640.8±395.19	0.209[a]	0.919[a]
Vitamin E (mg)	16.3±11.22	11.5±6.60	12.3±5.10	12.8±9.26	0.177[a]	0.746[a]
Thiamine (mg)	0.9±0.57	0.5±0.23	0.6±0.21	0.5±0.16	0.017*[a]	0.413[a]
Riboflavin (mg)	1.5±0.67	1.0±0.66	1.0±0.44	0.8±0.34	0.007*[a]	0.331[a]
Niacin (mg)	17.1±12.84	8.9±5.59	9.8±5.99	6.9±4.44	0.004*[a]	0.135[a]
Vitamin B6 (mg)	1.5±0.87	0.9±0.42	1.1±0.51	0.8±0.37	0.054[a]	0.132[a]
Folic acid (mcg)	124.9±62.44	78.1±34.87	87.7±39.90	68.5±25.69	0.025*[a]	0.242[b]
Vitamin B12(mcg)	6.0±6.04	4.9±12.75	3.4±2.29	3.3±3.28	0.021*[a]	0.894[a]
Vitamin C (mg)	80.2±68.52	57.1±46.24	57.6±56.38	54.4±33.83	0.222[a]	0.707[a]
Potassium (mg)	2444.2±1227.3	1511.3±651.74	1832.5±735.97	1372.7±550.24	0.126[a]	0.373[b]
Calcium (mg)	726.3±369.3	478.5±252.73	550.0±275.18	456.5±223.27	0.064[a]	0.780[a]
Magnesium (mg)	298.0±167.51	172.3±73.90	221.4±77.52	172.8±61.67	0.130[a]	0.977[b]
Phosphorus (mg)	1389.1±629.24	808.6±342.42	973.2±398.04	751.1±213.26	0.020*[a]	0.465[b]
Iron (mg)	11.9±5.21	7.1±3.32	9.5±3.31	6.9±2.71	0.061[a]	0.792[b]
Zinc (mg)	11.1±4.73	6.5±3.27	8.2±3.78	6.1±1.83	0.010*[a]	0.987[a]

[a]Mann-Whitney U test, [b]Student's t test *p<0.05
M=Male F=Female

our study suggests that people who exercise regularly could be more obsessive with nutrition, and they are in a considerable risk group.

It is unclear whether the orthorexic tendency change which depends on gender and different results were obtained in various studies (28, 29, 31, 34). In a study conducted on students, there was no difference between males and females regarding ON (35). On the contrary, Donini et al. (30) stated that more males have ON. In our study, it was determined that orthorexic tendency did not differ according to gender, which is consistent with the studies conducted in recent years (26, 35).

One`s educational level and socioeconomic status are important factors in the development of ON (36). Donini et al. (30) reported that individuals with low levels of education had high ON. However, in a study conducted on dietitians, ON cases did not differ regarding marital status and educational status (37). Similarly, there was no significant difference in terms of marital status, education level, and income status in participants with ON and in non-ON in this study (p>0.05) (Table 2).

Table 5. Anthropometric measurements and body composition of the individuals reagrding ON

	≤40 (ON)		>40 (non-ON)			
	Male (n:85) X±SD	**Female (n:83) X±SD**	**Male (n:17) X±SD**	**Female (n=21) X±SD**	**p (M-M)**	**p (F-F)**
Height (cm)	176.8±5.13	164.2±6.62	175.4±4.27	166.6±5.11	0.219[b]	0.209[a]
Body weight (kg)	78.5±14.22	64.6±13.28	75.4±11.45	58.2±9.23	0.515[a]	0.041[a*]
BMI(kg/m^2)	25.1±4.13	24.0±4.65	24.5±3.22	21.1±4.23	0.911[a]	0.001[a*]
BMR (kkal/gün)	1926.9±256.29	1409.9±172.65	1858.8±198.58	1344.9±106.67	0.304[b]	0.137[a]
Percent of body fat (%)	16.4±6.27	27.9±7.39	15.9±4.82	23.8±7.64	0.751[b]	0.023[a*]
Fat mass (kg)	13.5±7.80	18.8±8.88	12.4±5.37	14.4±7.62	0.900[a]	0.012[a*]
Total body water (kg)	47.6±6.03	33.5±4.15	46.1±4.75	32.0±2.57	0.334[b]	0.153[a]
Fat free mass (kg)	65.0±8.27	47.7±5.65	62.9±6.44	43.8±3.40	0.329[b]	0.161[a]
Neck circumference (cm)	37.4±2.62	31.6±2.24	36.7±2.91	30.8±2.34	0.312[a]	0.113[a]
Waist circumference (cm)	84.8±9.01	76.1±11.10	85.1±8.05	72.3±9.73	0.901[b]	0.095[a]
Hip circumference (cm)	98.5±7.99	97.5±9.12	97.7±7.43	94.1±7.98	0.896[a]	0.026[a*]
Waist/hip ratio	0.9±0.05	0.8±0.07	0.9±0.06	0.8±0.06	0.419[b]	0.496[a]
Waist/height ratio	0.5±0.05	0.5±0.07	0.5±0.04	0.4±0.06	0.294[a]	0.043[a*]

