Spor Hekimliği Dergisi, 57(4):171-176; 2022
Turkish Journal of Sports Medicine
Turk J Sports Med. DOI: 10.47447/tjsm.0675

Research Article / Araştırma Makalesi

Comparison of exercise dependence, eating attitude disorder and risk of orthorexia nervosa among regular students and student athletes

Öğrenciler ve sporcu öğrenciler arasında egzersiz bağımlılığı, yeme bozukluğu ve ortoreksiya nervoza riskinin karşılaştırılması

Yasemin Karaağaç, Fatma İrem Çetinkaya, Ezgi Bellikci Koyu

Nutrition and Dietetics Department, Faculty of Health Sciences, İzmir Katip Çelebi University, Izmir, Türkiye

ABSTRACT

Objective: Exercise dependence and eating disorders are growing up among university students. This study aimed to compare exercise dependence, eating attitude, and orthorexic tendencies between regular students and student athletes.

Material and Methods: A total of 168 students, 66 of whom were athletes participated in this study. Participants completed Exercise Dependence Scale-21 (EDS-21), Eating Attitude Test-40 (EAT-40), and Orthorexia Nervosa-11 (ORTO-11) scales. Anthropometric measurements were performed by the researchers. The data were analyzed using the SPSS version 25 and the significance level was accepted as $p<0.05$.

Results: While there were no students with exercise dependence among regular students, 10.6% of the student athletes were found to be exercise dependent ($p<0.001$). Orthorexic tendencies of student athletes were found to be higher ($p=0.045$). There was no significant difference between the groups in terms of eating attitude disorder ($p=0.253$). The EDS-21 scores were moderately positively correlated with the orthorexic tendency ($r=0.446$) and the EAT-40 scores ($r=0.397$) (for each $p<0.05$). Sports experience was also associated with exercise dependence ($r=0.363$) and orthorexic tendency ($r=0.195$) ($p<0.05$).

Conclusion: Student athletes, especially those with a longer sports experience are at higher risk of exercise dependence and have higher orthorexic tendencies compared to regular students. Health professionals who involve in the sports teams should be aware of these risks and monitor the students in terms of exercise dependence and orthorexia nervosa.

Keywords: *University students, student athlete, exercise dependence, eating attitude, orthorexia nervosa*

ÖZ

Amaç: Üniversite öğrencileri arasında egzersiz bağımlılığı ve yeme bozuklukları giderek artmaktadır. Bu çalışma ile öğrenciler ve öğrenci sporcular arasındaki egzersiz bağımlılığı, yeme tutumu ve ortoreksik eğilimlerin karşılaştırılması amaçlanmıştır.

Gereç ve Yöntemler: Bu çalışmaya 66'sı sporcu olmak üzere toplam 168 öğrenci katılmıştır. Katılımcılar Egzersiz Bağımlılığı Ölçeği-21 (EDS-21), Yeme Tutum Testi-40 (EAT-40) ve Ortoreksiya Nervoza-11 (ORTO-11) ölçeklerini doldurmuştur. Antropometrik ölçümler araştırmacılar tarafından yapılmıştır. Veriler SPSS versiyon 25 kullanılarak analiz edilmiş, anlamlılık düzeyi $p<0.05$ olarak kabul edilmiştir.

Bulgular: Öğrenciler arasında egzersiz bağımlılığı saptanmazken, öğrenci sporcuların %10,6'sının egzersiz bağımlısı olduğu belirlendi ($p<0,001$). Öğrenci sporcuların ortoreksik eğilimleri daha yüksek bulundu ($p=0,045$). Yeme tutum bozukluğu açısından gruplar arasında anlamlı fark yoktu ($p=0,253$). EDS-21 puanları, ortoreksik eğilim ($r=0,446$) ve EAT-40 puanları ($r=0,397$) (her biri için $p<0,05$) ile orta düzeyde pozitif korelasyona sahipti. Spor deneyimi ayrıca egzersiz bağımlılığı ($r=0,363$) ve ortoreksik eğilim ($r=0,195$) ($p<0,05$) ile ilişkiliydi.

