

# Personality traits and exercise addiction symptoms among university students: The role of perfectionism

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## Abstract

Exercise addiction is a proposed behavioral addiction characterized by impaired control over exercise and continued engagement despite harm. Personality traits and perfectionism have been linked to exercise addiction symptoms, but less is known about dark personality traits and sex-specific pathways. This cross-sectional study examined direct and indirect associations of Big Five traits and five dark traits with exercise addiction symptoms through perfectionism. Participants were 461 Turkish university students who had exercised during the previous week (225 men, 236 women; Mage = 22.00 years, SD = 2.39). They completed the Exercise Addiction Inventory, a positive perfectionism measure, and single-item descriptors of Big Five and dark traits. Bootstrapped path analyses were conducted in the total sample and separately by sex. Agreeableness had a small direct positive association with exercise addiction symptoms in the total sample and among men. Openness showed a positive indirect association through perfectionism in the total sample, whereas conscientiousness showed positive indirect associations in the total sample and among men. Psychopathy had a positive direct association in the total sample and among women. Perfectionism was positively associated with symptoms in the total sample and among men, but not among women. The models explained 15%, 25%, and 12% of the variance in symptoms in the total sample, men, and women, respectively. The findings suggest modest, trait-specific associations and indicate that perfectionistic striving may be particularly relevant among men. Because the study was cross-sectional and most personality traits were measured with single items, the indirect associations should not be interpreted as causal.

**Keywords:** Big Five, dark personality, exercise addiction, perfectionism, psychopathy, university students

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## 1. Introduction

Regular exercise is associated with substantial physical and psychological benefits (Çakın et al., 2021). For a small proportion of individuals, however, exercise may become rigid, difficult to control, and persist despite negative consequences (Çakın et al., 2021; Terry et al., 2004). Exercise addiction has been described as a pattern characterized by excessive salience, mood modification, tolerance, withdrawal-like experiences, conflict, and relapse following attempts to reduce exercise (Griffiths, 1996; Terry et al., 2004). Although exercise addiction is not currently recognized as an independent diagnosis in major diagnostic systems, these symptoms can still be associated with considerable psychological distress and functional impairment (Çakın et al., 2021). Accordingly, the present study uses the term exercise addiction symptoms to refer to the severity of self-reported symptoms assessed with the Exercise Addiction Inventory (EAI) (Terry et al., 2004).

The EAI is a brief screening instrument derived from the components model of behavioral addiction and has

been validated across a range of populations, including adolescents and emerging adults (Lichtenstein et al., 2018; Terry et al., 2004). A recent meta-analysis estimated that approximately 5.5% of university students without indicated eating-disorder symptoms meet the screening threshold for exercise addiction (Trott et al., 2020). Although these findings suggest that exercise addiction symptoms are relevant in university populations, high levels of exercise alone should not be interpreted as problematic. Rather, concern arises when intensive exercise is accompanied by impaired control, psychological dependence, and continued engagement despite harm (Szabo et al., 2013).

Personality may help explain why individuals with similar exercise habits differ in their vulnerability to rigid or difficult-to-control exercise patterns. Meta-analytic evidence links the Big Five traits to physical activity, especially higher extraversion and conscientiousness and lower neuroticism, although these associations are generally small (Rhodes & Smith, 2006; Wilson & Dishman, 2015). However, physical activity and exercise addiction symptoms are distinct outcomes (Szabo et al., 2013; Terry et al., 2004). Traits that support planning, persistence, or social engagement may facilitate healthy exercise participation for most individuals, but they may also become relevant to risk when exercise is organized around rigid standards or compulsive persistence. Consistent with this possibility, earlier studies have linked personality dimensions to exercise-dependence symptoms, although the pattern of findings has varied across samples (Hausenblas & Giacobbi, 2004; Miller & Mesagno, 2014).

Perfectionism may be one mechanism through which broad personality dispositions are associated with exercise addiction symptoms. Contemporary models distinguish perfectionistic strivings, which involve high personal standards, from perfectionistic concerns, which involve self-criticism and fear of mistakes (Stoeber & Otto, 2006). Both dimensions may become problematic when personal standards are rigid and self-worth depends strongly on achievement (Haase & Prapavessis, 2004). Research among exercisers has generally linked perfectionism to exercise dependence or compulsive exercise, although the strength of these associations varies across populations and perfectionism dimensions (Çakın et al., 2021; Deck et al., 2021; Hill et al., 2015; Miller & Mesagno, 2014; Taranis & Meyer, 2010). The positive perfectionism dimension used in the present study mainly reflects high standards and satisfaction from pushing personal limits (Haase & Prapavessis, 2004). Such striving may support healthy achievement, but it may also provide a pathway from conscientious or achievement-focused dispositions to more rigid forms of exercise behavior.

