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EXPLORING EXERCISE DEPENDENCE AND PERFECTIONISM ACROSS AGE

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ABSTRACT

This study examined the association between exercise dependence and perfectionism in a physically active Croatian sample, with age considered as a developmental variable. A cross-sectional design was applied using data from 117 adults engaged in regular physical activity. Exercise dependence was assessed using the Exercise Dependence Scale-21, and perfectionism was measured with the Burns' Perfectionism Scale. Descriptive statistics, Spearman correlations, partial correlation controlling for age, and multiple regression analyses were conducted.

A small-to-moderate positive association was observed between exercise dependence and perfectionism. Age showed a small negative association with exercise dependence, whereas its association with perfectionism did not reach statistical significance. The relationship between exercise dependence and perfectionism remained evident after controlling for age. Regression analyses further indicated that the two constructs were independently associated, each explaining a modest proportion of variance in the other, whereas the contribution of age was limited.

These findings support a dimensional understanding of exercise dependence as embedded within broader personality and self-regulatory processes. Rather than representing an isolated behavioural excess, maladaptive exercise engagement appears to be linked to rigid self-evaluative tendencies. The findings emphasise the significance of combining personality and developmental viewpoints when studying excessive exercise behaviours.

KEY WORDS

exercise dependence, perfectionism, age, behavioural regulation, physically active adults

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INTRODUCTION

Regular physical activity is associated with substantial health benefits; however, in some individuals, exercise may develop into a compulsive and maladaptive behavioural pattern. Exercise dependence is characterised by excessive engagement in physical activity accompanied by features typically observed in behavioural addictions, such as tolerance, withdrawal symptoms, loss of control, and continuation despite adverse consequences [1]. It may occur as a primary condition, where exercise itself is the main source of psychological reinforcement, or as a secondary manifestation linked to other psychopathological conditions. Although not formally recognised as a distinct mental disorder, epidemiological evidence suggests that the risk of exercise dependence is present in a non-negligible proportion of physically active individuals [2].

Although high levels of exercise involvement are often socially valued, the distinction between adaptive commitment and maladaptive compulsion remains conceptually complex. Excessive exercise may resemble behavioural addiction when it is characterised by salience, loss of control, withdrawal symptoms, and continuation despite negative consequences [3]. However, not all intense engagement is pathological. Research grounded in the dualistic model of passion demonstrates that the quality of internalisation is crucial: harmonious passion is associated with flexible persistence and well-being, whereas obsessive passion is linked to rigid involvement, negative affect, and compulsive patterns [4]. Thus, the distinction between healthy commitment and dysfunctional exercise may lie not simply in the amount of activity performed, but in the self-regulatory mechanisms that govern behavioural engagement. Conceptual debates persist regarding whether excessive exercise represents a distinct behavioural addiction or a symptom of broader psychopathology, reflecting ongoing terminological and diagnostic ambiguities [3, 5].

Theories on self-regulation and determination conceptualise behaviour as a balance between impulses and inhibitory control, whereby failures of regulatory resources may lead to maladaptive or compulsive engagement [6], emphasising that the quality of behavioural regulation, autonomous versus controlled, determines psychological change and well-being [7]. Empirical findings further suggest that difficulties in emotion regulation and impulse control are associated with problematic behavioural patterns, particularly when behaviour is used to alleviate negative affect [8].

Perfectionism has consistently been identified as one of the most relevant personality correlates of exercise addiction, and a recent systematic review [9] concluded that its dimensions exhibit weak-to-moderate associations with exercise addiction across diverse populations, including athletes, adolescents, and clinical samples. Importantly, maladaptive facets of perfectionism, particularly concern over mistakes and doubts about actions, appear to be more strongly related to compulsive exercise patterns than adaptive high standards. Empirical findings further indicate that maladaptive perfectionism may function as an underlying vulnerability factor for exercise dependence symptoms, operating through rigid self-evaluation and difficulty tolerating perceived failure [10]. These findings suggest perfectionistic tendencies represent a key regulatory mechanism linking achievement orientation to maladaptive exercise engagement.

Age-related differences in risk-related behaviour are best understood within a developmental framework. Contemporary dual-systems models propose that adolescence is characterised by a temporary imbalance between a socio-emotional system that becomes highly sensitive to reward and a cognitive control system that matures more gradually [11]. This developmental asynchrony contributes to heightened sensation seeking and impulsivity during mid-adolescence. Longitudinal evidence further indicates that impulsivity and self-regulatory capacities follow distinct developmental trajectories, with substantial inter-individual variability in their rate of change [12]. Thus, age does not merely represent a chronological

marker but reflects ongoing neurodevelopmental processes that may modulate vulnerability to maladaptive behavioural patterns.

