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Orthorexia Nervosa and Exercise Dependence in Male CrossFit Athletes: Behavioral and Health-Related Associations

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Abstract

Aim: The aim of this study was to examine the relationships between orthorexia nervosa tendencies and exercise dependence, including its subdimensions, in male CrossFit athletes, and to investigate how these psychological tendencies are associated with behavioral factors such as smoking status, dietary supplement use, planned meal consumption, and injury history.

Methods: This study was conducted using a correlational research design. The sample consisted of 252 male CrossFit athletes actively training in Diyarbakır, selected on a voluntary basis (mean age: 26.92 ± 4.09 years). Data were collected using a personal information form, the ORTO-11 Scale, and the Exercise Dependence Scale. ORTO-11 scores were categorized into quartile groups (Q1–Q4), while exercise dependence was classified as risk, dependent, and high-level dependent groups. Statistical analyses included descriptive statistics, chi-square tests, Cramér's V effect size, and Pearson correlation analysis. The Benjamini–Hochberg procedure was applied to control for multiple comparisons.

Results: The findings indicated that the relationship between orthorexia tendencies and exercise dependence is multidimensional and variable-specific. ORTO-11 scores were negatively and weakly correlated with the "Withdrawal of Individual–Social Needs and Conflict" ($r = -0.189$, $p < 0.01$) and "Tolerance Development and Passion" ($r = -0.152$, $p < 0.05$) subdimensions of exercise dependence. Significant associations were found between orthorexia and exercise dependence groups and smoking behavior, dietary supplement use, and planned meal consumption ($p < 0.05$). While injury history was significantly associated with orthorexia tendencies, it was not significantly related to exercise dependence levels.

Conclusion: In conclusion, orthorexia nervosa tendencies and exercise dependence in male CrossFit athletes may be associated with psychological characteristics, nutrition-related behaviors, and lifestyle factors. The findings suggest that the observed associations between orthorexia tendencies and exercise dependence may vary according to specific behavioral and psychological factors rather than reflecting a simple linear relationship. Therefore, comprehensive and interdisciplinary assessment approaches are recommended for the identification and management of orthorexia and exercise dependence risks in athletic populations.

Keywords: Athlete health, eating behaviors, exercise dependence, orthorexia nervosa

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Erkek CrossFit Sporcularında Ortoreksiya Nervoza ve Egzersiz Bağımlılığı: Sağlık ve Davranışsal Belirleyiciler

Öz

Amaç: Bu çalışmanın amacı, CrossFit sporu yapan erkek bireylerde ortoreksiya nervoza eğilimleri ile egzersiz bağımlılığı ve alt boyutları arasındaki ilişkileri incelemek ve bu psikolojik eğilimlerin sigara kullanımı, takviye besin kullanımı, planlı öğün tüketimi ve sakatlık geçmişi gibi davranışsal faktörlerle olan etkileşimlerini ortaya koymaktır.

Yöntemler: Araştırma, ilişkisel tarama (korelasyonel) araştırma modeli ile yürütülmüştür. Çalışmanın örneklemini Diyarbakır ilinde aktif olarak CrossFit yapan ve gönüllülük esasına göre seçilen 252 erkek sporcu oluşturmuştur (yaş: 26,92 ± 4,09 yıl). Veri toplama araçları olarak kişisel bilgi formu, ORTO-11 Ölçeği ve Egzersiz Bağımlılığı Ölçeği kullanılmıştır. ORTO-11 puanları çeyrek gruplara (Q1–Q4) ayrılmış, egzersiz bağımlılığı ise risk, bağımlı ve yüksek düzeyde bağımlı gruplar şeklinde sınıflandırılmıştır. Verilerin analizinde betimsel istatistikler, Ki-kare testi, Cramér's V etki büyüklüğü ve Pearson korelasyon analizi uygulanmış; çoklu karşılaştırmalar için Benjamini–Hochberg düzeltmesi kullanılmıştır.

Bulgular: Bulgular, ortoreksiya eğilimleri ile egzersiz bağımlılığı arasındaki ilişkinin çok boyutlu ve değişkene özgü olduğunu göstermiştir. ORTO-11 puanları ile egzersiz bağımlılığının "Bireysel-Sosyal İhtiyaçların Ertelenmesi ve Çatışma" ($r = -0{,}189$, $p < 0{,}01$) ve "Tolerans Gelişimi ve Tutku" ($r = -0{,}152$, $p < 0{,}05$) alt boyutları arasında negatif yönlü ve düşük düzeyde anlamlı ilişkiler saptanmıştır. Sigara kullanımı, takviye besin kullanımı ve planlı öğün tüketimi ile hem ortoreksiya hem de egzersiz bağımlılığı grupları arasında anlamlı ilişkiler belirlenmiştir ($p < 0{,}05$). Sakatlık geçmişi, ortoreksiya eğilimleri ile ilişkili bulunurken, egzersiz bağımlılığı düzeyleri ile anlamlı bir ilişki göstermemiştir.