Dark personality traits may provide an additional perspective on exercise addiction symptoms. The Dark Triad comprises narcissism, Machiavellianism, and psychopathy (Paulhus & Williams, 2002), whereas more recent work has also highlighted sadism and spitefulness as conceptually related but distinct traits (Buckels et al., 2013; Marcus et al., 2014; O'Meara et al., 2011). Although these traits differ in their characteristic expressions, they share a tendency toward self-serving behavior and reduced concern for others (Moshagen et al., 2018). In the context of exercise, characteristics such as grandiosity, disinhibition, or an intense focus on personal goals may be associated with excessive or inflexible exercise patterns, although these possibilities remain largely theoretical and require empirical examination (Nogueira et al., 2019).

Evidence linking dark personality traits to exercise addiction symptoms has begun to emerge. Existing studies suggest that narcissism, Machiavellianism, psychopathy, and maladaptive perfectionism may each be associated with greater exercise addiction symptoms or dependence, although the available evidence remains limited and has focused primarily on Dark Triad traits or athletic populations (González-Hernández et al., 2023; Miller & Mesagno, 2014; Rathilal & Van Niekerk, 2025). Consequently, little is known about the potential roles of sadism and spitefulness or about whether perfectionism helps explain associations between broad and dark personality traits and exercise addiction symptoms. Although some evidence suggests gender differences in these relationships (Miller & Mesagno, 2014), it remains largely unclear whether these associations systematically differ between men and women.

The present study examined the associations among Big Five traits, five dark personality traits, perfectionism, and exercise addiction symptoms within a single path model in Turkish university students. Perfectionism was expected to be positively associated with exercise addiction symptoms. Based on theoretical and empirical links between conscientiousness, perfectionistic striving, and persistent goal-directed behavior, conscientiousness was expected to show a positive indirect association with exercise addiction symptoms through perfectionism. Given the inconsistent and limited evidence regarding openness, no directional hypothesis was specified. Based on previous findings, narcissism and psychopathy were expected to show positive associations with exercise addiction symptoms, whereas the associations involving Machiavellianism, sadism, and spitefulness were examined exploratorily. Finally, the models were estimated separately for men and women to explore potential

sex-specific patterns.

## 2. Methods

### *Participants and procedure*

This cross-sectional study included 461 Turkish university students (225 men and 236 women) aged 19–44 years ( $M = 22.00$ ,  $SD = 2.39$ ). Participants were recruited through announcements posted in online courses offered by the distance education center of a university in Türkiye. To be eligible, participants had to report exercising at least once during the previous week. Participation was anonymous and voluntary, and no compensation was provided. Before completing the online survey, participants received information about the study and provided informed consent. Ethical approval was obtained from institutional ethics committee before data collection, and the study was conducted in accordance with the Declaration of Helsinki.

### *Measures*

#### *Exercise addiction symptoms*

Exercise addiction symptoms were measured using the Exercise Addiction Inventory (EAI; Terry et al., 2004), a six-item screening instrument based on the components model of behavioral addiction. The scale assesses six core features of addictive exercise behavior: salience, mood modification, tolerance, withdrawal, conflict, and relapse. Responses were recorded on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree), with higher total scores indicating greater exercise addiction symptom severity. A representative item is, “Exercise is the most important thing in my life.” The Turkish version of the EAI was produced following established forward–backward translation procedures for cross-cultural adaptation (Beaton et al., 2000). Confirmatory factor analysis supported the proposed one-factor structure,  $\chi^2(9) = 33.42$ ,  $p < .001$ ,  $RMSEA = .08$ , 90% CI [.05, .11],  $SRMR = .05$ ,  $CFI = .97$ , and  $GFI = .98$ . The scale demonstrated good internal consistency in the present sample (Cronbach's  $\alpha = .82$ ).