Previous research has indicated conceptual ambiguities, inconsistent terminology, and methodological variability in the assessment of exercise addiction [3]. In addition, although exercise dependence has been examined in relation to psychopathology and personality traits, less is known about its interaction with perfectionism patterns while accounting for developmental factors such as age, particularly in the Croatian context and among adults engaging in regular physical activity. Therefore, with an exploratory aim, the following research questions were posed.

RQ_1: What is the association between exercise dependence and perfectionism?
RQ_2: How is age associated with exercise dependence and perfectionism?
RQ_3: To what extent is the association between exercise dependence and perfectionism independent of age?

METHODS

RESEARCH DESIGN AND SETTING

This study employed a cross-sectional observational design based on data originally collected within the framework of a university research project conducted in 2025. The project examined psychological correlates of exercise behaviour among physically active adults. This study specifically examines the connections between exercise dependence, perfectionism, and age using an analytical, exploratory, and correlational approach.

This study's data came from research conducted according to ethical standards for human participant research [13]. Before data collection, the study protocol was reviewed and approved by the ethics committees (all available upon request), ensuring compliance with ethical guidelines and the General Data Protection Regulation. All participants were informed about the study, its objectives, and their rights, including the voluntary nature of their participation and the confidentiality of their responses. Informed consent was obtained from each participant, and all procedures protected the privacy and well-being of the individuals involved in the research.

TARGET POPULATION

The target population comprised adults living in Croatia who reported engaging in regular physical activity. Participants included individuals with varying levels of exercise involvement, ranging from recreationally active individuals to those training at higher intensities. The inclusion criterion for participation in the study was a regular engagement in physical activity for a minimum continuous duration of three months. Initially, 128 respondents voluntarily participated in the study. As the survey was distributed via open invitations on social media platforms and a fitness centre notice board, the number of individuals exposed to the invitation was unknown. A conventional response rate could not be calculated.

DATA COLLECTION

Data collection method

Data were collected using a structured, anonymous self-report questionnaire administered primarily electronically via Google Forms. The survey was distributed through an open call posted on social media platforms and within one fitness centre. Within the fitness centre, participants could complete the questionnaire either electronically via a link displayed on a notice board or in a paper-and-pencil format. Participation was voluntary, and respondents

were informed about the purpose of the study before completing the questionnaire. No personally identifiable information was collected. For the present analysis, data on exercise dependence, perfectionism, sociodemographic characteristics, and physical activity background were utilised.

In total, 128 questionnaires were received. Questionnaires with incomplete responses were excluded, resulting in a dataset of 121 complete cases. During subsequent data verification before statistical analysis, one implausible age value (beyond the plausible age range for the target population) was identified in the raw dataset and treated as a data entry error; this observation was excluded from further analyses. In addition, three respondents younger than 18 years were excluded to ensure consistency with the defined target population of physically active adults. The final analytical sample, therefore, comprised 117 participants, including 12 paper questionnaires and 105 online submissions.

Instrument and measurement structure

Exercise dependence was assessed using the Croatian version of the Exercise Dependence Scale-21 (EDS-21) [14] originally developed by Hausenblas and Downs [15]. The instrument comprises 21 items representing seven symptom dimensions conceptually aligned with behavioural addiction criteria: tolerance, withdrawal, intention effects, lack of control, time, reduction in other activities, and continuance. Items are rated on a Likert-type scale, and a total score is calculated by summing the item responses; higher scores indicate greater exercise dependence. Although the EDS-21 allows categorical classification of individuals by dependence risk, the present study used the total score as a dimensional indicator of symptom severity.

Perfectionism was measured using the Croatian version [16] of the Burns' Perfectionism Scale (BPS-10) [17, 18]. The BPS is a unidimensional self-report measure that assesses maladaptive perfectionistic tendencies, including rigid self-evaluation, excessive concern about mistakes, and unrealistically high personal standards. Items are rated on a Likert-type scale and summed to yield a total score, with higher scores reflecting greater perfectionistic tendencies. Consistent with the dimensional conceptualisation of both constructs and common psychometric practice, total scores of the EDS-21 and BPS-10 were treated as continuous variables in all analyses. This approach preserves variability and statistical power in correlational and regression models examining associations between behavioural constructs. Internal consistency coefficients for the psychometric instruments are reported in the Results section. All instruments were administered under the authors' guidelines, and permission for use was obtained where required.