Sonuç: Sonuç olarak, erkek CrossFit sporcularında ortoreksiya nervoza eğilimleri ve egzersiz bağımlılığı; psikolojik özellikler, beslenme ile ilişkili davranışlar ve yaşam tarzı faktörleriyle ilişkili olabilir. Bulgular, ortoreksiya eğilimleri ile egzersiz bağımlılığı arasındaki gözlenen ilişkilerin basit ve doğrusal bir ilişkiyi yansıtmak yerine, belirli davranışsal ve psikolojik faktörlere bağlı olarak farklılık gösterebileceğini ortaya koymaktadır. Bu nedenle, sporcu popülasyonlarında ortoreksiya ve egzersiz bağımlılığı risklerinin belirlenmesi ve yönetilmesi amacıyla kapsamlı ve disiplinler arası değerlendirme yaklaşımlarının kullanılması önerilmektedir.

Anahtar kelimeler: Sporcu sağlığı, yeme davranışları, egzersiz bağımlılığı, ortoreksiya nervoza.

INTRODUCTION

CrossFit is a high-intensity training modality based on functional movements, integrating weightlifting, gymnastics, and cardiovascular exercises within the "Workout of the Day" (WOD) framework, and characterized by constant variation and high training intensity. Beyond being an exercise program, CrossFit has evolved into a lifestyle shaped by performance monitoring, competitive elements, and strong community engagement. While these features are associated with increased exercise adherence and motivation[1], they also involve substantial physical demands. Systematic reviews report musculoskeletal injury rates ranging from 1.7 to 4.3 per 1,000 training hours among CrossFit athletes[2], suggesting a potential risk for maladaptive exercise behaviors in some individuals.

In addition to its physiological demands, CrossFit is also characterized by a strong community-based culture in which social interaction, group identity, and shared norms play an important role in shaping participant behavior. Recent evidence indicates that CrossFit communities operate within interconnected "community-environment" structures, where local social dynamics and interpersonal communication influence both organizational responses and participant engagement patterns[3]. Furthermore, qualitative findings suggest that cultural identity within CrossFit groups may be shaped by shared norms, language, and reactions to organizational discourse, thereby contributing to a distinctive cultural structure that influences member behavior and group cohesion[4].

Continuing exercise despite adverse physical or psychological consequences is conceptualized as exercise dependence. Exercise dependence is characterized by behavioral addiction–like symptoms, including tolerance, withdrawal, loss of control, and impairment in daily functioning[5]. It has also been described as the persistence of exercise despite harm, often driven by performance expectations and body image–related motivations[6]. Previous studies indicate that the risk of exercise dependence is higher in high-intensity and performance-oriented sports[7], with prevalence rates of approximately 7–8% reported among elite athletes[8].

Another construct that has received growing attention is Orthorexia Nervosa (ON), defined as a rigid and obsessive preoccupation with healthy eating that leads to functional impairment[9]. Although ON is not recognized as an independent diagnosis in the DSM-5 or ICD-11, it is increasingly examined in athletic populations and is characterized by excessive cognitive engagement, anxiety, and avoidance behaviors related to food choices[10,11]. Orthorexic tendencies have been reported more frequently in sports emphasizing disciplined lifestyles and structured nutritional practices[12]. Empirical evidence suggests significant associations between ON, high exercise volume, body image concerns, and performance orientation among athletes[13,14].

Within this cultural framework, social media platforms further contribute to the formation and reinforcement of CrossFit identity by amplifying community interactions and enabling both local and global connectivity. Studies suggest that digital environments may simultaneously intensify social comparisons and strengthen intergroup cohesion, thereby shaping behavioral norms and performance expectations within fitness communities[15]. In CrossFit settings, such digital and social structures may contribute to the dissemination of training norms and nutritional practices, reinforcing shared behavioral standards across communities[3].

In the context of CrossFit, high training intensity, performance pressure, widespread adherence to rigid dietary norms (e.g., paleo or zone diets), and a strong community culture may place athletes at increased risk for both exercise dependence and orthorexia[16]. Performance expectations within such environments may also be reinforced through community-based accountability mechanisms and perceived social evaluation, which can shape adherence to both training and dietary behaviors[3,4]. The literature further suggests a reciprocal and potentially reinforcing relationship between these two phenomena, whereby strict dietary control may coexist with excessive and compulsive exercise behaviors[17]. Accordingly, CrossFit athletes represent a unique population for examining the coexistence of orthorexic tendencies and exercise dependence.

Therefore, the aim of this study is to investigate the relationship between orthorexic tendencies and exercise dependence in male CrossFit athletes and to examine the influence of smoking status, dietary supplement use, injury history, and planned meal consumption on this relationship.

Hypotheses

H1: There is a negative relationship between ORTO-11 scores and levels of exercise dependence in male CrossFit athletes.

H2: Orthorexia levels differ between male CrossFit athletes who smoke and those who do not smoke.

H3: Dietary supplement use is associated with both orthorexia levels and exercise dependence among male CrossFit athletes.

H4: Levels of exercise dependence differ between male CrossFit athletes with a history of injury and those without an injury history.

H5: Orthorexia levels differ between male CrossFit athletes who consume planned meals and those who do not consume planned meals.

METHOD

Study Design

This study was conducted using a relational screening (correlational) research design. The correlational design is a quantitative approach aimed at determining the direction and strength of the relationship between two or more variables[18]. In this context, scores obtained from the ORTO-11 Scale and the Exercise Dependence Scale were analyzed. In addition, the relationships between these scale scores and participants' smoking status, dietary supplement use, injury history, and planned meal consumption were examined. No intervention was applied to the variables, and the study aimed to describe the existing situation.