#### *Perfectionism*

Perfectionistic striving was measured with the positive perfectionism subscale of the Positive and Negative Perfectionism Scale (Haase & Prapavessis, 2004). This seven-item subscale assesses the tendency to pursue high personal standards and derive satisfaction from striving toward challenging goals. Responses were provided on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree), with higher scores indicating stronger perfectionistic striving. An example item is, “I feel good when pushing my limits.” The Turkish version was developed using forward–backward translation procedures in accordance with established cross-cultural adaptation guidelines (Beaton et al., 2000). Confirmatory factor analysis supported the proposed one-factor structure,  $\chi^2(9) = 30.32$ ,  $p < .001$ ,  $RMSEA = .07$ , 90% CI [.05, .10],  $SRMR = .03$ ,  $CFI = .99$ , and  $GFI = .98$ . The scale demonstrated good internal consistency in the present sample (Cronbach's  $\alpha = .88$ ).

#### *Dark personality traits*

Dark personality traits were assessed using single-item self-descriptors for narcissism, Machiavellianism, psychopathy, sadism, and spitefulness. Each item was rated on a 7-point scale ranging from 1 (strongly disagree) to 7 (strongly agree), with higher scores indicating stronger self-attributed levels of the relevant trait. This brief assessment strategy was informed by previous work showing that single-item measures can provide useful estimates of socially aversive traits when longer inventories are not feasible, particularly in survey contexts where respondent burden is a concern (Konrath et al., 2014; Özsoy et al., 2017). Each item named the target trait and included a concise description derived from established conceptualizations of dark personality traits (Jonason & Webster, 2010; Marcus et al., 2014; O'Meara et al., 2011). For example, the psychopathy item described the trait in terms of callousness, low remorse, and limited concern for moral constraints.

#### *Big Five personality traits*

The Big Five personality traits were assessed using five single-item self-descriptors representing extraversion, neuroticism, agreeableness, openness to experience, and conscientiousness. This brief assessment approach was based on established single-item and ultra-short measures of the Big Five that have been proposed for research settings in which questionnaire length and respondent burden are important considerations (Rammstedt & John, 2007; Woods & Hampson, 2005; Zuckerman et al., 1993). Participants rated each item on a 7-point scale ranging from 1 (strongly disagree) to 7 (strongly agree). The extraversion item was reverse scored so that higher values

reflected greater extraversion, whereas higher scores on the remaining items indicated higher levels of neuroticism, agreeableness, openness to experience, and conscientiousness.

### *Statistical analysis*

Descriptive statistics, skewness, kurtosis, and Pearson correlation coefficients were calculated for all study variables. Absolute skewness values below 3 and kurtosis values below 8 were considered indicative of acceptable univariate normality (Kline, 2023). Sex differences were examined using independent-samples *t* tests, and Cohen's *d* was reported as an estimate of effect size. Path analyses were performed in AMOS 23 for the total sample and separately for men and women. The Big Five and dark personality traits were entered as correlated exogenous variables predicting both perfectionism and exercise addiction symptoms, while perfectionism was modeled as a predictor of exercise addiction symptoms. Because the models were saturated, overall fit indices were not interpreted. Indirect associations were evaluated using bias-corrected bootstrapping with 5,000 resamples and 95% confidence intervals. Indirect associations were considered statistically significant when the corresponding confidence intervals did not include zero. Statistical significance was set at  $p < .05$  (two-tailed). Analyses stratified by sex were exploratory, and no formal tests of between-group differences were conducted.

## **3. Results**

### *Descriptive statistics and group comparisons*

Descriptive statistics and bivariate correlations are presented in Table 1. All study variables fell within the prespecified skewness and kurtosis thresholds, indicating no evidence of substantial univariate non-normality. Exercise addiction symptoms were positively associated with perfectionism, agreeableness, openness, conscientiousness, Machiavellianism, psychopathy, sadism, spitefulness, and male sex. Among these variables, perfectionism showed the strongest bivariate association with exercise addiction symptoms ( $r = .29$ ,  $p < .001$ ). As shown in Table 2, men reported higher exercise addiction symptom scores than women,  $t(459) = 3.05$ ,  $p < .01$ ,  $d = 0.28$ . Men also scored higher on psychopathy, sadism, and spitefulness, whereas women scored higher on neuroticism, agreeableness, and conscientiousness. Most sex differences were small in magnitude, although the difference in conscientiousness approached a moderate effect size ( $d = 0.40$ ).