Sociodemographic variables included age (in years), sex (female/male), and level of sport participation (recreational/professional). Participants also reported the primary type of exercise (aerobic/anaerobic), exercise intensity (low/moderate/high), and exercise frequency (days per week). Age was analysed as a continuous variable, whereas categorical sociodemographic variables were used descriptively to characterise the sample.

STATISTICAL PROCESSING OF DATA

Statistical analyses were conducted on data from 117 physically active adults to describe the distributions of exercise dependence and perfectionism and to examine their interrelations by age. All analyses were performed using Jeffreys's Amazing Statistics Program (JASP; version 0.95.4, JASP Team, University of Amsterdam), with a significance level of $p < 0,05$.

Descriptive statistics were calculated for all continuous variables, including mean (M), standard deviation (SD), median, interquartile range (IQR), and range (minimum–maximum). Exercise dependence, assessed with the EDS-21, and perfectionism, measured with the BPS-10, were treated as continuous variables in subsequent analyses. Normality of distributions was evaluated using the Shapiro-Wilk test.

Given deviations from normality in selected variables, associations between age, EDS-21 total score, and BPS-10 total score were examined using Spearman's rank-order correlation coefficient (ρ). To evaluate the extent to which the association between exercise dependence and perfectionism was independent of age, a partial Spearman correlation was conducted, controlling for age.

Building upon the correlational findings, multiple linear regression analyses were performed to examine the independent contributions of age and the alternate construct (perfectionism or exercise dependence) to each outcome variable. Although some study variables deviated from normality, linear regression was kept for multivariable modelling because regression assumptions pertain primarily to the distribution of residuals rather than raw variables, and the models were used for exploratory estimation of independent associations. For each model, unstandardized regression coefficients (B), standard errors (SE), standardized coefficients (β), coefficient of determination (R^2), adjusted R^2, and F-statistics were reported.

RESULTS

SAMPLE CHARACTERISTICS

As shown in Table 1, the sample (N = 117) consisted predominantly of recreationally active individuals engaged primarily in anaerobic forms of exercise, with a clear female predominance. Most participants reported exercising at least 3 times per week, and the majority indicated moderate-to-high training intensity, reflecting a physically active study population.

Table 1. Descriptive statistics of categorical variables (N = 117).

Variable	Category	*n*	Percentage
Sex	Female	84	71,8
	Male	33	28,2
Level of exercise/sport activity	Recreational	102	87,2
	Professional	15	12,8
Exercise duration	3-12 months	23	19,7
	1-3 years	31	26,5
	3-5 years	18	15,4
	> 5 years	45	38,5
Primary type of exercise	Aerobic	28	23,9
	Anaerobic	89	76,1
Exercise intensity	Low	11	9,4
	Moderate	46	39,3
	High	60	51,3
Exercise frequency per week	1-2 days	29	24,8
	3-6 days	82	70,1
	7 days	6	5,1

As shown in Table 2, age displayed substantial variability and a non-normal distribution (M = 31,40; SD = 9,58; range 18-62). The mean EDS-21 score was 65,89 (SD = 20,51), indicating moderate endorsement of exercise dependence symptoms in the sample. The mean BPS-10 score was 29,99 (SD = 6,42), suggesting moderate levels of perfectionistic tendencies. While EDS-21 scores approached normality with slight distributional asymmetry, perfectionism scores were normally distributed. Overall, these values indicate moderate expression of both constructs in a heterogeneous sample of physically active individuals, supporting the examination of their interrelations.

Table 2. Descriptive statistics of continuous variables ($N = 117$).

Variable	Mean	SD	Median	IQR	Min	Max	Shapiro–Wilk *p*
Age	31,40	9,58	29,00	12,00	18	62	< 0,001
Weight	73,28	15,37	69,00	16,90	46	140	< 0,001
Height	170,97	9,89	169,00	15,00	153	197	0,003
EDS-21 total	65,89	20,51	64,00	21,00	21	112	0,034
BPS-10 total	29,99	6,42	30,00	8,00	15	45	0,352

The EDS-21 demonstrated excellent internal consistency in the present sample (McDonald's ω = 0,937, 95% CI [0,921, 0,954]; Cronbach's α = 0,936, 95% CI [0,917, 0,955]). The average inter-item correlation was 0,412, indicating good internal consistency. Item–rest correlations ranged from 0,420 to 0,725, with all items showing satisfactory positive associations with the total scale score.

