Progress in Nutrition 2021; Vol. 23, N. 4: e2021326 DOI 10.23751/pn.v23i4.12482

Original article

Relationship Between Exercise Addiction, Orthorexia Nervosa, and Sports Supplement Attitude in Turkish Fitness Participants

Caner Özgen[1], Hüseyin Köse[1], Servet Reyhan[2]

[1] Faculty of Sports Sciences, Eskişehir Technical University, Eskisehir, Turkey; [2] School of Physical Education and Sports, Siirt University, Siirt, Turkey

Summary. *Study Objectives:* There is not enough evidence in the literature for a causal relationship between ON, which is generally expressed as an obsession with healthy eating, and EA, which is expressed as an individual's loss of control over exercise behavior. The aim of this research is to determine the causal relationships between ON, EA, and SSA (Sports Supplement Attitude) in individuals who do fitness. *Methods:* Within the scope of the research, 204 people who are doing fitness were reached by convenience sampling method. The obtained data were analyzed within the scope of structural equation modeling. *Results:* As a result, of the analyzes of the hypotheses put forward within the scope of the structural model, it has been determined that EA is an important antecedent of ON within the scope of individuals doing fitness. While it has been empirically proven that SSA is an important precursor of EA, ON has no significant effect on SSA. *Conclusion:* The results revealed that ON behavior is not only related to maintaining a healthy lifestyle, but also has aesthetic concerns within the scope of individuals who do fitness. In addition, the significant positive effect of SSA on EA is important evidence among the risks that affect the formation of EA behavior. Finally, the finding that ON has no significant effect on SSA has opened the door to new research that will point to the difference between ON and other eating disorders.

Key words: Exercise addiction, Orthorexia nervosa, Sports supplement attitude

Introduction

The ongoing literature discussions on the relationship between diet and health have brought about significant changes in the eating habits of individuals (1). Due to the increase in the ease of access to scientific information, the interest in healthy nutrition has increased significantly (2). Some of the people who tried to comply with the recommendations made by various health institutions in this direction turned this into an obsessive behavior (3). In order to determine this situation, the term "Orthorexia Nervosa (ON)" (4), which is a pathological obsession for consuming healthy food, was introduced. If it continues for a long time as an obsessive behavior that does not contain artificial additives, focuses on the perceived quality of the food, constantly worries about nutrition, and sets strict rules in this sense, it is inevitable that bring potential health risks (2,3). Related to the subject, Mc Comb and Mills (2019) conceptualized the factors that reveal the risk of ON as the condemnation of obesity, access to organic foods, and various personality traits (5).

Numerous studies have been conducted in the literature aiming to reveal the relationship of ON with different structures. Just as observed in other eating disorder (ED) behaviors, ON patients do not enjoy their eating behaviors and use this behavior as a tool

to improve their self-esteem (3,6). The most basic distinction between these two diseases is that while ON patients evaluate the food they eat by content and nutritional values, they are concerned with the number of other types of ED (7). Despite the basic differences expressed, both diseases bring about similar psychological problems (8). Food restriction is likely to have risky consequences such as inadequate and unbalanced nutrition, psychological strain, and social isolation (2).

Although ON is not yet officially defined as a disorder in the DSM-5, discussions continue regarding the criteria of what it is associated with (9). It has been determined that individuals with ON have higher behaviors related to general eating pathological problems such as stress, depression, and life satisfaction compared to individuals without ON (10). However, Hayles (2017) found that there was no relationship between ON and depression and anxiety (11). It has been determined that ON can give different results according to culture and gender (12, 13, 16). Regarding this, Stutts, (2020). He stated that the perception of ON as a problem may differ according to the current situation (14). In this context, more empirical evidence is needed to determine the relationship of ON with different variables.

The most important criteria for a healthy lifestyle are exercise and nutrition (15). It indicates that regular physical activity, which is related to the lifestyle of the individual, reduces the symptoms of psychiatric disorders such as depression and anxiety disorders. Eating behavior, which is a habit related to lifestyle, begins to develop from infancy and is largely shaped in adolescence and youth (13). Individuals with ON disease usually simply restrict their diet and this turns into a pathological problem with mental preoccupation (16). They begin to be isolated from social activities, especially due to strict dietary practices, and as a result of this, various emotional disorders may occur (4). The most important personality traits of people who seek perfection in their eating habits appear as perfectionism (17). Accordingly, a relationship was found between ON and high body dissatisfaction (18). In another study, it was determined that individuals engaged in performance sports exhibit higher pathological eating disorders compared to the general population (19). However, there are various studies showing that individuals exhibiting various pathological eating disorder behaviors (anorexia nervosa and bulimia nervosa) go to extremes in their exercise habits (16, 20). Related to the subject, Köse and Özgen (2020) proved that there is a relationship between eating disorder and exercise addiction in male university students (21).