### *Path analyses*

Table 3 summarizes the statistically significant direct and indirect associations with exercise addiction symptoms. In the total sample, agreeableness and psychopathy showed positive direct associations with exercise addiction symptoms, whereas openness and conscientiousness were positively associated with symptoms indirectly through perfectionism. Perfectionism itself was positively associated with exercise addiction symptoms ( $\beta = .25$ ,  $p < .001$ , 95% CI [.14, .35]). As illustrated in Figure 2, openness, conscientiousness, and narcissism were positively associated with perfectionism in the total-sample model. Overall, the model accounted for 15% of the variance in exercise addiction symptoms. Specifically, agreeableness had a small positive direct association with exercise addiction symptoms ( $\beta = .11$ ,  $p < .05$ , 95% CI [.02, .22]), whereas psychopathy also showed a positive direct association ( $\beta = .20$ ,  $p < .05$ ). Openness demonstrated a positive indirect association through perfectionism ( $\beta = .03$ ,  $p < .05$ , 95% CI [.01, .06]), and conscientiousness showed a stronger positive indirect association through perfectionism ( $\beta = .08$ ,  $p < .001$ , 95% CI [.05, .13]).

Among men, agreeableness showed a positive direct association with exercise addiction symptoms, whereas conscientiousness was positively associated with symptoms indirectly through perfectionism. Perfectionism was also positively associated with exercise addiction symptoms in men ( $\beta = .38$ ,  $p < .001$ , 95% CI [.23, .50]), and the model explained 25% of the variance in symptoms. Specifically, the direct association for agreeableness was small ( $\beta = .18$ ,  $p < .05$ , 95% CI [.04, .31]), and the indirect association for conscientiousness through perfectionism was statistically significant ( $\beta = .13$ ,  $p < .001$ , 95% CI [.07, .21]). Among women, psychopathy was the only personality trait showing a significant direct association with exercise addiction symptoms ( $\beta = .28$ ,  $p < .05$ , 95% CI [.01, .49]). Although perfectionism was positively associated with exercise addiction symptoms, this association did not reach statistical significance ( $\beta = .18$ , 95% CI [-.05, .25]). The model accounted for 12% of the variance in exercise addiction symptoms among women. Because the sex-stratified analyses were exploratory and no formal between-group comparisons were conducted, differences in statistical significance across men and women should not be interpreted as evidence of sex differences in the estimated associations.

#### 4. Discussion

The present study examined the associations of Big Five traits, five dark personality traits, and perfectionism with exercise addiction symptoms among university students. Overall, the findings suggest that exercise addiction symptoms are associated with a combination of broad personality traits, dark personality characteristics, and perfectionistic striving rather than any single personality dimension. Perfectionism emerged as the most consistent correlate, whereas conscientiousness and openness showed small indirect associations through perfectionism, agreeableness showed a small direct association, and psychopathy was directly associated with exercise addiction symptoms. The models explained a modest proportion of the variance, with the highest explanatory power observed among men.

The positive association between perfectionism and exercise addiction symptoms is consistent with previous research and systematic-review evidence (Çakın et al., 2021; Hill et al., 2015; Miller & Mesagno, 2014). The measure used in the present study primarily captured perfectionistic striving, including the tendency to pursue high personal standards and derive satisfaction from pushing personal limits (Haase & Prapavessis, 2004). Although such striving is often associated with achievement and persistence (Stoeber & Otto, 2006), it may become maladaptive when personal standards are inflexible and self-worth depends heavily on continued achievement (Haase & Prapavessis, 2004). Under these conditions, persistence in exercise may gradually shift from disciplined engagement toward more rigid and compulsive patterns (Szabo et al., 2013).

Perfectionism was more strongly associated with exercise addiction symptoms among men, and the model explained a larger proportion of the variance in symptoms in the male subsample. This pattern suggests that achievement-focused standards may be more closely related to exercise addiction symptoms among the men represented in this study (Miller & Mesagno, 2014). However, because the analyses were stratified by sex and no formal tests of coefficient equality were conducted, these findings should be interpreted as descriptive patterns rather than evidence of statistically significant sex differences. Replication using adequately powered multigroup analyses is needed.