The BPS-10 demonstrated acceptable internal consistency (McDonald's ω = 0,743, 95% CI [0,675, 0,810]; Cronbach's α = 0,688, 95% CI [0,601, 0,775]). The average inter-item correlation was 0,168. Two items (BPS 3 and BPS 4) showed negative item–rest correlations (−0,166 and −0,193, respectively). However, given the theoretical structure of the scale and the acceptable overall reliability indices, all items were retained, and total scores were used in subsequent analyses.

AGE, EXERCISE DEPENDENCE, AND PERFECTIONISM ASSOCIATIONS

Exercise dependence was positively associated with perfectionism (ρ = 0,278; $p = 0,002$), indicating that higher perfectionistic tendencies corresponded with greater endorsement of exercise dependence symptoms. Age showed a small negative association with exercise dependence (ρ = −0,176; $p = 0,058$), while its association with perfectionism did not reach statistical significance (ρ = −0,148; $p = 0,111$). Importantly, the association between EDS-21 and BPS-10 remained statistically significant after controlling for age (ρ = 0,259; $p = 0,005$), indicating that their relationship was not fully attributable to age-related variation, Table 3.

Table 3. Spearman correlations among age, exercise dependence, and perfectionism ($N = 117$).

Variable	1	2	3
1. Age	-		
2. EDS-21 total	−0,176	-	
3. BPS-10 total	−0,148	0,278**	-
Partial correlation (EDS–BPS, controlling for age)	**0,259****		

**significant at the level $p < 0,01$

Given the observed correlations between exercise dependence and perfectionism, regression analyses (Table 4) were conducted to examine their independent contributions while accounting for age. In both models, the corresponding predictor (perfectionism or exercise dependence) significantly contributed to the variance of the outcome variable. In contrast, the contribution of age was smaller and did not reach statistical significance. The proportion of explained variance was modest and comparable across models (approximately 9–10%), suggesting a stable association between exercise dependence and perfectionistic tendencies, with age playing a more limited role in these relationships.

Table 4. Multiple regression models predicting exercise dependence and perfectionism (N = 117). Model fit: EDS-21 model (R^2 = 0,097; Adjusted R^2 = 0,081; F(2,114) = 6,095; p = 0,003), and BPS-10 model (R^2 = 0,087; Adjusted R^2 = 0,071; F(2,114) = 5,400; p = 0,006).

Predictor	EDS-21 total				BPS-10 total			
	B	SE	β	p	B	SE	β	p
Age	−0,287	0,192	−0,134	0,139	−0,059	0,061	−0,088	0,334
BPS-10 total	0,841	0,287	0,263	0,004	-	-	-	-
EDS-21 total	-	-	-	-	0,083	0,028	0,266	0,004

DISCUSSION

The present study examined the association between exercise dependence and perfectionism in a Croatian sample of physically active individuals, with age included as a developmental variable. Three key findings emerged. First, exercise dependence was positively associated with perfectionism. Second, age showed a small negative trend in relation to exercise dependence, although the association did not reach statistical significance, while its relationship with perfectionism was also not statistically significant. Third, the association between exercise dependence and perfectionism remained after controlling for age. Regression analyses further indicated that each construct explained a modest proportion of variance in the other, whereas the contribution of age was minimal.

The positive association between exercise dependence and perfectionism is consistent with findings from Croatia. In a study of 281 young women in Croatia, personal standards and doubts about actions were significant predictors of exercise dependence symptoms, alongside dieting behaviours, accounting for 23% of the variance [19]. Similarly, Vižintin and Barić reported that 9% of exercisers showed addiction symptoms and 84% were in a risk group, with higher symptom expression linked to increased training volume and conflict because of exercise [20]. Although perfectionism was not directly examined in that study, the behavioural rigidity and escalation patterns described are conceptually aligned with perfectionistic striving.

International literature further supports the link between perfectionism and exercise addiction. A systematic review by Çakın et al. concluded that perfectionism and its sub-dimensions are weakly to moderately associated with exercise addiction across different populations [9]. Importantly, most studies reported that maladaptive perfectionism dimensions (e.g., concern over mistakes, socially prescribed perfectionism) were more consistently linked to addiction symptoms than adaptive forms.

Costa et al. demonstrated that maladaptive perfectionism mediated the relationship between parental psychological control and exercise dependence symptoms in habitual exercisers [10]. In their sample of 348 exercisers, maladaptive perfectionism functioned as a significant mediator for both men and women. These findings support the interpretation that perfectionism is not merely correlated with exercise dependence but may act as an explanatory mechanism.