Prototypes for male and female bodies (muscular men, slim fit women) designed from our socio-cultural background have been visualized and disseminated through social media, the most popular communication tools of today (22, 23, 24). Individuals with a healthy appearance can be positively discriminated against compared to others who do not appear healthy. This creates the perception that people with a healthy appearance are more valuable than others (20, 26). Individuals who want to benefit from this emerging situation benefit from nutrition and physical activity in order to have a healthy appearance. It is thought that reaching the stated prototype bodies and healthy appearance contributes significantly to the spread of fitness sports (25). As stated before, regular physical activity has many positive effects on psychological and physiological health. Just as in ON, which is defined as an obsession with healthy eating, the transformation of exercise into an obsession and a pathological problem may expose the individual to unavoidable health problems (15, 26). On the contrary, if we consider the negativities brought by obesity and an inactive lifestyle, it is possible that the balance cannot be established, and it will bring along obsessive psychological problems. Exercise addiction, which causes the individual to lose control over his/her exercise behavior and exhibit behaviors that include all dimensions of temporary withdrawal and addiction symptoms, was first described by Baekeland in 1970 (26). Individuals suffering from exercise addiction, which is characterized as a form of behavioral addiction, show withdrawal symptoms just like substance addiction behavior when exercise is absent or its frequency decreases (27, 28). The use of substance addiction criteria in the literature on exercise addiction, which is not among the addiction types described in DSM-V, illuminates the situation in a way (22). Just like ON, exercise addiction brings with it very important psychological and physiological risks. Changes in dopamine or endorphin release, which affect enjoyment, are among the leading

physiological risks (29). The most common effective risk factors are dissatisfaction with one's own body and constant criticism, which is conceptualized with body dissatisfaction. In addition, a personality characterized by obsessive-compulsive tendencies is shown as risky psychological consequences of exercise addiction (20).

The most important logical correlation between ON and EA is the motivation of individuals to have a healthy and fit appearance (20). The fact that the behavioral diagnoses of both conditions are similar in this sense can be shown as evidence for a possible relationship. The criteria for exercise addiction, which focuses on individuals engaged in endurance sports in the literature, include components such as spending too much time on exercise and refusing the negative results of the exercise. In this sense, studies (16, 30, 31) have determined that the level of exercise addiction differs in different sample groups (exercise, culture, etc.). In the related literature, there are different studies investigating the relationship between ON and EA. For example, Rudolph (2017) empirically proved the relationship between ON and exercise addiction in individuals who do fitness, and as a result, he stated that participation in fitness sports carries a higher risk of ON and EA compared to other sports (15).

Haman et al. (2017) stated that one of the main factors of ON is excessive exercise behavior according to their exploratory research implications (21). Malmborg et al., (2017) found experimental evidence between ON and high levels of physical activity in their research. in relation to our research context, various studies on ON and EA of individuals doing fitness (24,11) have provided empirical evidence related to different variables in the literature. On the other hand, various studies could not detect the desired level of relationship (13,17,18).

Eating behavior, which is a habit related to lifestyle, begins to develop from infancy and is largely shaped in adolescence and youth (13). The desire to be healthy in relation to ON may motivate individuals to use various nutritional supplements, as well as adequate and balanced nutrition (33, 34). Sports nutritional supplements (SNS) have a wide range of uses. Especially due to the perfect body syndrome, individuals show great interest in SNS to increase the benefits they will get from the exercises they do. The general purpose of the use of SNS products is to increase endurance, increase strength and accelerate recovery. SNSs may also be broadly referred to as vitamins, minerals, herbal remedies, diet, nutritional supplements, or ergogenic aids. They are typically sold in the form of tablets, capsules, soft gels, liquids, powders, and sticks (35, 36).