[a]Mann-Whitney U test, [b]Student's t test [*]p<0.05
M=Male, F=Female

According to physical activity recommendations for adults from the American College of Sports Medicine, doing moderate physical activity 5 days a week, 30 minutes a day or severe physical activity 3 days a week, 20 minutes a day are recommended to maintain and improve health (38). Word Health Organization recommends that adults should undergo 150 minutes of moderate intensity or 75 minutes of severe physical activity per week (39). According to the Turkey Nutrition and Physical Activity Pyramid, adults are recommended to walk 30 minutes per day, do endurance (aerobic) exercises at least 3 times a week, and do endurance and balance exercises 5-10 minutes twice a week (40). If exercise frequency and duration are increased to the extent to exceed beyond positive effects, it can damage the body and decrease the quality of life (41). In this study, exercise frequency were higher among individuals with ON than in non-ON individuals (p<0.05), and the duration of exercise was found to be slightly higher in both individuals with ON and non-ON individuals than recommended in the guidelines.

There is little information about the relationship between different types of exercise, exercise duration, exercise frequency, and eating disorders (42-44). Some studies reported a positive relationship between exercise practices, especially in which body image is at the forefront, and impaired eating attitudes along with behaviors (45-48). Similarly, in this study, the exercise frequency was higher in individuals with orthorexic behaviours (p<0.05). Studies showed that exercise frequency is related to eating behaviors (49, 50) and results were consistent with this study.

Some health professionals and researchers believe that excessive interest in healthy eating behavior can cause many problems. ON begins with the examination of every detail when buying or preparing food and it can be dangerous enough to lead to hunger for days when consumed foods are believed to be unhealthy (19). Although orthorexic tendency is focused on healthy nutrition, it is accompanied by an increase in the restriction of energy and macronutrient intake, which may result in changes in anthropometric measurements and body composition (2, 51, 52). According to a present study, energy and cholesterol intake were higher in males with ON than in non-ON males (p<0.05). Males with ON had the tendancy to reduce carbohydrate intake. This may be because these males

consume more animal-based foods such as meat and milk. However, in this case total energy and the percentage of energy from lipid increased, although it was not statistically significant. Among females, the percentage of energy from protein was higher in individuals with ON than in non-ON individuals($p<0.05$) (Table 4).

In a study, it was determined that the increase in BMI increased the orthorexic tendency in students of the medical faculty (28). Gezer and Kabaran (51) also found a significant relationship between the BMI and ORTO-15 scores. In a study, consisting of 375 healthy women and 375 men, a significant relationship between orthorexic tendency and BMI was found in women (52). In another study conducted with health professionals, the body weight of orthorexic individuals was higher than that of non-orthorexic individuals (2). Conversely, studies showing no association between BMI and ON are also present (19, 30, 53). In this study, body weight, BMI, percentage of body fat, hip circumference, and waist/height ratio were found higher in females with ON. Similar to the females, body weight and fat mass were found to be higher in males with ON than in non-ON males, although not statistically significant ($p>0.05$) (Table 5). This may be explained by the higher energy intake in males with ON. It is remarkable that males with ON have higher energy intake in a daily diet. In females, although not statistically significant, it may be associated with higher fat intake.