Conceptually, exercise dependence is characterised by tolerance, withdrawal, loss of control, reduced participation in other activities, and continued use despite negative consequences [1, 15]. Substance dependence models highlight persistent, compulsive behaviours and inflexible patterns, which also resemble aspects of maladaptive perfectionism discussed in psychological research. While exercise addiction in the general population is estimated at approximately 0,3-0,5% [5, 21], higher prevalence rates have been reported in specific exercise forms, particularly endurance disciplines [5, 22]. These findings support the dimensional approach adopted in the present study, in which total scores were analysed as continuous rather than categorical variables.

The observed negative association between age and exercise dependence was modest, and the association with perfectionism did not reach statistical significance. These findings suggest that age may play a more limited role in these relationships than initially expected. Steinberg [11] proposed that adolescence and emerging adulthood are characterised by heightened reward sensitivity and incomplete maturation of cognitive control systems. This developmental imbalance contributes to increased risk-taking behaviours in younger individuals. Given that exercise dependence shares features with behavioural addictions [1], younger age may be associated with a greater vulnerability to compulsive exercise patterns. Personality and regulatory mechanisms also provide explanatory context. Emotion regulation difficulties and impulse control deficits have been associated with addictive and compulsive behaviours [8]. Although the present study did not directly measure emotion regulation, the association between perfectionism and exercise dependence may reflect broader self-regulatory processes. Rigid standards and fear of failure characterise maladaptive perfectionism [9], features that overlap with compulsive persistence and withdrawal symptoms described in exercise addiction [1].

Obsessive passion, characterised by a rigid, controlled commitment to an activity, often leads to persistent engagement marked by rumination and negative emotions [4]. Exercise dependence symptoms described in the components model [5, 23] include salience, conflict, and relapse, which conceptually resemble obsessive passion rather than harmonious engagement. The observed association across regression models may therefore reflect interconnected patterns between perfectionistic self-regulation and rigid exercise involvement.

Finally, Croatian findings on sex differences in exercise addiction symptoms [20] indicate that conflict with family and progressive training escalation are more typical of men. Although sex differences were not the primary focus of the present analysis, the sociocultural context described in Croatian samples suggests that exercise behaviours are embedded within broader social expectations and performance norms. The sample was sex-disproportionate, with more females than males participating. This imbalance may affect the generalizability of the findings, as previous research suggests that sex differences can influence the prevalence and manifestations of exercise dependence and perfectionism.

In summary, the present findings are consistent with Croatian and international evidence showing a modest but stable association between perfectionism and exercise dependence [9, 10, 14, 19]. The negative association between age and exercise dependence aligns with developmental models of risk behaviour [11]. In contrast, the conceptualisation of exercise dependence as a behavioural addiction [1] supports interpretation within a dimensional and regulatory framework. The findings indicate that exercise dependence is not an isolated behavioural phenomenon, but a pattern embedded within interacting personality, developmental, and contextual systems. Viewing exercise behaviour through an interdisciplinary lens allows for a more integrative understanding of how perfectionistic regulation, alongside broader developmental context, may shape vulnerability to maladaptive exercise engagement.

LIMITATIONS

The study has several limitations. Its cross-sectional design prevents causal inference regarding the directionality of associations between perfectionism and exercise dependence. Using self-report measures introduces the possibility of shared method variance and response bias. As the present analysis represents a secondary use of data collected for a broader academic project, potentially relevant constructs were not included. The sample, although heterogeneous in exercise involvement, was not representative of the general population, limiting generalizability. Future studies should examine these associations in adolescent and emerging adult populations using appropriately defined and sufficiently powered samples, as developmental differences in self-regulation and reward sensitivity may shape vulnerability to

maladaptive exercise patterns in distinct ways. Finally, the Burns' Perfectionism Scale primarily captures maladaptive perfectionism, preventing differentiation between adaptive and maladaptive dimensions.

CONCLUSION

The present study examined the association between exercise dependence and perfectionism in a Croatian sample of physically active individuals, while considering age as a developmental context for these behavioural patterns. Three key findings emerged. First, exercise dependence was positively associated with perfectionism. Second, age showed a small negative trend in relation to exercise dependence, although the association did not reach statistical significance, while its relationship with perfectionism was also not statistically significant. Third, the association between exercise dependence and perfectionism remained after controlling for age. Regression analyses further indicated that each construct was independently associated with the other, explaining a modest proportion of variance, whereas the contribution of age was minimal.

These findings support a dimensional interpretation of exercise dependence as embedded within broader personality and regulatory systems rather than as an isolated behavioural phenomenon. Taken together, the results underscore the importance of approaching excessive exercise within an interdisciplinary framework that integrates personality traits and behavioural regulation processes. Such a perspective may inform more targeted preventive and educational strategies in physically active populations.

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