Sonuç: Öğrenci sporcular, özellikle daha uzun spor deneyimi olanlar, normal öğrencilere göre egzersiz bağımlılığı açısından daha yüksek risk altındadır ve ortoreksik eğilimleri daha yüksektir. Spor takımlarında görev alan sağlık profesyonelleri bu risklerin farkında olmalı ve öğrencileri egzersiz bağımlılığı ve ortoreksiya nervoza açısından izlemelidir.

Anahtar Sözcükler: *Üniversite öğrencileri, öğrenci sporcu, egzersiz bağımlılığı, yeme tutumu, ortoreksiya nervoza*

INTRODUCTION

Following a healthy diet is one of the key factors of a healthy life and helps to prevent non-communicable diseases such as diabetes mellitus, cardiovascular disease and some types of cancer (1). However, focusing on healthy eating sometimes turn into obsessive and pathological behavior. This condition, first described by Steve Bratman in 1997 (2), is defined as a fixation on healthy or clean eating called *Orthorexia nervosa* (ON) (2-5). Since then, ON has gained increasing interest and many different definitions and diagnostic tools have been developed. Currently, ON has not been recognized as a distinct eating disorder in the International Classification of Disease-11 (ICD-11) or the Diagnostic

Received / Geliş: 24.02.2022 · **Accepted / Kabul:** 15.04.2022 · **Published / Yayın Tarihi:** 10.10.2022 · **Issue:** December 2022

Correspondence / Yazışma: Ezgi Bellikci Koyu · İzmir Katip Çelebi Üniversitesi, Sağlık Bilimleri Fakültesi, Beslenme ve Diyetetik Bölümü, İzmir, Türkiye · ezgi.bellikci@ikc.edu.tr

Cite this article as: Karaagac Y, Cetinkaya FI, Bellikci Koyu E. Comparison of exercise dependence, eating attitude disorder and risk of orthorexia nervosa among regular students and student athletes. *Turk J Sports Med.* 2022, 57(4):171-6; https://doi.org/10.47447/tjsm.0675

and Statistical Manual of Mental Disorders-V (DSM-V) and there is no consensus on the definition or diagnostic criteria (3). However, there are some common factors in the different diagnostic criteria of ON including obsessional or pathological preoccupation with healthy nutrition, emotional consequences such as anxiety or distress when not following self-imposed dietary rules, psychosocial impairments in relevant areas of life, and physical impairments related to nutritional deficiencies (4). Obsessive-compulsive features, history of an eating disorder, poor body image, and some personality traits such as perfectionism have been consistently associated with a greater risk for orthorexic tendencies (5).

Regular physical activity, the other key to a healthy life, reduces the risk of several chronic diseases and all-cause mortality, improves the quality of life, and cognitive function (6). But just like in ON, when exercise becomes excessive, it may negatively affect psychological and physiological health and may disrupt social relationships (7). Many various terms have been used in the literature to name this form of exercise. Some of these terms are morbid exercise, excessive exercise, compulsive exercise, obligatory exercise, exercise addiction, exercise dependence (ED), and exercise abuse (7-10). The most frequently used terms in studies are ED, measured using the Exercise Dependence Scale-21 (EDS-21), and exercise addiction, assessed with the Exercise Addiction Inventory (EAI) (8, 9).

Exaggerated exercise behavior is classified as primary and secondary, depending on whether ED is the main problem of the individual or not. Although exercise behavior itself is the unique pathology in primary ED, it is a symptom that develops due to another main pathology, such as eating disorder in secondary ED (11-13). Therefore, studies generally reported that ED and eating disorders are positively correlated (10, 14). A recent meta-analysis reported that the risk of ED in people with eating disorders was approximately four times higher than in people without eating disorders (15). However, the relationship between ON and ED has been contradictory. While positive correlations have been reported between ON and ED among members of the fitness studios and university students (16, 17), no association has been found among Brazilian exercise practitioners (18). Since population characteristics, dietary habits, type of exercise, and cultural factors can interfere with this association, it is necessary to evaluate the relationship between ON and ED in different groups and populations.