Population and Sample

The target population of the study consisted of male CrossFit athletes training in the city of Diyarbakır, Türkiye. The sample was selected on a voluntary basis using a convenience sampling method. Male individuals aged 18 years and older who actively participated in CrossFit training were included in the study. Participants were recruited from various CrossFit gyms as well as individuals training independently.

A priori sample size estimation was performed using G*Power software. Based on a bivariate normal model correlation, a medium effect size ($r = 0.30$) as defined by Cohen[19], a significance level of 5% (α error probability), and a statistical power of 95% ($1-\beta$ error probability), the minimum required sample size was calculated as 138 participants. To enhance the validity and reliability of the study, a total of 252 eligible male CrossFit athletes were included in the final sample.

All participants volunteered to take part in the study, and necessary precautions were taken to minimize anonymity concerns during scale administration. Individuals with a history of psychological disorders and those who did not engage in regular exercise were excluded from the study.

Inclusion and Exclusion Criteria

Inclusion criteria were as follows:

• Being 18 years of age or older,

• Participating regularly in CrossFit training for at least the past 6 months,

• Voluntarily agreeing to participate in the study.

Exclusion criteria were defined as:

• Having experienced a musculoskeletal injury within the past 6 months that restricted training participation,

• Having an acute condition at the time of assessment that could affect performance or questionnaire responses,

• Failure to comply with the specified measurement or questionnaire protocols.

Data Collection Procedure

During the data collection process, all necessary measures were taken to ensure that participants felt comfortable and did not experience concerns regarding anonymity. The questionnaires were administered under appropriate conditions with guidance provided by the researcher and certified CrossFit coaches experienced in the field. All collected data were used solely for scientific purposes.

Data Collection Instruments

Data were collected using a personal information form, the ORTO-11 Scale

(Orthorexia Nervosa Assessment Tool), and the Exercise Dependence Scale.

Personal Information Form

The personal information form was developed by the researcher and included items related to participants' age, height, body weight, smoking status, dietary supplement use, injury history, and planned meal consumption.

ORTO-11 Scale (Orthorexia Nervosa Assessment Tool)

In this study, the ORTO-11 Scale, derived from the original 15-item ORTO-15 and adapted into Turkish by Arusoğlu et al. (2008), was used to assess orthorexic tendencies. Each item is scored on a 4-point Likert scale (1–4), with lower total scores indicating higher orthorexic tendencies[20].

Given the variability reported in the internal consistency of the ORTO scale and its derivatives, the results obtained from this instrument should be interpreted with due consideration. A comprehensive reliability generalization meta-analysis reported a pooled internal consistency of $\alpha = 0.59$ (95% CI: 0.49–0.68) for the ORTO scale and its variants, with individual study alpha values ranging from 0.23 to 0.83 and substantial heterogeneity ($I^2 = 99.31\%$)[21]. In the present study, the Cronbach's alpha coefficient was calculated as 0.59, which is consistent with previously reported average values. However, this level of internal consistency indicates limited reliability, and therefore the results derived from the ORTO-11 scale should be interpreted with methodological caution. The Turkish version demonstrated an internal consistency coefficient of $\alpha = 0.62$ and supported a unidimensional factor structure[20].

For analytical purposes, total ORTO-11 scores were first ranked from lowest to highest and subsequently divided into quartiles to facilitate categorical comparisons. The quartile classification was defined as follows: Q1 (<25 points), Q2 (25–27 points), Q3 (28–29 points), and Q4 (≥30 points). It should be noted that lower scores represent higher orthorexic tendencies, and thus Q1 corresponds to the highest level of orthorexic tendency within the sample[22].

Exercise Dependence Scale

Exercise dependence was assessed using the Exercise Dependence Scale developed by Demir et al. (2018). The scale has a three-factor structure explaining 54.61% of the total variance. The first factor, Excessive Focus and Mood Modification, consists of the first seven items (Items 1–7) and explains 34.89% of the variance. The second factor, Postponement of Individual–Social Needs and Conflict, includes six items (Items 8–13) and accounts for 13.06% of the variance. The third factor, Tolerance Development and Passion, consists of four items (Items 14–17) and explains 6.65% of the variance[23].

Based on total scores, participants were classified as follows: 1–17 (normal), 18–34 (low risk), 35–51 (risk), 52–69 (dependent), and 70–85 (highly dependent). The original scale demonstrated high internal consistency (Cronbach's $\alpha = 0.88$)[23]. In the present study, the total internal consistency coefficient was $\alpha = 0.85$.

Statistical Analysis

Descriptive statistics (frequency, percentage, mean, and standard deviation) were calculated for participants' personal characteristics. Differences between categorical variables derived from the scales were examined using the chi-square test. As multiple chi-square analyses were performed, the Benjamini–Hochberg false discovery rate (FDR) correction was applied to control for potential type I error, and adjusted p-values (p_adj) were calculated. Although the original p-values were very small and no change in statistical significance was observed, the correction was applied to reduce the risk of false-positive findings. Cramer's V coefficient was calculated to assess effect sizes for associations between categorical variables.