Conscientiousness was indirectly associated with exercise addiction symptoms through perfectionism in the total sample and among men. This finding is theoretically plausible because conscientiousness is characterized by persistence, organization, and goal-directed behavior (Costa & McCrae, 1992), attributes that are generally associated with regular physical activity (Rhodes & Smith, 2006; Wilson & Dishman, 2015). The present findings suggest that conscientiousness itself may not be problematic (Hausenblas & Giacobbi, 2004); rather, its association with exercise addiction symptoms may emerge when these characteristics are expressed through rigid achievement standards. Openness also showed a small indirect association in the total sample. Given the modest effect size and the absence of a corresponding association in the sex-specific models, this finding should be interpreted cautiously and requires replication before firm conclusions can be drawn.

The direct positive association between agreeableness and exercise addiction symptoms was unexpected (Hausenblas & Giacobbi, 2004). Agreeableness is typically linked to cooperation, compliance, and lower interpersonal conflict (Costa & McCrae, 1992), and it is not usually considered a risk factor for behavioral addiction. One possible interpretation is that agreeable individuals may be more responsive to structured expectations or social pressures surrounding exercise. However, the effect was small and may also reflect sample-specific covariance or the limited precision of a single-item measure (Woods & Hampson, 2005). This finding should therefore not be interpreted as evidence that agreeableness is generally maladaptive. Rather, it requires replication using validated multi-item measures.

Psychopathy was the only dark personality trait that showed an independent direct association with exercise addiction symptoms. This finding is consistent with recent evidence linking psychopathy to exercise dependence among university students (Rathilal & Van Niekerk, 2025). Characteristics such as disinhibition, reduced sensitivity to negative consequences, and persistent pursuit of immediate goals may help explain why psychopathy is associated with continued exercise despite physical or social costs (Paulhus & Williams, 2002). In the sex-stratified analyses, this association was statistically significant among women but not among men. However, the confidence interval was wide, and no formal between-group comparison was conducted. The finding should therefore be interpreted as a sample-specific pattern requiring direct replication rather than as evidence that psychopathy is more important for women.

Narcissism, Machiavellianism, sadism, and spitefulness did not show independent associations with exercise addiction symptoms in the path models, despite several positive zero-order correlations. This pattern may reflect shared variance among the dark traits, particularly because psychopathy and sadism were highly correlated in the



present sample (Buckels et al., 2013; Moshagen et al., 2018). Dark traits are understood to share a common aversive core (Moshagen et al., 2018), and estimating several strongly related single-item indicators in the same model may reduce the stability of unique coefficients. Narcissism was positively associated with perfectionism in the total-sample model (Miller & Mesagno, 2014), but its indirect association with exercise addiction symptoms was not statistically supported. This differs from previous evidence linking narcissism with exercise dependence (Nogueira et al., 2019; Miller & Mesagno, 2014) and may reflect differences in measurement, sample characteristics, or model specification.

The findings have several practical implications. Screening and assessment should focus on impaired control, conflict, withdrawal-like experiences, and continued exercise despite harm rather than on exercise frequency alone. For individuals reporting elevated symptoms, it may be useful to assess rigid standards, guilt related to rest, and difficulty adjusting exercise goals. The results do not support labeling individuals on the basis of personality traits, particularly given the small effects and single-item personality measures. Instead, personality may help identify processes, such as inflexible striving or reduced sensitivity to negative consequences, that can be addressed in prevention or counseling. Interventions may therefore benefit from emphasizing flexible goal setting, planned recovery, and the separation of self-worth from exercise performance.

### ***Strengths and limitations***

A strength of the present study is the simultaneous examination of broad personality traits, dark personality traits, and perfectionism within a single analytical model in a relatively large sample of university students. The inclusion of sadism and spitefulness extends previous research, which has focused primarily on the Dark Triad. In addition, the use of bootstrapped indirect-effect estimates and sex-stratified analyses provided a more comprehensive description of the observed associations.

Several limitations should also be acknowledged. First, the cross-sectional design does not permit conclusions regarding temporal ordering or causality, and indirect associations should not be interpreted as evidence of mediation over time (Maxwell & Cole, 2007). Second, the Big Five and dark personality traits were assessed using single-item measures. Although this approach reduced participant burden, it provided limited content coverage and precluded the estimation of internal consistency (Woods & Hampson, 2005). Third, all variables were assessed using self-report measures, raising the possibility of shared method variance and socially desirable responding. Fourth, participants were recruited from a single university, and eligibility required only that they had exercised at least once during the previous week. Information on exercise modality, training volume, competitive level, injury status, primary versus secondary exercise addiction, and eating-disorder symptoms was not collected, limiting the scope of the findings. Finally, the models were saturated and therefore could not be evaluated using global fit indices. In addition, the high correlations among several dark traits may have reduced the stability of some unique path estimates.