Research has indicated that university students are at risk for both exercise dependence and eating disorders (12, 19, 20). In particular, students who exercise regularly or are in university sports teams may be considered to be at higher risk. However, to the best of our knowledge, only a pilot study investigated the prevalence of ON in university sports teams, and in that study, students were not evaluated for ED (21). Therefore, the main objective of this study was to compare regular students and students athletes in terms of ED, eating attitude, and orthorexic tendencies. Our second objective was to determine the relationships between ED, eating attitude, and orthorexia in Turkish university students.

MATERIALS and METHODS

Participants and data collection

A total of 168 undergraduate students (66 student athletes and 102 regular students) studying in Izmir province were enrolled in the study. A questionnaire was administered to each participant and anthropometric measurements were taken. The questionnaire consisted of four sections: personal information form including sociodemographic features and sports experience (recorded as months), Exercise Dependence Scale-21 (EDS-21), Eating Attitude Test-40 (EAT-40), and Orthorexia Nervosa-11 (ORTO-11) scale. The study was approved by the Non-Interventional Clinical Studies Institutional Review Board of Izmir Katip Celebi University (26.07.2019/419) and written informed consent was obtained from all participants.

Instruments

Exercise Dependence Scale-21

Exercise dependence was determined by EDS-21. The scale was developed by Hausenblas and Downs in 2002, and it was prepared based on the drug addiction criteria in the DSM-IV (22). The Turkish validation and reliability study of the scale was conducted by Yeltepe and Ikizler in 2007 (23). The scale consists of 21 items and each item is answered on a 6-point Likert scale. EDS-21 is based on seven addiction criteria; tolerance, withdrawal effects, continuance, lack of control,reductions in other activities, time, and intention. Higher EDS scores indicate a higher incidence of symptoms of exercise dependence. Categorization is also established and based on responses, individuals are classified into one of three categories: at risk of ED, nondependent symptomatic, and nondependent asymptomatic (22).

Eating Attitudes Test-40

Eating attitudes were evaluated using the EAT-40. It is a 40-item scale and has been widely used to detect symptoms of eating disorders. The test has been used in nonclinical samples as a general screening measure for disordered eating attitudes. It was developed by Garner and Garfinkel and adapted to Turkish by Savaşır and Erol in 1989 (24, 25). Responses were rated on a six-point Likert scale from “always (1)” to “never (6)”. The cut-off point of the scale is 30,

and ≥30 indicates having a higher risk of eating disorder (25).

Orthorexia Nervosa-11

ORTO-15 was developed by Donini et al. (2005) to assess the tendency of ON (26). It was adapted into Turkish as ORTO-11, removing four questions from the original test (27). Each question of the ORTO-11 was answered on a four-point Likert scale. Although the scale does not have an established cut-off point, the lower scores reflect the higher tendency for behavior or attitudes related to ON (27).

Anthropometric measurements

Weight was measured with 0.1 kg accuracy using a scale without shoes and wearing light clothing. Waist, hip, and neck circumferences and height were measured with an inelastic measuring tape. All anthropometric measurements were taken by the same researcher. Body mass index (BMI) was calculated and evaluated according to World Health Organization (WHO) classification.

Statistical analysis

The data were analyzed using the SPSS version 25. Continuous variables were checked for normal distribution with the Shapiro-Wilk test and data were presented as mean and standard deviation or median and interquartile range (IQR) according to the normality of the distribution. Student's t-test or Mann Whitney U tests were used to analyze group differences for continuous variables between regular students and student athletes. Categorical variables were compared using the chi-square test. Spearman's Rho correlation analysis was used to examine the correlations between sports history, BMI, EDS-21, ORTO-11, and EAT-40 scores. The level of significance was set at $p<0.05$.