Individuals who have played sports a lifestyle are interested in SNS products in order to achieve their general exercise goals and to find quick solutions to the metabolic stress caused by intense exercise. Especially the emphasis on the aesthetic and healthy body through various media channels contributed to the widespread use of these products. It is observed that the use of SNS products among US fitness individuals exceeds 46% (37). Individuals who do fitness can resort to various ways in order to increase their sports performance and to get the maximum benefit from the exercise. The easiest way to do this is doping, which carries great risks for the health of athletes. In relation to the issue, the World Anti-Doping Agency (WADA) is struggling to identify substances that put the health of athletes at risk and to reduce their use. In addition, SNS products with various purposes and forms of use stated above are among the legal substances approved by health institutions in terms of use. On the subject, Hurst et al., (2019) suggested that performance enhancing SNS products whose use is not prohibited may lead to doping use in the future and stated that the most important evidence for this is Thorndike's (1911) 'law of effect' (38). Individuals will associate the possible increases in their performance after the use of SNS products with these substances that they have not used. This positive experience will provide a positive attitude towards the related substance and increase it in the future (38). Continuous use of such products causes a decrease in their pharmacological effect (39). Sensitizing reactions of the individual to related products may lead to taking stronger supplements in the future or using a different substance that can be described as stronger (40). Ntoumanis et al. (2014) have shown the use of sports supplements to be an important determinant of doping use behavior (41). Individuals with ON symptoms are more likely to take dietary supplements than individuals with normal eating behaviors (20, 34). This provides evidence that there may be causal relationships between EA, SSA, and ON.

In the related literature, research between ON and EA have generally been carried out with easily accessible and repeated sample groups such as university students. Studies detecting ON and EA among fitness individuals are very limited in number and much more research is needed. Our research will make an important empirical contribution to the literature in this sense by examining the relevant gap at different cultures and sample levels. In addition, the detection of SSA, which we added to the model that examines the relationship between EA and ON, will reveal the relationships that cannot be expanded by expanding the subject. Revealing the role of SSA in the relationship between both EA and ON in the context of individuals doing fitness will not only make an important contribution to the relevant literature but will also prepare the ground for discussion for new research to be made. There is very limited research in the related literature evaluating the use of ED, EA, and SSA from various perspectives. In their study, Köse and Özgen (2020) found that the use of sports supplements mediated the relationship between EA and dichotomous thinking in eating disorders (DT). This research was carried out with male university students and the subject was discussed in the context of DT, which, unlike ON, divides the food into two opposite poles as black or white (21). In addition, Yurdakul (2020) revealed the relationship between belief in SNS products and exercise addiction (42). Selcuk et al. (2020) determined the relationship between the use of nutritional supplements in the last 12 months and ON by Turkish nursing students (34). In the literature review, no research was found that empirically determined ON, exercise addiction, and attitude towards SNS products in the population of people doing fitness. In order to fill this gap expressed in the literature and to prepare a discussion ground for new research on these phenomena, the aim of our research was to determine the causal relationships between ON, EA, and SSA. In line with all this information, the hypotheses to be analyzed within the scope of the research and the model (Figure-1) related to these hypotheses are as follows.

***H*^{1}** *ON has a positive and significant effect on SSA.*
***H*^{2}** *EA has a positive and significant effect on ON.*
***H*^{3}** *SSA has a positive and significant effect on EA.*

Material and Method

Participants and Data Collection

Within the scope of the research, a total of 204 members of the fitness center were reached by convenience sampling method. Links prepared via Google drive forms were delivered to the participants for the collection of research data. 84.8% of the participants are men and 15.2% are women. In addition, 76.5% of them are single and 59.8% of them have undergraduate education. While the largest share in the age distribution consists of individuals between the ages of 23-28 with 33.8%, the proportion of individuals in the age range of 29-34 is 28.4% and the rate of individuals in the age range of 17-22 is 27%. Finally, 52.5% of the participants stated that they went to the fitness center between 3-5 days, while 26% stated that they went almost every day, and 21.6% stated that they went

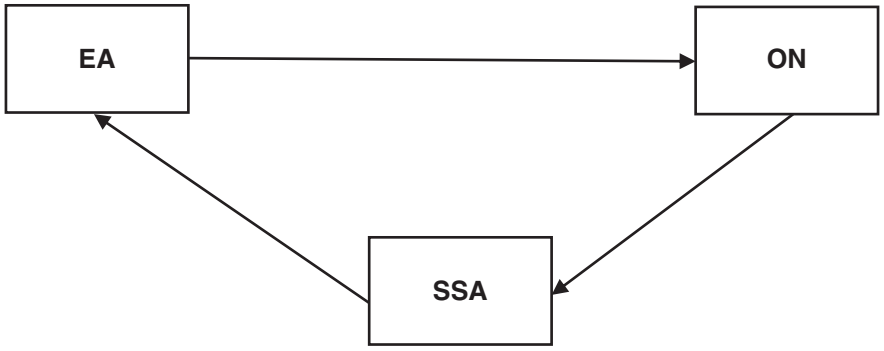


Figure 1. Research model

2 days or less. When the above-mentioned sample group is examined, it can be stated that the population going to the Turkish fitness center has similar characteristics in general.