Results and recommendations

In this study, it was determined that ON is remarkably high among individuals who exercise regularly and there was no difference in ON cases according to gender. Similarly, it was determined that income level, marital status, and education level did not affect ON. While the exercise frequency was higher in individuals with ON, it was lower in non-ON individuals. As a result of this study, in males with ON, it was determined that the percentage of energy from carbohydrates was lower and the percentage of energy from protein was higher. Therefore, it can be said that ON affects nutritional behavior and diet composition. It is also important to note that individuals with high fat mass and high BMI had more orthorexic tendency.

Individuals who exercise should be encouraged to be aware of healthy eating and follow a correct dietary pattern. Diet, exercise, and weight control are important for maintaining a healthy life. Thus, it may be advisable for these individuals to receive support from dietitians and exercise professionals to ensure that all components meet at the optimum level and to avoid false nutritional trends, such as ON.

Limitations

The most important limitation of our study is that it is based only on ORTO-15 scale and that the data obtained from ORTO-15 is not compared with other scales. The ORTO-15 is the most widely used scale to evaluate orthorexia nervosa, although previous studies obtained inconsistent results about its psychometric properties. In addition, the ORTO-15 scale was a culturally adapted and tested questionnaire in the Turkish population. A further limitation is that we evaluate food intake of paticipants with 24-hour dietary recall. The 24-hour dietary recall has many advantages and disadvantages. These disadvantages include extensive dependence on the recent memory of the study subject, depends on interviewer capacity for describing ingredients, food preparation, dishes. However, considering its advantages, we preferred to 24-hour dietary recall. Another limitation is that we did not question the exercise addiction among the participants. In further studies, exercise addiction can be questioned in this population. Despite these limitations, our study is important because there are the limited number of studies in this field and our study is one of the valuable studies.

Conflict of interest: No potential conflict of interest relevant to this article was reported by the authors.

References

1. Rudolph S. The connection between exercise addiction and orthorexia nervosa in German fitness sports. Eat Weight Disord 2018;23(5):581-6.