RESULTS

The distribution of students according to the sports disciplines is given in Table 1. The majority of the students were playing football (37.9%), volleyball (31.8%), and basketball (18.2%).

Table 1. Distribution of students in the university sport teams

Sports team disciplines	n	Prevalence (%)*
Football	25	37.9
Volleyball	21	31.8
Basketball	12	18.2
Sailing	3	4.5
Athletics	3	4.5
Others	2	3

* The percentage of students in the university sport teams is presented.

Table 2. Descriptive characteristics of students

	Total	Students in the university sport teams (n=66)	Regular students (n=102)	*p*
Age (years), ($\bar{X}$±SD) [a]	21.71±2.04	21.36±2.02	21.94±2.02	0.072
Gender, n (%) [b]				
Male	105 (62.5)	46 (69.7)	59 (57.8)	0.121
Female	63 (37.5)	20 (30.3)	43 (42.2)	
Body weight self- perception, n (%) [b]				
Underweight	22 (13.1)	9 (13.6)	13 (12.7)	0.634
Normal	123 (73.2)	46 (69.7)	77 (75.5)	
Overweight	23 (13.7)	11 (16.7)	12 (11.8)	
BMI, n (%) [b]				
Underweight	13 (7.7)	4 (6.1)	9 (8.8)	0.722
Normal	131 (78.0)	51 (77.3)	80 (78.4)	
Overweight	19 (11.3)	8 (12.1)	11 (10.8)	
Obese	5 (3.0)	3 (4.5)	2 (2.0)	
BMI (kg/m^2), (median [IQR]) [c]	22.14 (3.66)	22.60 (3.50)	21.87 (3.85)	0.325
Waist circumference (cm), ($\bar{X}$±SD) [a]	78.27±10.18	79.65±9.78	77.46±10.36	0.193
Hip circumference (cm), ($\bar{X}$±SD) [a]	98.17±9.02	98.34±10.67	98.07±7.96	0.854
Neck circumference (cm), (median [IQR]) [c]	35.25 (5.5)	35.75 (5.1)	35.00 (5.8)	0.195

BMI: Body mass index.

[a] Student t-test, [b] Chi-square tests, [c] Mann Whitney U test were performed.

There were no significant differences in terms of age, gender, anthropometric measurements, including BMI, waist, hip, and neck circumference, and self-perception of body weight between regular students and student athletes (Table 2).

According to EDS-21, 4.2% of all students were classified as at risk for ED, 42.3% as symptomatic, and 53.6% as asymptomatic. A significant relationship was found between groups for exercise dependency. All student athletes are classified as at-risk, and the number of symptomatic students was also higher among student athletes compared to regular students ($p<0.001$) (Table 3).

Table 3. Distributions of students according to the EDS-21 and EAT-40

	Total	Students in the university sports teams (n=66)	Regular students (n=102)	*p*
ORTO-11, ($\bar{X}$±SD) [c]	28.63±5.23	27.53±5.04	29.27±5.25	0.045*
EAT-40, (median [IQR]) [b]	14.00 (11.00)	14.00 (11.50)	13.00 (10.25)	0.671
EAT-40, n (%) [a]				
Have eating attitude disorder, n (%)	14 (8.3)	8 (12.1%)	6 (5.9)	0.253
No eating attitude disorder, n (%)	154 (91.7)	58 (87.9%)	96 (94.1)	
EDS-21, n (%) [a]				
At risk for exercise dependence	7 (4.2)	7 (10.6)	-	
Nondependent-symptomatic	71 (42.3)	43 (65.2)	28 (27.5)	<0.001**
Nondependent-asymptomatic	90 (53.6)	16 (24.2)	74 (72.5)	

EDS: Exercise Dependence Scale, EAT: Eating Attitudes Test.