The distributional properties of continuous variables obtained from the scales were evaluated using skewness and kurtosis values. As these values were within acceptable limits, the data were considered to be normally distributed. Following confirmation of the normality assumption, Pearson correlation analysis was used to examine associations between scale scores rather than implying causal relationships. The level of statistical significance was set at $p < 0.05$ for all analyses.

RESULTS

The findings obtained from the present study are presented in this section.

Table I: Descriptive Statistics of the Participants

Variables	N	Mean	SD	Min	Max
Age (years)	252	26.92	4.09	20.00	35.00
Height (cm)	252	184.00	8.63	167.00	201.00
Body weight (kg)	252	81.35	11.88	58.00	100.00

N = number of participants; SD = standard deviation; Min = minimum; Max = maximum.

According to Table I, the descriptive characteristics of the participants indicate that the mean age was 26.92 ± 4.09 years (range: 20.00–35.00), the mean height was 184.00 ± 8.63 cm (range: 167.00–201.00), and the mean body weight was 81.35 ± 11.88 kg (range: 58.00–100.00).

Table II: Descriptive Statistics of Scale Scores by Groups

Variables	Groups	N	Mean	SD	Min	Max
ORTO-11 Scale	Q1 (<25)	90	21.60	2.51	16.00	24.00
	Q2 (25–27)	90	25.90	0.83	25.00	27.00
	Q3 (28–29)	45	28.80	0.40	28.00	29.00
	Q4 (≥30)	27	32.33	0.48	32.00	33.00
	Total	252	25.57	3.87	16.00	33.00
Exercise Dependence Scale	Risk group	54	46.33	2.95	42.00	49.00
	Dependent group	162	58.50	4.83	53.00	68.00
	Highly dependent group	36	73.50	2.32	70.00	76.00
	Total	252	58.03	9.02	42.00	76.00

N = number of participants; SD = standard deviation; Min = minimum; Max = maximum.

According to Table II, descriptive statistics of participants' ORTO-11 and Exercise Dependence Scale scores are presented. ORTO-11 scores increased progressively across quartile groups, from 21.60 ± 2.51 in Q1 (<25) to 32.33 ± 0.48 in Q4 (≥30), reflecting differences in orthorexic tendencies according to the reverse scoring structure of the scale. Exercise Dependence Scale scores also increased systematically across categories, ranging from 46.33 ± 2.95 in the risk group to 73.50 ± 2.32 in the highly dependent group. Overall, the mean ORTO-11 and Exercise Dependence Scale scores were 25.57 ± 3.87 and 58.03 ± 9.02, respectively, indicating variability in orthorexic tendencies and exercise dependence within the sample.

Table III: Chi-square analysis of smoking status and scale subgroup distributions

Variables		Smoking status			χ^2	df	p	p_adj	V
		Smoker	Non-smoker	Total					
ORTO-11 Scale	Q1 (<25)	9 (16.7%)	81 (40.9%)	90 (35.7%)	13,23	3	0,004	0,004	0,229
	Q2 (25-27)	27 (50.0%)	63 (31.8%)	90 (35.7%)					
	Q3 (28-29)	9 (16.7%)	36 (18.2%)	45 (17.9%)					
	Q4 (≥30)	9 (16.7%)	18 (9.1%)	27 (10.7%)					
	Total	54	198	252					
Exercise Dependence Scale	Risk group	27 (50.0%)	27 (13.6%)	54 (21.4%)	36,69	2	0,000	0,000	0,382
	Dependent group	18 (33.3%)	144 (72.7%)	162 (64.3%)					
	Highly dependent group	9 (16.7%)	27 (13.6%)	36 (14.3%)					
	Total	54	198	252					

p = significance level; p_adj = Benjamini–Hochberg adjusted p-value; V = Cramér's V effect size; χ^2 = Chi-square statistic; df = degrees of freedom.

According to Table III, a statistically significant association was observed between smoking status and ORTO-11 quartile groups ($\chi^2(3, N = 252) = 13.23$, $p < 0.05$, p_adj < 0.001), with a small-to-moderate effect size (Cramér's V = 0.229). Smoking prevalence differed across orthorexia groups, particularly in the Q2 category, indicating a modest association between smoking status and orthorexic tendencies.

A significant association was also found between smoking status and exercise dependence categories ($\chi^2(2, N = 252) = 36.69$, $p < 0.001$, p_adj < 0.001). The effect size was moderate (Cramér's V = 0.382), suggesting that smoking behavior varied across exercise dependence levels.

Table IV: Chi-square analysis of supplement use and scale subgroup distributions

Variables		**Supplement Use**			**χ²**	**df**	**p**	**p_adj**	**V**
		Users	**Non-users**	**Total**					
ORTO-11 Scale	**Q1 (<25)**	45 (38.5%)	45 (33.3%)	90 (35.7%)	31,27	3	0,000	0,000	0,352
	Q2 (25–27)	54 (46.2%)	36 (26.7%)	90 (35.7%)					
	Q3 (28–29)	18 (15.4%)	27 (20.0%)	45 (17.9%)					
	Q4 (≥30)	0 (0.0%)	27 (20.0%)	27 (10.7%)					
	Total	**117**	**135**	**252**					
Exercise Dependence Scale	**Risk group**	36 (30.8%)	18 (13.3%)	54 (21.4%)	31,87	2	0,000	0,000	0,356
	Dependent group	54 (46.2%)	108 (80.0%)	162 (64.3%)					
	Highly dependent group	27 (23.1%)	9 (6.7%)	36 (14.3%)					
	Total	**117**	**135**	**252**					

χ² = Chi-square statistic; df = degrees of freedom; p = significance level; p_adj = Benjamini–Hochberg adjusted p value; V = Cramér's V effect size.