2. Tek NA, Ermumcu MSK. Healthy eating concern (Orthorexia Nervosa) and related factors in women. COJ Nursing&Healthcare 2018;2(5):1-5.
3. American Psychiatric Association. Diagnostic and statistical manual of mental disorders. American Psychiatric Association Publication 2013.
4. Oberle CD, Lipschuetz SL. Orthorexia symptoms correlate with perceived muscularity and body fat, not BMI. Eat Weight Disord 2018;23(3):363-8.
5. Kiss-Leizer M, Tóth-Király I, Rigó A. How the obsession to eat healthy food meets with the willingness to do sports: the motivational background of orthorexia nervosa. Eat Weight Disord 2019;24(3):465-72.
6. Oberle CD, Watkins RS, Burkot AJ. Orthorexic eating behaviors related to exercise addiction and internal motivations in a sample of university students. Eat Weight Disord 2018;23(1):67-74.
7. Bartrina J. Orthorexia or when a healthy diet becomes an obsession. Arch Latinoam Nutr 2007;57(4):313-5.
8. Dunn TM, Bratman S. On orthorexia nervosa: a review of the literature and proposed diagnostic criteria. Eat Behav 2016;21:11-7.
9. Donini L, Marsili D, Graziani M, Imbriale M, Cannella C. Orthorexia nervosa: validation of a diagnosis questionnaire. Eat Weight Disord 2005;10(2):28-32.
10. Novara C, Maggio E, Piasentin S, Pardini S, Mattioli S. Orthorexia Nervosa: differences between clinical and non-clinical samples. BMC Psychiatry 2021;21(1):1-10.
11. Hagger M. Current issues and new directions in psychology and health: Physical activity research showcasing theory into practice. Psychol Health 2010;25(1):1-5.
12. Republic of Turkey. Physical Activity Guidelines for Turkey (2014). Ankara, 2014. [cited 2021 September 2]. Available from: https://hsgm.saglik.gov.tr/depo/birimler/saglikli-beslenme-hareketli-hayat-db/Fiziksel_Aktivite_Rehberi/Turkiye_Fiziksel_Aktivite_Rehberi.pdf
13. Bóna E, Szél Z, Kiss D, Gyarmathy VA. An unhealthy health behavior: analysis of orthorexic tendencies among Hungarian gym attendees. Eat Weight Disord 2019;24(1):13-20.
14. Segura-García C, Papaianni MC, Caglioti F, et al. Orthorexia nervosa: a frequent eating disordered behavior in athletes. Eat Weight Disord 2012;17(4):e226-e33.
15. Varga M, Thege BK, Dukay-Szabó S, Túry F, van Furth EF. When eating healthy is not healthy: orthorexia nervosa and its measurement with the ORTO-15 in Hungary. BMC Psychiatry 2014;14(1):59.
16. Almeida C, Borba VV, Santos L. Orthorexia nervosa in a sample of Portuguese fitness participants. Eat Weight Disord 2018;23(4):443-51.
17. Rakıcıoglu N, Acar-Tek N, Ayaz A, Pekcan G. Photograph Catalog of Food and Dishes: Portion Sizes and Amounts. 7 ed. Ankara: Merdiven Offset Publication; 2017.
18. BeBiS. Computer Aided Nutrition Program, Nutrition Information System (version 7.2). 2010.
19. Arusoglu G, Kabakci E, Koksal G, Merdol TK. Orthorexia Nervosa and Adaptation of ORTO-11 into Turkish. Turk Psikiyatri Derg 2008;19(3).
20. Pekcan G. Determination of nutritional status [Beslenme durumunun belirlenmesi]. 2 ed. Tufekci EA, editor. Ankara: Hatiboğlu Publications; 2014.
21. Pekcan G. Diyet El Kitabı [Diet Handbook]. Ankara: Hatipoğlu Publications; 2008.
22. Lohman TG, Roche AF, Martorell R. Anthropometric standardization reference manual. Human kinetics books. Champaign, IL:1988.
23. WHO. Waist circumference and waist-hip ratio (2008). Geneva, 2008. [cited 2021 September 2]. Available from: http://www.webcitation.org/query?url=http%3A%2F%2Fapps.who.int%2Firis%2Fbitstream%2F10665%2F44583%2F1%2F9789241501491_eng.pdf&date=2018-01-20.
24. Statistical Package for the Social Sciences (SPSS Inc.). 2001.
25. Dalmaz M, Tekdemir-Yurtdaş G. Prevalence of orthorexia nervosa symptoms among people who exercise in gyms [Spor salonunda spor yapanlarda ortoreksiya nervoza belirtilerinin incelenmesi]. OTSHD 2015;4(4):23-39.
26. Karakus B, Hidiroglu S, Keskin N, Karavus M. Orthorexia nervosa tendency among students of the department of nutrition and dietetics at a university in Istanbul. North Clin Istanb 2017;4(2), 117.
27. Korinth A, Schiess S, Westenhoefer J. Eating behaviour and eating disorders in students of nutrition sciences. Public Health Nutr 2010;13(1):32-7.
28. Fidan T, Ertekin V, Işikay S, Kırpınar I. Prevalence of orthorexia among medical students in Erzurum, Turkey. Compr Psychiatry 2010;51(1):49-54.
29. Brytek-Matera A, Donini LM, Krupa M, Poggiogalle E, Hay P. Orthorexia nervosa and self-attitudinal aspects of body image in female and male university students. J Eat Disord 2015;3(1):2.
30. Donini L, Marsili D, Graziani M, Imbriale M, Cannella C. Orthorexia nervosa: a preliminary study with a proposal for diagnosis and an attempt to measure the dimension of the phenomenon. Eat Weight Disord 2004;9(2):151-7.
31. Ramacciotti C, Perrone P, Coli E, et al. Orthorexia nervosa in the general population: a preliminary screening using a self-administered questionnaire (ORTO-15). Eat Weight Disord 2011;16(2):127-30.
32. Dell'Osso L, Abelli M, Carpita B, et al. Orthorexia nervosa in a sample of Italian university population. Rivista di Psichiatria 2016;51(5):190-6.
33. Aksoydan E, Camci N. Prevalence of orthorexia nervosa among Turkish performance artists. Eat Weight Disord 2009;14(1):33-7.
34. Bo S, Zoccali R, Ponzo V, et al. University courses, eating problems and muscle dysmorphia: are there any associations? J Transl Med 2014;12(1):221.
35. Malmborg J, Bremander A, Olsson MC, Bergman S. Health status, physical activity, and orthorexia nervosa: A