Measurement Tools

Duesseldorf Orthorexia Scale (DOS)

Within the scope of the research, the 3-dimensional (Obsession in healthy food, Adherence to strict nutrition rules, Emotional symptoms) 10-item (Düsseldorf Orthorexie Scale DOS) scale used by He et al., (2019) was used to measure ON behaviors of individuals (43). In the Obsession in healthy food (5 items) dimension, there are statements such as "Eating healthy food is more important to me than indulgence/ enjoying the food", "I have certain nutrition rules that I adhere to". Within the dimension of Adherence to strict nutrition rules (3 items), there are statements such as 'I find it difficult to go against my personal dietary rules'. Finally, there are statements like 'I feel upset after eating unhealthy foods' for the Emotional symptoms (2 items) dimension.

Sports Supplement Attitude (SSA)

Attitude is an important antecedent of behavioral intention, which is the most important indicator in predicting a behavior (44). In this context, general attitude scales for sports supplement products were revised and used to measure the attitudes of individuals engaged in fitness within the scope of the research towards sports supplement products. In this context, a total of 3 items was created. The expressions used in the structure are "I think it is good to use supplements." "I think it is important to use supplements", "I think it is useful to use supplements".

The Exercise Addiction Inventory

To measure the exercise addiction of individuals, Terry et al., Griffiths et al. used the expressions of The Exercise Addiction Inventory measurement tool they developed (45,46). In the related structure, there are expressions such as "Exercise is the most important thing in my life", "If I have to miss an exercise session, I feel moody and irritable".

The translation back-translation method was used to prevent possible translation problems of all expressions included in the research and to reveal the measurement equivalence. In addition, before starting the research, a pilot study was conducted with a small sample group of 10 people to evaluate the statements in terms of intelligibility. All statements included in the research were prepared in accordance with the five-point Likert scale procedure (1 Strongly Disagree – 5 Strongly Agree) and presented to the views of the participants.

Data Analysis

Within the scope of the research, the basic methodological principles of SEM (Structural Equation Modeling) were used to test the hypotheses for multi-causality relationships. First of all, all the obtained data were transferred to SPSS and AMOS was used to test the structural model for the hypotheses.

Results

Validity and reliability procedure of ON scale

Within the scope of the research, CFA (confirmatory factor analysis) analysis was applied through the AMOS program to verify the factor structure of the ON scale, which is a 3-dimensional structure. The values obtained from the analyzes showed that the structure has perfect fit values (x^2= 56.412 p=0.000, X^2/ df =1.82, GFI=0.94, AGFI= 0.90, CFI = 0.98, TLI = 0 .97, IFI =0.98, RMSEA =0.064).

In addition, a number of validity and reliability analyzes recommended in the literature were carried out in order to determine the validity and reliability level of the DOS scale within the scope of the research. First of all, Cronbach's alpha coefficient was calculated in order to determine the internal reliability coefficient of the DOS scale. As a result, it was determined that all dimensions were above the recommended values (0.7) (48). In order to demonstrate the structural reliability (construct

reliability-CR) values were calculated. As a result, the fact that all values were above 0.7 provided evidence for construct validity (48). First of all, AVE values were calculated in order to determine the discriminant and convergent validity of DOS. A value above 0.5 for all dimensions provided evidence for convergent validity. It demonstrated discriminant validity that all expressions did not have a value above 0.6 (49). In the context of all this information, the Turkish version of the DOS scale used in the research has been proven to be a valid and reliable model among fitness room members (Table 1).

SSA (Sports Supplement Attitude) and TEAI (The Exercise Addiction Inventory) Validity and Reliability Procedure

Other structures used within the scope of the research are TEAI which is used to measure exercise addiction of fitness center members, and SSA structures, which are used to measure attitudes towards athlete nutritional supplements. many analyzes were applied in order to determine the validity and reliability of the structures used as one-dimensional in our sample group. AVE, CR, and Cronbach's alpha coefficients of TEAI and SSA constructs were calculated. As a result of the analysis, the TEAI structure was determined as (CR= .93; AVE= .69; Cronbach's alpha= .93). Regarding the SSA structure (CR= .93; AVE= .82; Cronbach's alpha= .93) was determined. It has been revealed that the constructs related to these results are at sufficient levels of validity and reliability (48, 49).

Testing the Structural Model

In order to determine the multiple causality relationships between the structures included in the research, the structural model shown in the structural figure-1 was established. Before testing the structural model, the fit index value of the model was checked and the fit between the data and the model was revealed (X^2= 270.836 p=0.000, X^2/df=1.89, GFI=0.87, AGFI= 0.83, CFI= 0.96, TLI = 0.94, IFI = 0.96, RMSEA = 0.066).