According to the findings presented in Table IV, a statistically significant association was identified between supplement use and the ORTO-11 quartile groups ($\chi^2(3, N = 252) = 31.27$, $p < 0.001$, p_adj < 0.001). The effect size, calculated using Cramér's V, was 0.352, indicating a moderate association. Among participants using dietary supplements, the highest proportion was observed in the Q2 (25–27) group, whereas supplement use was not reported in the Q4 (≥30) group. These findings indicate that supplement use differed across orthorexic tendency groups.

Similarly, a significant association was observed between supplement use and exercise dependence categories ($\chi^2(2, N = 252) = 31.87$, $p < 0.001$, p_adj < 0.001). The effect size was moderate-to-large (Cramér's V = 0.356). Supplement use was more common in the risk and highly dependent groups compared with the dependent group, suggesting variability in supplement use across exercise dependence levels.

Table V: Chi-square Analysis of Injury History Status and Scale Subgroups

Variables		**Injury History**			**χ²**	**df**	**p**	**p_adj**	**V**
		Yes	**No**	**Total**					
ORTO-11 Scale	**Q1 (<25)**	45 (38.5%)	45 (33.3%)	90 (35.7%)	27,65	3	0,000	0,000	0,331
	Q2 (25–27)	45 (38.5%)	45 (33.3%)	90 (35.7%)					
	Q3 (28–29)	27 (23.1%)	18 (13.3%)	45 (17.9%)					
	Q4 (≥30)	0 (0.0%)	27 (20.0%)	27 (10.7%)					
	Total	**117**	**135**	**252**					
Exercise Dependence Scale	**Risk group**	18 (15.4%)	36 (26.7%)	54 (21.4%)	4,73	2	0,094	0,094	0,137
	Dependent group	81 (69.2%)	81 (60.0%)	162 (64.3%)					
	Highly dependent group	18 (15.4%)	18 (13.3%)	36 (14.3%)					
	Total	**117**	**135**	**252**					

χ² = Chi-square statistic; df = degrees of freedom; p = significance level; p_adj = Benjamini–Hochberg adjusted p value; V = Cramér's V effect size.

According to Table V, a statistically significant relationship was observed between injury history and the quartile groups derived from ORTO-11 scale scores ($\chi^2(3, N = 252) = 27.65$, $p < 0.001$, p_adj < 0.001).The effect size, calculated using Cramér's V, was 0.331, indicating a moderate association. Participants with an injury history were more frequently represented in the Q1 (<25) and Q2 (25–27) groups, whereas no participants with an injury history were observed in the Q4 (≥30) group. These findings indicate that injury history was associated with differences in orthorexic tendency groups.

In contrast, exercise dependence categories did not differ significantly according to injury history ($\chi^2(2, N = 252) = 4.73$, $p > 0.05$, p_adj = 0.05). The effect size was small (Cramér's V = 0.137), indicating a limited relationship between injury history and exercise dependence levels.

Table VI: Chi-square Analysis of Planned Meal Consumption and Scale Subgroups

Variables		Planned Meal Consumption			χ²	sd	p	p_adj	V
		Yes	No	Total					
ORTO-11 Scale	Q1 (<25)	45 (45.5%)	45 (24.9%)	90 (35.7%)	7,99	3	0,046	0,046	0,178
	Q2 (25–27)	27 (27.3%)	63 (41.2%)	90 (35.7%)					
	Q3 (28–29)	18 (18.2%)	27 (17.6%)	45 (17.9%)					
	Q4 (≥30)	9 (9.1%)	18 (11.8%)	27 (10.7%)					
	Total	99	153	252					
Exercise Dependence Scale	Risk group	27 (27.3%)	27 (17.6%)	54 (21.4%)	30,84	2	0,000	0,000	0,350
	Dependent group	45 (45.5%)	117 (76.5%)	162 (64.3%)					
	Highly dependent group	27 (27.3%)	9 (5.9%)	36 (14.3%)					
	Total	99	153	252					

χ² = Chi-square statistic; df = degrees of freedom; p = significance level; p_adj = Benjamini–Hochberg adjusted p value; V = Cramér's V effect size.

According to Table VI, a statistically significant association was identified between planned meal consumption and the ORTO-11 quartile groups ($\chi^2(3, N = 252) = 7.99$, $p < 0.05$, p_adj < 0.05). The effect size, calculated as Cramér's V = 0.178, indicated a weak association. Participants consuming planned meals were more frequently represented in the Q1 (<25) group, whereas those not consuming planned meals showed a higher proportion in the Q2 (25–27) group. These findings suggest a weak but statistically significant relationship between planned meal consumption and orthorexic tendency groups.

A statistically significant association was also observed between exercise dependence categories and planned meal consumption ($\chi^2(2, N = 252) = 30.84$, $p < 0.001$, p_adj < 0.001). The effect size was moderate (Cramér's V = 0.350). Planned meal consumption varied across exercise dependence levels, with higher representation in the highly dependent group and lower representation in the dependent group among those consuming planned meals. These findings indicate a moderate association between planned meal consumption and exercise dependence categories.