*p<0.05, **p<0.001 [a] Chi-square tests, [b] Mann Whitney U test, [c] Student t-test were performed.

The mean ORTO-11 scores for all students were 28.63±5.23. ORTO-11 scores of student athletes (27.53±5.04) were significantly lower than those of regular students (29.27±5.25) (p=0.045). The median scores of the EAT-40 were 14.00 (11.00) and a total of 8.3% of students scored above the cut-off (>30) on EAT-40. No significant difference was found between groups for EAT-40 scores or categorical classification of EAT-40 (Table 3).

In the whole sample, the EDS-21 scores were positively correlated with the sports experience (r=0.363, p<0.001) and the EAT-40 scores (r=0.397, p<0.001), and were negatively correlated with the ORTO-11 scores (r=-0.446, p<0.001). Additionally, the ORTO-11 score was negatively correlated with both EAT-40 scores (r=-0.530, p<0.001) and sport experience (r= -0.195, p<0.05) (Table 4).

Table 4. Correlations between sports duration and BMI, EDS-21, ORTO-11, and EAT-40 scores

	EDS-21	ORTO-11	EAT-40	Sports experience[&]
EDS-21	1.000	-0.446**	0.397**	0.363**
ORTO-11		1.000	-0.530**	-0.195*
EAT-40			1.000	0.081
Sport experience				1.000

BMI: Body mass index, EDS: Exercise Dependence Scale, EAT: Eating Attitudes Test, [&]Sports experience recorded as months

* p<0.05, ** p<0.001. Spearman correlation was used.

DISCUSSION

The purpose of this study was to investigate the risks of ED, ON tendencies, and disordered eating attitudes of university students who participated in university sports and not. The main finding of this study was that student athletes were at greater risk for ED and had higher orthorexic tendencies than regular students. Additionally, a positive correlation was found between ED, orthorexic tendency, and disordered eating attitudes.

Previous studies had reported the prevalence of ED as 6-8.8% among university athletes (12, 28). In our study, 4.2% of all students were classified as at risk for ED and all of them were student athletes (Table 3). These findings have supported the literature showing that the risk of ED has been higher among individuals who play regular sports than those who do not (8, 9, 12). It may be possible that people who attend sports activities regularly, especially for competitive purposes, exercise more frequently and intensely, making them vulnerable to a higher risk of ED. Studies have reported that time spent in sport (13, 29, 30), childhood physical activity (29), type (9, 30), intensity (13), and frequency (13, 28) of sports are also important factors that may affect the risk of ED. In this study, a positive correlation was found between sports experience and the EDS-21 score, indicating that students with longer sports experience had a higher risk of ED. Cicioğlu et al. (31), also reported a similar correlation in both elite athletes and students of the faculty of sports sciences.

A recent literature review on the prevalence of ON reported that some groups were more susceptible to the risk of ON than other groups due to their profession (e.g., sports people, dieticians, doctors) (3). University students, especially those involved in sports, were also one of the risk groups for ON. Our study has shown that ORTO-11 scores of the students in the sports teams were statistically lower than regular students indicating more orthorexic trends in student athletes, however the magnitude of the difference was small. Besides, the literature strongly indicates ORTO scales are not valid for detecting ON as a clinical disorder. Therefore the prevalence of ON in university students was not determined (5). Our findings are in line with the previous research (21, 32, 33). Malmborg et al. (32) found that university students studying in the exercise science program had higher orthorexic tendencies compared to students studying in the business program. In another study, the frequency of students with a tendency to orthorexia in the faculty of sports science students was higher than in the department of nursing students (33). Clifford and Blyth found no difference between the ORTO-15 scores of athletes from the university sports team and regular students. However, they had reported that students who exercised 10 hours or more per week had statistically lower ORTO-15 scores than those who exercised less than 10 hours, indicating that the volume of exercise might play an important role in ON (21).