While all two hypotheses regarding the structural model formed within the scope of the research were accepted, one of them was rejected (Table 2). In this context, it is seen that ON behaviors of the fitness room members and SSA do not affect it significantly. It was determined that EA had a positive and significant effect on ON and was an important variable in the explanation of EN behavior. In addition, it was revealed that SSA EA was significantly affected (p<0.01). In the context of these results, the causal relationships between ON, EA, and SSA of individuals who are members of the fitness room have been empirically proven.

Discussion

Excessive obsessive behavior towards nutrition and exercise, which are accepted as the most important

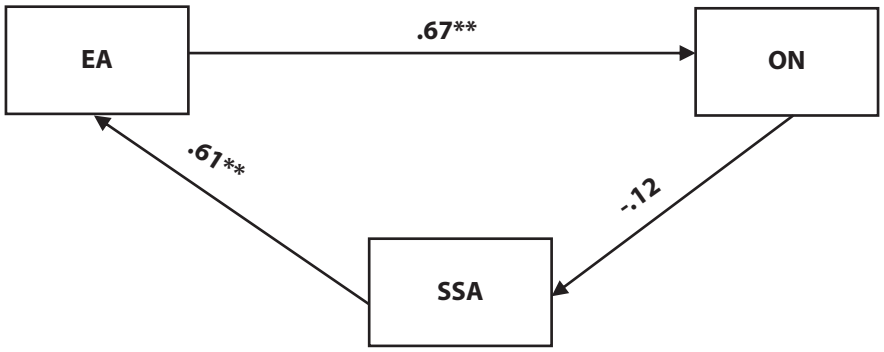
Table 1. Validity and reliability results for scale structures and items factor loading

Structures	Factor Loading
Obsession in healthy food ***(CR= .89), (Cronbach's alpha= .87), (AVE=.60)***	
Eating healthy food is more important to me than indulgence/enjoying the food	**.682**
I have certain nutrition rules that I adhere to	**.831**
I can only enjoy eating foods considered healthy	**.743**
I like that I pay more attention to healthy nutrition than other people	**.821**
I try to avoid getting invited over to friends for dinner if I know that they do not pay attention to healthy nutrition.	**.775**
Adherence to strict nutrition rules ***(CR= .78), (Cronbach's alpha= .77), (AVE= .55)***	
I have the feeling of being excluded by my friends and colleagues due to my strict nutrition rules	**.642**
My thoughts constantly revolve around healthy nutrition and I organize my day around it	**.903**
I find it difficult to go against my personal dietary rules	**.649**
Emotional symptoms ***(CR= .85), (Cronbach's alpha= .85), (AVE= .74)***	
If I eat something I consider unhealthy, I feel really bad	**.842**
I feel upset after eating unhealthy foods	**.879**

Table 2. Results of Path Analysis

Analysis	Coefficient	T-value	Result
H[1] Sport supplements Attitude <--- Orthorexia Nervosa	-.12	-.78	Rejected
H[2] Orthorexia Nervosa <--- Exercise Addiction	.67	6.36	Accepted **
H[3] Exercise Addiction <--- Sport supplements Attitude	.61	5.95	Accepted **

Notes: **= p<0.01



Notes: **= p<0.01
Figure 2. Regression weights for hypothesized model

health indicators of human life, can have significant negative effects on the quality of life, psychological and physiological health of individuals. The progression of various psychological obsessive behaviors indicates different pathological problems that may be related. The aim of this research was to determine the causal relationships between ON EA and SSA among individuals doing fitness. Until the date of this research, the fact that no study emphasized that there could be a relationship between the related phenomena, but that investigated the meaningful relationships between all these structures can be considered as a sign of the contribution of this research to the related literature. In addition, although the relationship between ON and EA behaviors among fitness individuals has been determined by the literature, it can be stated that the level of significance between these pathological problems in SSA, which is included in our research model, has created a discussion ground for new research.

Evidence of the relationship between ON and exercise dependence in the literature (eg., 20, 15, 21) is due to individual motivations between the two pathological problems. Accordingly, individuals feel obliged to change not only their eating habits but also the amount of exercise in order to maintain physical health and have an aesthetic appearance (20, 25). On the subject, Rudolph et al. (2017) stated that fitness provides an environment that is more prone to developing ON and EA behaviors compared to other sports branches, and in the context of his research, he brought light to this subject in a sense (15). The fact that ON and EA behaviors complement each other, especially in the fitness environment, increases the frequency of encountering ON and EA behaviors in individuals in these environments. Rudolph et al., (2017) stated that there is no causality evidence for the relationship between these two phenomena as a result of their research investigating ON and EA behaviors among German fitness individuals (15). The results obtained in the context of the research proved the causal relationship between the two phenomena and made an important contribution to the literature in this sense. Accordingly, it has been determined that EA is a very important antecedent without explaining ON behavior in the context of individuals doing fitness.