Table VII: Pearson Correlation Analysis Between ORTO-11 and Exercise Dependence

Variables	ORTO-11 Scale	
Excessive Focus and Mood Modification	r	-0,097
	p	0,124
Postponement of Individual–Social Needs and Conflict	r	-0,189**
	p	0,003
Tolerance Development and Passion	r	-0,152*
	p	0,016
Exercise Dependence Scale (Total Score)	r	-0,106
	p	0,092

*r = Pearson correlation coefficient; *p < 0,05, **p < 0,01*

As shown in Table VII, the relationships between ORTO-11 total scores and the Exercise Dependence Scale and its subdimensions were examined. Significant negative and weak correlations were observed between ORTO-11 scores and the Postponement of Individual–Social Needs and Conflict subdimension ($r = -0.189$, $p = 0.003$) and the Tolerance Development and Passion subdimension ($r = -0.152$, $p = 0.016$). These findings indicate weak inverse associations.

No statistically significant correlations were found between ORTO-11 scores and the Excessive Focus and Mood Modification subdimension ($r = -0.097$, $p = 0.124$) or the total Exercise Dependence Scale score ($r = -0.106$, $p = 0.092$), indicating the absence of significant linear associations between these variables.

DISCUSSION

This study aimed to examine the relationships between orthorexic tendencies and exercise dependence and its subdimensions among male CrossFit athletes. The study was conducted on 252 male participants aged between 20 and 35 years (mean age = 26.92 ± 4.09). Within this framework, the interactions between dietary behaviors, exercise patterns, and psychological tendencies were evaluated.

The participants' mean height and body weight were 184.00 ± 8.63 cm and 81.35 ± 11.88 kg, respectively. The ORTO-11 results indicated that orthorexic tendencies were distributed across quartile groups from low to high levels. Similarly, the Exercise Dependence Scale findings showed that participants were classified into risk, dependent, and highly dependent groups. These distributions may be associated with participation in CrossFit, a high-intensity and performance-oriented sport; however, causal inferences cannot be made due to the cross-sectional design of the study[24].

A methodological consideration that should be taken into account when interpreting the present findings is the internal consistency of the ORTO-11 scale used to assess orthorexic tendencies. In the current study, the Cronbach's alpha coefficient of the scale was 0.59, indicating relatively low reliability. Therefore, the findings related to orthorexic tendencies should be interpreted with caution. This limitation may have reduced the precision of participant classification across quartile groups and may have influenced the strength of the observed associations. Accordingly, the results should be considered as indicative rather than definitive evidence regarding orthorexic tendencies among male CrossFit athletes.

The relationships between orthorexia, exercise dependence, and lifestyle-related variables such as smoking status, supplement use, planned meal consumption, and injury history were also examined. Smoking status differed significantly across ORTO-11 quartile groups ($\chi^2 = 13.23$; df = 3; $p = 0.004$; Cramer's V = 0.229). Notably, 50.0% of individuals in the Q2 (25–27) group reported smoking, representing a higher proportion compared with the other quartile groups. This may suggest that certain orthorexic tendencies coexist with unhealthy behaviors, particularly among subgroups reflecting pathological orthorexia (OrNe) rather than healthy orthorexia (HeOr)[25].

This finding indicates that orthorexic tendencies may co-occur with certain health-related behaviors; however, the direction and underlying mechanisms of this association cannot be determined based on the present data. Consistent with the present results, a study conducted in Erzurum reported a significant association between ORTO-11 scores and smoking habits[26]. However, another study involving male nutrition and dietetics students found no such relationship[27], indicating that cultural context, sample characteristics, and methodological differences may influence these outcomes. The discrepancy between these findings may be related to differences in participant characteristics, as individuals engaged in intensive sports may experience distinct lifestyle demands, performance-related pressures, and dietary concerns compared with non-athletic populations. Therefore, smoking behavior in relation to orthorexic tendencies may not represent a uniform pattern across different populations.

Previous research has distinguished between pathological orthorexia (OrNe) and healthy orthorexia (HeOr), reporting positive associations between smoking and OrNe and negative associations with HeOr[28,29]. This distinction may help explain why smoking was not consistently distributed across orthorexia groups in the present study, as orthorexic tendencies may encompass both adaptive health-oriented behaviors and maladaptive restrictive patterns. In this context, the distribution observed in the Q2 group may reflect heterogeneity within orthorexic tendencies rather than a uniform behavioral pattern. Similarly, Brytek-Matera et al. (2022) emphasized that smoking may function as a psychological regulation strategy among individuals at risk of pathological orthorexia[25]. Nevertheless, given the cross-sectional design of the study, these interpretations should be considered as speculative and interpreted with caution.

According to the Exercise Dependence Scale findings, smoking prevalence was high among participants in the risk group, whereas it decreased in the dependent and highly dependent groups. This pattern may suggest differences in health-related behaviors across dependence levels; however, it does not imply a directional or causal relationship. Previous studies have reported that eating disorders and exercise dependence may coexist with risky health behaviors[30]. However, the inconsistent distribution of smoking behavior across exercise dependence categories suggests that exercise dependence should not be considered as a single behavioral construct associated with all health-risk behaviors. Instead, individual lifestyle factors and psychological characteristics may contribute differently to these patterns. The observed variation in smoking prevalence across groups highlights the complexity of these behavioral patterns rather than indicating a linear relationship.