From this point of view, ON may be more pronounced in those who follow a long-term and high-intensity exercise program, or who have problematic exercise habits. Hence, a recent meta-analysis found a weak correlation between ON and exercise (r=0.12) and a stronger correlation between ON and addictive exercise (r= 0.29) (34). In line with this finding, we found a moderate negative correlation between ED and ORTO-11 scores.

The prevalence of disordered eating attitudes in Turkish university students has been ranging from 5.6% to 35.7% (35, 36). A total of 8.3% of the students who participated in this study had an eating attitude disorder and the prevalence did not differ significantly according to whether they were in the university sports team or not. Studies had also reported that regular sports practice was not associated with disordered eating attitudes among university students (19, 37). However, morbid exercise behavior and exercise addiction have consistently been associated with eating disorders (10, 15) and our study also confirmed this relationship. We found a positive correlation between ED and EAT-40 scores.

Different explanations have been proposed regarding the relationship between exercise addiction and eating disorders Melissa et al. (38) suggested that physical activity was sometimes voluntarily increased in eating disorders to optimize weight loss and sometimes involuntarily increased simultaneously with weight loss under subconscious biological drive. In ON situations, individuals might exercise to enhance their physical and mental health and this internal motivation might trigger extreme exercise habits resulting in exercise addiction (17). It has been possible that obsession with healthy eating may extend to obsession with exercise. Moreover, several risk factors linked with ON including low self-esteem (39), high narcissism (40), and perfectionism (40) have also been associated with ED (7, 11). On the other hand, Alcaraz-Ibáñez et al. (10) had suggested that exercise for weight control might be the key factor in the development and maintenance of eating disorders. As a result, the relationship between eating disorders and ED might be considered two-sided.

Our findings indicated that higher EAT-40 scores were associated with lower ORTO-11 scores. These results were consistent with other studies showing that greater symptomatology of ON was associated with a greater risk of disordered eating (18, 27, 39). These findings also support that ON should be considered an eating behavior disorder.

To the best of our knowledge, this is the first study to evaluate students in university sports teams in terms of ED, ON, and disordered eating attitude. However, this study has several limitations. The first important limitation is that, due to the cross-sectional study design, only associations between ED and ON and eating disorders could be determined, but it could not explain causality between the variables and whether ED is primary or secondary. The second limitation of the present study is that the orthorexic tendencies of the students were evaluated with the ORTO scale. Studies reported that the psychometric quality of the ORTO scale was poor, as it was unable to distinguish between healthy and pathological healthy eating (3, 21). So, EAT-40 was also used together with the ORTO scale in this study. The third limitation is that the ED risks and eating behaviors of university students could not be examined according to exercise types due to the limited sample size. Future research should examine associations between these phenomena according to exercise type in a larger sample.

CONCLUSION

Healthy lifestyle behaviors, including regular exercise and eating an adequate and balanced diet, can become unhealthy when they become an obsession. The results of the present study demonstrate that students in the university sports team are at higher risk for ED and have higher orthorexic tendencies than regular students. For this reason, health professionals who work in the sports teams should be aware of these risks and monitor the students in terms of ED and ON.

Ethics Committee Approval / Etik Komite Onayı

Approval for this study was obtained from the Institutional Ethics Committee of İzmir Katip Çelebi University, İzmir, Türkiye (Decision No: 419 Date: 26.09.2019).

Conflict of Interest / Çıkar Çatışması

The authors declared no conflicts of interest with respect to authorship and/or publication of the article.

Financial Disclosure / Finansal Destek

The authors received no financial support for the research and/or publication of this article.

Author Contributions / Yazar Katkıları

Concept: FİÇ, EBK; Design: YK, FİÇ, EBK; Supervision: EBK; Materials: FİÇ; Data Collection and Processing: YK, FİÇ; Analysis and Interpretation: YK, FİÇ, EBK; Literature Review: YK, FİÇ; Writing Manuscript: YK; Critical Reviews: EBK.