### ***Conclusion***

The findings suggest that perfectionism represents one pathway through which broad personality traits, particularly conscientiousness, may be associated with exercise addiction symptoms. Psychopathy showed an independent positive association with symptom severity, whereas the remaining dark personality traits did not contribute uniquely after their shared variance was taken into account. Overall, the results support a process-oriented perspective in which rigid achievement standards and reduced sensitivity to negative consequences may represent distinct pathways associated with exercise addiction symptoms. Longitudinal studies using validated multi-item personality measures, more detailed assessments of exercise behavior, and formal multigroup comparisons are needed to clarify the temporal and potentially sex-specific nature of these associations.

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## Tables

Table 1. Descriptive statistics, distributional indices, and correlations among study variables

| Variable                       | 1      | 2      | 3       | 4      | 5       | 6       | 7       | 8      | 9      | 10     | 11     | 12    |
|--------------------------------|--------|--------|---------|--------|---------|---------|---------|--------|--------|--------|--------|-------|
| 1. Exercise addiction symptoms | —      |        |         |        |         |         |         |        |        |        |        |       |
| 2. Perfectionism               | .29*** | —      |         |        |         |         |         |        |        |        |        |       |
| 3. Extraversion                | -.02   | .09    | —       |        |         |         |         |        |        |        |        |       |
| 4. Neuroticism                 | .00    | -.01   | -.33*** | —      |         |         |         |        |        |        |        |       |
| 5. Agreeableness               | .14**  | .10*   | -.14**  | .06    | —       |         |         |        |        |        |        |       |
| 6. Openness                    | .12**  | .24*** | .10*    | -.03   | .30***  | —       |         |        |        |        |        |       |
| 7. Conscientiousness           | .15**  | .37*** | .14**   | -.11*  | .15**   | .34***  | —       |        |        |        |        |       |
| 8. Narcissism                  | .09    | .08    | -.21*** | .24*** | -.12*   | -.12**  | -.03    | —      |        |        |        |       |
| 9. Machiavellianism            | .15**  | .00    | .20***  | .22*** | -.05    | -.20*** | -.15**  | .56*** | —      |        |        |       |
| 10. Psychopathy                | .17*** | -.06   | -.27*** | .23*** | -.14**  | -.27*** | -.12*   | .46*** | .58*** | —      |        |       |
| 11. Sadism                     | .13**  | -.09*  | -.31*** | .17*** | -.13**  | -.31*** | -.10*   | .46*** | .56*** | .85*** | —      |       |
| 12. Spitefulness               | .10*   | -.05   | -.26*** | .28*** | -.17*** | -.28*** | -.14**  | .46*** | .51*** | .71*** | .69*** | —     |
| 13. Male sex                   | .14**  | .00    | -.04    | -.13** | -.11*   | .00     | -.20*** | .00    | .09    | .18*** | .14**  | .14** |
| M                              | 16.82  | 26.47  | 5.24    | 3.56   | 4.76    | 5.53    | 4.84    | 2.47   | 2.02   | 1.82   | 1.60   | 2.12  |
| SD                             | 5.57   | 6.22   | 1.72    | 1.96   | 1.70    | 1.51    | 1.70    | 1.64   | 1.57   | 1.48   | 1.43   | 1.65  |
| Skewness                       | .12    | -.67   | -.72    | .30    | -.60    | -1.13   | -.48    | 1.04   | 1.60   | 1.92   | 2.48   | 1.54  |
| Kurtosis                       | -.36   | .40    | -.49    | -1.02  | -.39    | .89     | -.55    | .26    | 1.73   | 2.95   | 5.28   | 1.56  |

\* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$ .