Overall, these findings indicate that orthorexic tendencies and exercise dependence may be associated with smoking behavior. However, given the variability in findings across studies and the modest effect sizes observed, these associations should be interpreted with caution.

Table 4 demonstrates a significant association between supplement use and ORTO-11 scores, with higher prevalence particularly in the Q2 group. This finding aligns with literature suggesting that orthorexic tendencies may be associated with rigid dietary behaviors and increased supplement use, although this relationship appears to be weak and context-dependent; however, the nature of this relationship remains unclear[31]. Consistent with this, previous studies have shown that individuals with higher orthorexia tendencies are more likely to use dietary supplements[32,33]. However, the relationship between orthorexic tendencies and supplement use may vary depending on the characteristics of the studied population. In athletic groups, supplement use may reflect not only restrictive or control-oriented eating patterns but also performance optimization strategies, making it difficult to distinguish adaptive nutritional practices from potentially maladaptive behaviors.

Exercise Dependence Scale results further indicate that supplement use varies across dependence levels. While supplement use was common in the risk group, it decreased in the dependent group and increased again in the highly dependent group. This non-linear distribution suggests that supplement use may vary across dependence categories without indicating a consistent directional trend[34]. This variability may indicate that supplement use is influenced by multiple factors, including performance goals, training demands, and individual beliefs about health and exercise, rather than exercise dependence alone. Therefore, supplement use should be interpreted as a multifactorial behavior within the context of CrossFit participation.

Finally, Table 5 reveals a significant relationship between injury history and ORTO-11 scores ($\chi^2 = 27.65$, $p < 0.001$, $V = 0.331$). Injury history was more prevalent in the Q1 and Q2 groups, suggesting an association between past injuries and orthorexic tendencies; this may indicate that injury experiences may be associated with heightened attention to diet and health-related behaviors in a weak and context-dependent manner, consistent with previous findings, although such interpretations cannot be confirmed within the scope of the present study[31]. Supporting this interpretation, previous research has shown that athletes with injury histories tend to increase their focus on nutrition and supportive products[35]. This pattern may be explained by the possibility that injury experiences encourage athletes to adopt more structured dietary practices as part of recovery and performance maintenance. However, increased nutritional awareness after injury does not necessarily represent pathological orthorexic behavior, as these practices may also reflect adaptive responses to rehabilitation demands.

With regard to exercise dependence, no significant difference was found between injury history and dependence levels ($\chi^2 = 4.73$, $p = 0.094$, $V = 0.137$). This finding indicates that no statistically meaningful association was observed between these variables. Similarly, previous studies have reported that post-injury exercise dependence behaviors are complex, leading to increased dependence in some athletes and temporary decreases in others[35]. The absence of a significant relationship in the present study may indicate that injury history alone is insufficient to explain exercise dependence patterns, which are likely influenced by additional psychological and behavioral factors such as motivation, training goals, and individual coping strategies.

Overall, these results indicate that injury history may be associated with orthorexic behaviors in a limited and non-deterministic manner, but does not appear to be a determining factor for exercise dependence on its own. These findings should be interpreted within a multidimensional framework rather than as direct relationships.

According to Table 6, a significant association was observed between planned meal consumption and ORTO-11 scores ($\chi^2 = 7.99$, $p = 0.046$, $V = 0.178$). Given the weak effect size, this relationship should be interpreted cautiously. The higher prevalence of planned meal consumption in the Q1 group suggests that individuals with lower orthorexia tendencies may exhibit more flexible dietary patterns. However, this interpretation remains limited to observed group differences and does not imply a directional relationship. Consistent with this, previous research has shown that individuals with lower orthorexia tendencies exhibit more flexible eating behaviors[35]. Nevertheless, in athletic populations, planned meal consumption may represent both an adaptive nutritional strategy for meeting performance demands and a potential indicator of excessive dietary control. Therefore, the interpretation of planned eating behaviors requires consideration of the broader motivational and behavioral context.

In terms of exercise dependence, a strong association was found between planned meal consumption and dependence levels ($\chi^2 = 30.84$, $p < 0.001$, $V = 0.350$). Planned meal consumption was more common in the risk group, whereas it was less prevalent in the highly dependent group. This pattern indicates variability across groups rather than a consistent directional association. Similar associations between exercise dependence and disordered eating behaviors have been reported in the literature[36]. The variation observed across exercise dependence categories may indicate that structured eating practices are not exclusively linked to maladaptive exercise patterns but may also reflect different levels of training commitment, nutritional awareness, and performance orientation among athletes.

Taken together, these findings suggest that planned meal consumption is related to both orthorexia tendencies and exercise dependence. However, the direction and nature of these relationships remain unclear and should be interpreted cautiously.

Table 7 presents the relationships between ORTO-11 scores and exercise dependence and its subdimensions. No significant association was found between the Excessive Focus and Mood Modification subdimension and ORTO-11 scores ($r = -0.097$, $p = 0.124$). This finding indicates that no statistically significant linear association was observed between these variables. This lack of association may indicate that orthorexic tendencies and exercise-related emotional regulation behaviors represent partially distinct constructs rather than overlapping behavioral patterns.