The effort to reach the ideal appearance (fit and tight for women, muscular for men) created by society significantly affects the nutrition and exercise habits of individuals (22, 23, 24). Creating a perception that individuals with a healthy and ideal body are more valuable in society may lead to individual discrimination (20, 25). For individuals who are aware of this or who have been exposed to such discrimination in the past, the ideal appearance they have achieved or wanted to achieve becomes an important part of their lives. The power of this motivation can cause serious disturbances in the exercise behaviors and eating habits of individuals. Fitness sport is very important to achieve this ideal look. The fact that weight training is not enough to achieve a muscular and fit appearance, and nutrition is a very important factor for this appearance, is likely to change the behavior of individuals in this sense. There is a large body of research in the related literature that has empirically proven the relationships between various eating disorders and exercise addiction phenomena. However, ON, which is expressed as a healthy eating obsession, is thought to create a more effective context for those who do fitness sports to achieve a healthy appearance. For eating disorders that focus on different contexts, the main focus is the fear of gaining weight. But for ON, besides the fear of gaining weight, there is an obsession with healthy eating. Weight loss, which is important in eating behavior for a fitness sport whose general purpose is to build muscle, is not a very desirable situation. The phenomenon called 'clean feeding' among fitness individuals is considered a key role in maintaining a muscular appearance without being fat. The point that all these contexts point to is reaching and maintaining the ideal body by eating healthy and gradually increasing the amount of exercise. When the subject is considered from this aspect, it can be said that ON draws a more accurate framework among the concepts of eating disorders for fitness athletes. In this sense, the causality-related we have identified within the scope of our research has provided an important gain to the ongoing discussions in the literature.

The importance of SSA in the development of ON and EA behaviors, which are considered to be important behavioral disorders, is worth examining if we look at its widespread use among individuals engaged in fitness. SS, which contains significant doubts about whether they are healthy or even considered an important antecedent of my use of doping (41), established a significant causal relationship with both phenomena in the context of our research. Köse and Özgen, (2020) found a positive correlation between dichotomous thinking in eating disorders (DT), which separates the food into two opposite poles as black and white while detecting the relationship between EA and sports supplement use in the study they conducted with male university students (21). According to the results of the research, sports supplement shows a partial mediation effect in the relationship between DT and EA. As stated before with reasons, fitness sports provide a more suitable basis for ON among eating behaviors. However, it is surprising that no significant relationship was found between the two concepts included in the study. In the context of the relevant results, the lack of a relationship between sports supplement use and ON, which was previously associated with DS, may be an important issue that needs to be investigated with variables such as different eating disorders, culture, and gender. As a result, this may be an important indicator that ON and DS eating disorders may develop different behaviors.

Conclusion

All studies may contain various limitations in terms of perspectives on the problem they are interested in, sample groups, and methodological approaches they follow. It will be a guide for new research to show the limitations of the research in which the subject is evaluated in this way. Our research was created using easy sampling methods. By using probabilistic sampling methods in future studies, this limitation can be eliminated, and more generalizable results can be obtained. Our research focus is on individuals engaged in fitness. Therefore, different results can be obtained from similar studies conducted in similar sports branches (CrossFit, powerlifting, etc.). Our research is aimed at Turkish fitness individuals. Studies with a sample group consisting of different cultures may be important in order to determine the relations between the related phenomena and the differences between

cultures. Finally, new research that will be carried out by adding new variables to the conceptual model discussed within the scope of our research will expand the field of discussion on the subject.