REFERENCES

1. World Health Organization. Healthy diet. 2020 April 29. Available from: https://www.who.int/news-room/fact-sheets/detail/healthy-diet.
2. Bratman S. Health Food Junkie; c2022 (cited Feb 2022). Available from: https://www.beyondveg.com/bratman-s/hfj/hf-junkie-1a.shtml.
3. Niedzielski A, Kaźmierczak-Wojtaś N. Prevalence of Orthorexia Nervosa and its diagnostic tools-A literature review. *Int J Environ Res Public Health*. 2021;18(10):5488.
4. Cena H, Barthels F, Cuzzolaro M, Bratman S, Brytek-Matera A, Dunn T, et al. Definition and diagnostic criteria for Orthorexia Nervosa: A narrative review of the literature. *Eat Weight Disord*. 2019;24(2):209-46.
5. McComb SE, Mills JS. Orthorexia Nervosa: A review of psychosocial risk factors. *Appetite*. 2019;140:50-75.

6. Posadzki P, Pieper D, Bajpai R, Makaruk H, Könsgen N, Neuhaus AL, et al. Exercise/physical activity and health outcomes: An overview of Cochrane systematic reviews. *BMC Public Health*. 2020;20(1):1724.
7. Macfarlane L, Owens G, Cruz BDP. Identifying the features of an exercise addiction: A Delphi study. *J Behav Addict*. 2016;5(3):474-84.
8. Szabo A, Griffiths MD, de La Vega Marcos R, Mervó B, Demetrovics Z. Methodological and conceptual limitations in exercise addiction research. *Yale J Biol Med*. 2015;88(3):303-8.
9. Di Lodovico L, Poulnais S, Gorwood P. Which sports are more at risk of physical exercise addiction: A systematic review. *Addict Behav*. 2019;93:257-62.
10. Alcaraz-Ibáñez M, Paterna A, Sicilia Á, Griffiths MD. Morbid exercise behaviour and eating disorders: A meta-analysis. *J Behav Addict*. 2020;9(2):206-24.
11. Chen WJ. Frequent exercise: A healthy habit or a behavioral addiction? *Chronic Dis Transl Med*. 2016;2(4):235-40.
12. Marques A, Peralta M, Sarmento H, Loureiro V, Gouveia É R, Gaspar de Matos M. Prevalence of risk for exercise dependence: A systematic review. *Sports Med*. 2019;49(2):319-30.
13. Back J, Josefsson T, Ivarsson A, Gustafsson H. Psychological risk factors for exercise dependence. *Int J Sport Exerc Psychol*. 2021;19(4):461-72.
14. Trott M, Yang L, Jackson SE, Firth J, Gillvray C, Stubbs B, et al. Prevalence and correlates of exercise addiction in the presence vs. absence of indicated eating disorders. *Front Sports Act Living*. 2020;2:84. doi: 10.3389/fspor.2020.00084.
15. Trott M, Jackson SE, Firth J, Jacob L, Grabovac I, Mistry A, et al. A comparative meta-analysis of the prevalence of exercise addiction in adults with and without indicated eating disorders. *Eat Weight Disord*. 2021;26(1):37-46.
16. Rudolph S. The connection between exercise addiction and orthorexia nervosa in German fitness sports. *Eat Weight Disord.* 2018;23(5):581-6.
17. 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.
18. 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;8:23.
19. Tavolacci MP, Grigioni S, Richard L, Meyrignac G, Déchelotte P, Ladner J. Eating disorders and associated health risks among university students. *J Nutr Educ Behav*. 2015;47(5):412-20.
20. Chan YL, Samy AL, Tong WT, Islam MA, Low WY. Eating disorder among Malaysian university students and its associated factors. *Asia Pac J Public Health*. 2020;32(6-7):334-9.
21. 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.