In contrast, a significant negative correlation was observed between ORTO-11 scores and the Individual–Social Needs Postponement and Conflict subdimension ($r = -0.189$, $p = 0.003$). Given the weak magnitude of this correlation, the relationship should be interpreted cautiously. This result reflects a weak inverse association rather than a strong or predictive relationship. Previous studies have reported that orthorexia is often associated with social isolation and rigid lifestyle patterns, while its relationship with exercise dependence appears to be weak and inconsistent across studies[35]. The inconsistency reported in the literature may be related to differences in measurement approaches, sample characteristics, and the extent to which exercise behaviors are driven by health orientation, performance goals, or compulsive motives. Therefore, the present finding should be interpreted as a limited association rather than evidence of a direct relationship between orthorexic tendencies and social or individual impairment.

Similarly, a significant negative association was found between ORTO-11 scores and the Tolerance Development and Passion subdimension ($r = -0.152$, $p = 0.016$). This results also represents a weak association and should not be overinterpreted in terms of practical or clinical significance. Although statistically significant, the small effect size suggests that this relationship may have limited practical implications and should be considered within the broader psychological and behavioral context of athletic participation.

No significant relationship was identified between total ORTO-11 scores and total exercise dependence scores ($r = -0.106$, $p = 0.092$). This result suggests that no statistically significant association was observed between overall orthorexic tendencies and exercise dependence levels. Accordingly, these findings support the view that the relationship between orthorexia and exercise dependence may be multifactorial and not strictly linear and that observed associations are generally weak in magnitude[33,37]. This finding is consistent with the perspective that orthorexic tendencies and exercise dependence may share certain behavioral characteristics, such as dietary discipline or commitment to training, but may also develop through different motivational pathways.

CONCLUSION

In conclusion, this study thematically demonstrates the relationships between orthorexic tendencies, exercise dependence, and individual behavioral factors. The findings indicate that individuals with moderate to high levels of orthorexic tendencies exhibit lower rates of smoking but higher rates of dietary supplement use. This pattern suggests that health-oriented control behaviors may be associated with lower rates of certain harmful habits while being related to higher rates of other health-related behaviors.

Regarding dietary patterns, planned meal consumption was found to be significantly associated with both orthorexic tendencies and levels of exercise dependence. This finding implies that controlled eating behaviors may coexist with exercise-related attitudes, reflecting overlapping behavioral mechanisms.

Analysis of exercise dependence subdimensions revealed that ORTO-11 scores were associated with postponement of social and individual needs, passion, and tolerance in both inverse and parallel directions depending on the context (Table 7). These results indicate that orthorexic tendencies do not relate to exercise behaviors in a unidirectional manner but rather through vary across different behavioral contexts.

Overall, the findings demonstrate that orthorexia and exercise dependence are linked not only to individual psychological characteristics but also to broader nutritional and health-related behaviors. This highlights the importance of jointly considering dietary habits and dependence-related behaviors in the assessment of athletes and physically active individuals. Furthermore, the results emphasize the need for personalized and multidimensional assessment and intervention strategies to prevent and manage orthorexia and exercise dependence risks.

Recommendations

Based on the findings of this study, regular monitoring of dietary habits and physical activity levels is recommended for athletes at risk of orthorexic tendencies and exercise dependence. Such monitoring may assist in the identification of risk behaviors and is associated with healthier lifestyle patterns.

Structured educational programs focusing on planned meal consumption, balanced nutrition, and dietary supplement use may be beneficial. These programs should aim to be associated with lower orthorexic tendencies and support sustainable exercise performance.

Psychological counseling and behavioral support are recommended for individuals exhibiting exercise dependence or excessive focus on exercise. These interventions may be associated with improved balance between social, personal, and athletic demands.

For athletes with a history of injury, integrated programs combining physical rehabilitation with nutritional planning are advised. Such holistic approaches may be associated with lower reinjury risk and may assist in managing behaviors associated with orthorexia and exercise dependence.

Additionally, awareness-raising seminars and training programs for coaches, sports clubs, and healthcare professionals may enhance early recognition of at-risk individuals and facilitate timely interventions.

Assumptions

• Participants were assumed to provide honest and accurate responses.

• ORTO-11 and the Exercise Dependence Scale were assumed to be valid and reliable for male CrossFit athletes.

• The sample was considered representative of the target population.

• Voluntary participation was assumed not to negatively affect data accuracy.

Limitations and Strengths

Limitations

• The study was limited to male CrossFit athletes from a single city, limiting generalizability.

• Data were collected using self-report measures.

• Female athletes were not included.

• Psychosocial variables were assessed to a limited extent.

Strengths

• A sample size exceeding the minimum required by power analysis.

• A homogeneous and well-defined target group.

• Use of validated measurement instruments.

• Multidimensional analysis of orthorexia and exercise dependence.

• Appropriate and robust statistical methods.

• Ethical compliance and voluntary participation.

Ethical Approval: This study was approved by the Dicle University Social and Human Sciences Ethics Committee (Approval Date: 27.03.2025, Decision No: 897503) and conducted in accordance with the Declaration of Helsinki. Written informed consent was obtained from all participants.

Conflict of Interest: The author declared no conflict of interest.

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