References

1. Almeida, C., Borba, V. V., & Santos, L. Orthorexia nervosa in a sample of Portuguese fitness participants. Eating and Weight Disorders-Studies on Anorexia, Bulimia and Obesity, 2018: 23(4), 443-451.
2. Brytek-Matera A, Rogoza R, Gramaglia C, & Zeppegno P. Predictors of orthorexic behaviours in patients with eating disorders: a preliminary study. BMC Psychiatry 2015: 15, 1–8.
3. Vandereycken W. Media hype, diagnostic fad or genuine disorder? Professionals' opinions about night eating syndrome, orthorexia, muscle dysmorphia and emetophobia. Eat Disord. 2011: 19, 145–155.
4. Bratman, S. Health food junkie. Yoga J September. 1997: 42-50.
5. McComb, S. E., & Mills, J. S. Orthorexia nervosa: A review of psychosocial risk factors. Appetite, 2019: 140, 50-75.
6. Brytek-Matera, A., Fonte, M. L., Poggiogalle, E., Donini, L. M., & Cena, H. Orthorexia nervosa: relationship with obsessive-compulsive symptoms, disordered eating patterns and body uneasiness among Italian university students. Eating and Weight Disorders-Studies on Anorexia, Bulimia and Obesity, 2017: 22, 609-617.
7. Varga M, Thege BK, Dukay-Szabó S, Túry F, van Furth EF, Bratman S, et al. When eating healthy is not healthy: orthorexia nervosa and its measurement with the ORTO-15 in Hungary. BMC Psychiatry. BioMed Central. 2014: 14-59.
8. Varga M, Dukay-Szabó S, Túry F, van Furth EF, van Furth Eric F. Evidence and gaps in the literature on orthorexia nervosa. Eat Weight Disord. 2013: 18, 103–11.
9. 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. Eating and Weight Disorders. 2019: 24, 209-246.
10. Strahler, J., Hermann, A., Walter, B., & Stark, R. Orthorexia nervosa: A behavioral complex or psychological condition? Journal of Behavioral Addictions. 2018: 7, 1143–1156.
11. Hayles, O., Wu, M. S., De Nadai, A. S., & Storch, E. A. (). Orthorexia nervosa: An examination of the prevalence, correlates, and associated impairment in a university sample. Journal of Cognitive Psychotherapy. 2017: 31(1), 124–135.
12. Barnes, M. A., & Caltabiano, M. L. The interrelationship between orthorexia nervosa, perfectionism, body image and attachment style. Eating and Weight Disorders, 2017: 22, 177–184.
13. Parra-Fernandez, M.-L., Rodriguez-Cano, T., Onieva-Zafra, M.-D., Perez-Haro, M. J., Oberle, C. D., Fernandez-Martinez, E., et al. Prevalence of orthorexia nervosa in university students and its relationship with psychopathological aspects of eating behaviour disorders. BMC Psychiatry, 2018: 18, 1–8.
14. Stutts, L. A. It's complicated: The relationship between orthorexia and weight/shape concerns, eating behaviors, and mood. Eating Behaviors. 2020: 39, 1-4.
15. Rudolph, S. The connection between exercise addiction and orthorexia nervosa in German fitness sports. Eating and Weight Disorders-Studies on Anorexia, Bulimia and Obesity. 2018: 23(5), 581-586.
16. Zeulner B, Ziemainz H, Beyer C et al. Disordered eating and exercise dependence in endurance athletes. Adv Phys Educ. 2016: 6, 76–87.
17. Brytek-Matera A Orthorexia nervosa: an eating disorder, obsessive-compulsive disorder or disturbed eating habit? Arch Psychiatry Psychother. 2012: 1, 55–60
18. Barnes, M. A., & Caltabiano, M. L. The interrelationship between orthorexia nervosa, perfectionism, body image and attachment style. Eating and Weight Disorders. 2017: 22(1), 177–184.
19. Sundgot-Borgen J, Torstveit MK. Prevalence of eating disorders in elite athletes is higher than in the general population. Clin J Sport Med, 2004: 14, 25–32.
20. Oberle, C. D., Watkins, R. S., & Burkot, A. J. (2). Orthorexic eating behaviors related to exercise addiction and internal motivations in a sample of university students. Eating and Weight Disorders-Studies on Anorexia, Bulimia and Obesity. 2018: 23(1), 67-74.
21. Köse, H., & Özgen, C. Fit or Nothing! University Students' Exercise Addiction, Eating Disorders and Mediator Effect of Sports Supplement Use. African Educational Research Journal. 2020: 8(2), 381-386.
22. Dell'Arte, S., & Lenzo, V. (2021). Personality, exercise addiction and orthorexia. A research contribution. Journal of Clinical & Developmental Psychology. 2021: 3(2), 63-83.
23. Aubrey J.S. Looking good versus feeling good: an investigation of media frames of health advice and their effects on women's body-related self-perceptions. Sex Roles. 2010: 63, 50-63.
24. Leit, R.A., Pope, H.G. & Gray, J.J. Cultural expectations of muscularity in men: The evolution of Playgirl centerfolds. International Journal of Eating Disorders. 2001: 29, 90-93.
25. Lee J. & Macdonald D. "Are they just checking our obesity or what?" The healthism discourse and rural young women. Sport Education and Society, 2010: 15, 203-219.
26. Baekeland F. Exercise deprivation. Sleep and psychological reactions. Arch Gen Psychiatry. 1970: 22, 365–369.
27. Adams J., & Kirkby R. J. Excessive exercise as an addiction: A review. Addiction Research and Theory. 2002: 10(5), 415-437
28. Hausenblas H.A. & Downs, D.S. Exercise dependence: A systematic review. Psychology of Sport and Exercise. 2002: 3(2), 89-123.
29. Farrell PA, Gates WK, Maksud MG, Morgan WP. Increases in plasma beta-endorphine/betalipotropin immunoreactivity after treadmill running in humans. Journal of Applied Physiology. 1982: 52(5), 1245-1249.