comparison between exercise science students and business students. Appetite 2017;109:137-43.
36. Varga M, Dukay-Szabo S, Tury F. Orthorexia nervosa and it's background factors. Ideggyogyaszati Szemle 2013;66(7-8):220-7.
37. Asil E, Surucuoglu MS. Orthorexia nervosa in Turkish dietitians. Ecol Food Nutr 2015;54(4):303-13.
38. Haskell WL, Lee I-M, Pate RR, et al. Physical activity and public health: updated recommendation for adults from the American College of Sports Medicine and the American Heart Association. Circulation 2007;116(9):1081.
39. WHO. Active ageing: A policy framework (2002). Geneva, 2002. [cited 2021 September 2]. Available from: http://www.webcitation.org/query?url=http%3A%2F%2Fapps.who.int%2Firis%2Fbitstream%2F10665%2F67215%2F1%2FWHO_NMH_NPH_02.8.pdf&date=2018-01-20.
40. Turkey Dietary Guidelines. Ankara: Ministry of Turkey Health Publication 2016;
41. Griffiths M. Exercise addiction: A case study. Addiction Research 1997;5(2):161-8.
42. Trott M, Yang L, Jackson SE, et al. Prevalence and correlates of exercise addiction in the presence vs. absence of indicated eating disorders. Front Sports Act Living 2020;2:84.
43. Clifford T, Blyth C. A pilot study comparing the prevalence of orthorexia nervosa in regular students and those in university sports teams. Eat Weight Disord 2019;24(3):473-80.
44. Maltby J, Day L. The relationship between exercise motives and psychological weil-being. J Psychol 2001;135(6):651-60.
45. Freire GLM, da Silva Paulo JR, da Silva AA, Batista RPR, Alves JFN, do Nascimento Junior JRA. Body dissatisfaction, addiction to exercise and risk behaviour for eating disorders among exercise practitioners. J Eat Disord 2020;8(1):1-9.
46. Cardoso AA, Reis NM, Moratelli J, et al. AC Body Image Dissatisfaction, Eating Disorders, and Associated Factors in Brazilian Professional Ballroom Dancers. J Dance Med Sci 2021;25(1):18-23.
47. Simas JPN, Macara A, Melo SIL Eating disorders and associated factors in professional classical ballet dancers in Brazil. Mundo Saúde (Impr.) 2019;472-93.
48. Smolak L, Murnen SK, Ruble AE. Female athletes and eating problems: A meta-analysis. Int J Eat Disord 2000;27(4):371-80.
49. Adkins EC, Keel PK. Does "excessive" or "compulsive" best describe exercise as a symptom of bulimia nervosa? Int J Eat Disord 2005;38(1):24-9.
50. Cook BJ, Hausenblas HA. The role of exercise dependence for the relationship between exercise behavior and eating pathology: mediator or moderator? J Health Psychol 2008;13(4):495-502.
51. Gezer C, Kabaran S. The risk of orthorexia nervosa for female students studying nutrition and dietetics. SDÜ Saglık Bilimleri Dergisi 2013;4(1):14-22.
52. Karadag MG, Elibol E, Yildiran H, et al. Evaluation of the Relationship Between Obesity with Eating Attitudes and Orthorexic Behavior in Healthy Adults. Gazi Med J 2016;27(3):107-14.
53. Varga M, Dukay-Szabó S, Túry F, van Furth Eric F. Evidence and gaps in the literature on orthorexia nervosa. Eat Weight Disord 2013;18(2):103-11.

Correspondence
Ozge Yesildemir, Dr, Research Assistant
Gazi University
Faculty of Health Sciences
Department of Nutrition and Dietetics
Postcode: 06490
Cankaya, Ankara, Turkey
Tel: +90 312 2162982
E-mail: ozgeyesildemir@gazi.edu.tr