22. Hausenblas HA, Downs DS. How much is too much? The development and validation of the Exercise Dependence Scale. *Psychol Health*. 2002;17(4):387-404.
23. Yeltepe H, Ikizler H. Egzersiz Bağımlılığı Ölçeği-21'in Türkçe geçerlilik ve güvenilirlik çalışması. *Bağımlılık Dergisi*. 2007;8(1):29-35.
24. Garner DM, Garfinkel PE. The Eating Attitudes Test: An index of the symptoms of anorexia nervosa. *Psychol Med*. 1979;9(2):273-9.
25. Savaşır I, Erol N. Yeme tutum testi: Anoreksiya Nervoza belirtileri indeksi. *Psikoloji Dergisi.*1989;7(23):19-25.
26. Donini LM, Marsili D, Graziani MP, Imbriale M, Cannella C. Orthorexia nervosa: validation of a diagnosis questionnaire. *Eat Weight Disord*. 2005;10(2):e28-32.
27. Arusoğlu G, Kabakçi E, Köksal G, Merdol TK. Ortoreksiya Nervoza ve Orto-11'in Türkçeye uyarlama çalışması. *Turk Psikiyatri Derg*. 2008;19(3):283-91.
28. Reche-García C, Ortín Montero FJ, Martínez-Rodríguez A. Aspects related with physical exercise dependence in university students. *Sport Rev Euroam Ciencias Dep*. 2018;7(2):39-44.
29. Lukács A, Sasvári P, Varga B, Mayer K. Exercise addiction and its related factors in amateur runners. *J Behav Addict*. 2019;8(2):343-9.
30. Meulemans S, Pribis P, Grajales T, Krivak G. Gender differences in exercise dependence and eating disorders in young adults: A path analysis of a conceptual model. *Nutrients.* 2014;6(11):4895-905.
31. Cicioğlu HI, Demir GT, Bulğay C, Çetin E. Elit düzeyde sporcular ile spor bilimleri fakültesi öğrencilerinin egzersiz bağımlılığı düzeyleri. *Bağımlılık Dergisi*. 2019;20(1):12-20.
32. Malmborg J, Bremander A, Olsson MC, Bergman SJA. Health status, physical activity, and Orthorexia Nervosa: A comparison between exercise science students and business students. *Appetite*. 2017;109:137-43.
33. Duran S, Çiçekoğlu P, Kaya E. Relationship between orthorexia Nervosa, muscle dysmorphic disorder (bigorexia), and self-confidence levels in male students. *Perspect Psychiatr Care*. 2020;56(4):878-84.
34. Strahler J, Wachten H, Mueller-Alcazar A. Obsessive healthy eating and orthorexic eating tendencies in sport and exercise contexts: A systematic review and meta-analysis. *J Behav Addict*. 2021;10(3):456-70.
35. Hacıhasanoğlu R, Yıldırım A, Cebi K, Sahin H. Investigation of the relationship between eating attitudes and sleep quality in university students. *Turkish Journal of Family Medicine and Primary Care*. 2020;14(1):3-14.
36. Akdevelioğlu Y, Yörüsün TO. Universite öğrencilerinin yeme tutum ve davranışlarına ilişkin bazı faktörlerin incelenmesi. *Gazi Sağlık Bilimleri Dergisi*. 2019;4(1):19-28.
37. Karaağaç Y, Bellikci-Koyu E. Universite öğrencilerinde zayıflama diyetleri yeme tutum bozukluğu riskini arttırıyor mu? *4th International Health Sciences and Life Congress*; 2021 Apr 08-10; Burdur, Turkey. p. 21-31.
38. Rizk M, Mattar L, Kern L, Berthoz S, Duclos J, Viltart O, et al. Physical activity in eating disorders: A systematic review. *Nutrients*. 2020;12(1):183.
39. Barrada JR, Roncero M. Bidimensional structure of the orthorexia: Development and initial validation of a new instrument. *Anal Psicol*. 2018;34(2):282-90.
40. Oberle CD, Samaghabadi RO, Hughes EM. Orthorexia Nervosa: Assessment and correlates with gender, BMI, and personality. *Appetite*. 2017;108:303-10.