30. Szabo A, Griffiths MD. Exercise addiction in British sport science students. Int J Ment Health Addict. 2007: 5, 25–28.
31. Lichtenstein MB, Jensen TT. Exercise addiction in CrossFit: prevalence and psychometric properties of the exercise addiction inventory. Addict Behav Rep. 2016: 3, 33–37.
32. Haman L, Lindgren E. C. & Prell H. "If it's not Iron it's Iron f*cking biggest Ironman": personal trainers' views on health norms, orthorexia and deviant behaviors. International Journal of Qualitative Studies on Health and Well-being. 2017: 12(2), 1-9.
33. Atalay D, Erge HS. Dietary supplements and their effects on health. Food Health. 2018: 4(2), 98-111.
34. Selçuk, K. T., Çevik, C., Sarıoğlu, N., Bilen, Ç., Gencer, N., Kökçü, Ö. D., ... & Eser, E. (2020). Use of dietary supplements among nursing students in Turkey in the last 12 months and its relation with orthorexia nervosa. Perspectives in psychiatric care, 56(4), 885-893.
35. Petróczi, A., Naughton, D. P., Mazanov, J., Holloway, A., & Bingham, J. Limited agreement exists between rationale and practice in athletes' supplement use for maintenance of health: a retrospective study. Nutrition journal, 2007: 6(1), 1-8.
36. US Food and Drug Administration. Dietary Supplement Products & Ingredients. https://www.fda.gov/food/dietary-supplements/dietary- supplement-products-ingredients
37. NBJ. Supplement Business Report. 2021. https://store.newhope.com/products/2021-supplement-business-report.
38. Hurst, P., Kavussanu, M., Boardley, I., & Ring, C. Sport supplement use predicts doping attitudes and likelihood via sport supplement beliefs. Journal of sports sciences. 2019: 37(15), 1734-1740.
39. Hyman, S. E., & Malenka, R. C. (2001). Addiction and the brain: the neurobiology of compulsion and its persistence. Nature reviews neuroscience, 2(10), 695-703.
40. Robinson, T. E., & Berridge, K. C. The neural basis of drug craving: an incentive-sensitization theory of addiction. Brain research reviews, 1993: 18(3), 247-291.
41. Ntoumanis, N., Ng, J. Y., Barkoukis, V., & Backhouse, S. Personal and psychosocial predictors of doping use in physical activity settings: a meta-analysis. Sports medicine, 2014: 44(11), 1603-1624.
42. Yurdakul, H. Ö. The Relationship Between Exercise Addiction And Beliefs in Sports Nutritional Supplements. Turkish Journal of Sport and Exercise. 2020: 22(2), 338-343.
43. He, J., Ma, H., Barthels, F., & Fan, X. Psychometric properties of the Chinese version of the Düsseldorf Orthorexia Scale: Prevalence and demographic correlates of orthorexia nervosa among Chinese university students. Eating and Weight Disorders-Studies on Anorexia, Bulimia and Obesity. 2019: 24(3), 453-463.
44. Ajzen, I. The theory of planned behavior. Organizational behavior and human decision processes. 1991: 50(2), 179-211.
45. Griffiths, M. D., Szabo, A., & Terry, A. The exercise addiction inventory: a quick and easy screening tool for health practitioners. British journal of sports medicine. 2005: 39(6), 30-39.
46. Terry, A., Szabo, A., & Griffiths, M. The exercise addiction inventory: A new brief screening tool. Addiction Research & Theory. 2004: 12(5), 489-499.
47. Byrne, B. M. Structural equation modeling with LISREL, PRELIS, and SIMPLIS: Basic concepts, applications, and programming. Psychology Press. 2013.
48. Malhotra, N. K., Peterson, M., & Uslay, C. Helping marketing research earn a seat at the table for decision-making: An assessment and prescription for the future. European Business Review. 2006: 18(4), 294-306.
49. Nunnally, J.C. & Bernstein, I.H. Psychometric theory (3rd ed.). 1994: New York: McGraw-Hill.

Correspondence
Caner ÖZGEN
Faculty of Sports Sciences, Eskişehir Technical University, Eskişehir, Turkey
E-mail: canerozgen@eskisehir.edu.tr