Table 2. Comparison of study variables between men and women

| Variable                    | Men (n = 225) | Women (n = 236) | t        | Cohen's d |
|-----------------------------|---------------|-----------------|----------|-----------|
| Exercise addiction symptoms | 17.63 ± 5.61  | 16.06 ± 5.44    | 3.05**   | 0.28      |
| Perfectionism               | 26.47 ± 6.47  | 26.47 ± 5.99    | 0.01     | 0.00      |
| Extraversion                | 5.17 ± 1.74   | 5.31 ± 1.71     | -0.87    | 0.08      |
| Neuroticism                 | 3.30 ± 1.88   | 3.81 ± 2.01     | -2.84**  | 0.26      |
| Agreeableness               | 4.57 ± 1.77   | 4.94 ± 1.61     | -2.36*   | 0.22      |
| Openness                    | 5.53 ± 1.54   | 5.53 ± 1.49     | -0.04    | 0.00      |
| Conscientiousness           | 4.50 ± 1.79   | 5.16 ± 1.54     | -4.27*** | 0.40      |
| Narcissism                  | 2.48 ± 1.59   | 2.47 ± 1.69     | 0.06     | 0.01      |
| Machiavellianism            | 2.16 ± 1.62   | 1.88 ± 1.51     | 1.88     | 0.18      |
| Psychopathy                 | 2.09 ± 1.59   | 1.56 ± 1.31     | 3.91***  | 0.36      |
| Sadism                      | 1.80 ± 1.60   | 1.41 ± 1.22     | 2.97**   | 0.27      |
| Spitefulness                | 2.36 ± 1.79   | 1.90 ± 1.48     | 2.97**   | 0.28      |

\* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$ .

Table 3. Standardized total, direct, and indirect effects on exercise addiction symptoms

| Effect                                                         | $\beta$ (SE) |              |            |
|----------------------------------------------------------------|--------------|--------------|------------|
|                                                                | Total sample | Men          | Women      |
| Agreeableness → exercise addiction symptoms (total effect)     | .12* (.05)   | .18* (.07)   | .08 (.07)  |
| Direct effect                                                  | .11* (.05)   | .18* (.07)   | .07 (.07)  |
| Indirect effect through perfectionism                          | .01 (.01)    | .00 (.03)    | .01 (.01)  |
| Openness → exercise addiction symptoms (total effect)          | .11* (.06)   | .06 (.09)    | .12 (.07)  |
| Direct effect                                                  | .08 (.05)    | .03 (.08)    | .10 (.08)  |
| Indirect effect through perfectionism                          | .03* (.01)   | .04 (.03)    | .01 (.01)  |
| Conscientiousness → exercise addiction symptoms (total effect) | .13* (.06)   | .17* (.08)   | .15 (.08)  |
| Direct effect                                                  | .05 (.06)    | .04 (.08)    | .12 (.09)  |
| Indirect effect through perfectionism                          | .08*** (.02) | .13*** (.04) | .04 (.03)  |
| Psychopathy → exercise addiction symptoms (total effect)       | .21* (.09)   | .13 (.12)    | .30* (.13) |
| Direct effect                                                  | .20* (.08)   | .13 (.12)    | .28* (.13) |
| Indirect effect through perfectionism                          | .02 (.02)    | .00 (.05)    | .02 (.02)  |

Note. The table reports effects for predictors with at least one statistically significant total effect. SE = standard error.

\* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$ .

## Figures

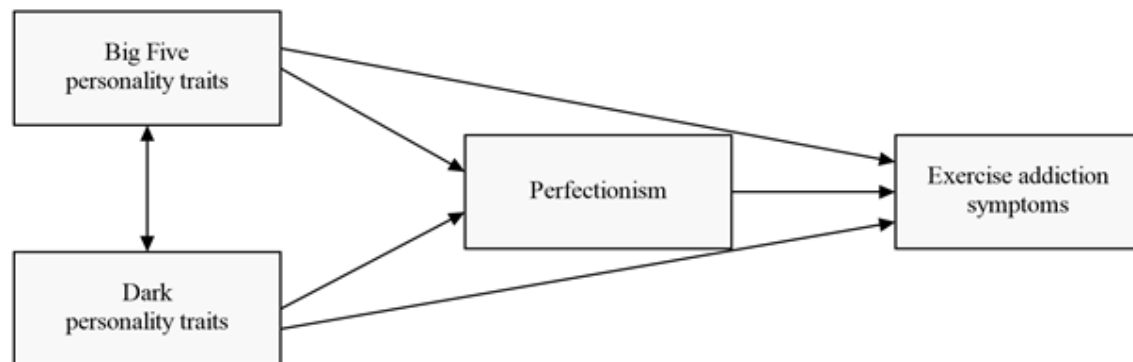


Figure 1. Hypothesized path model

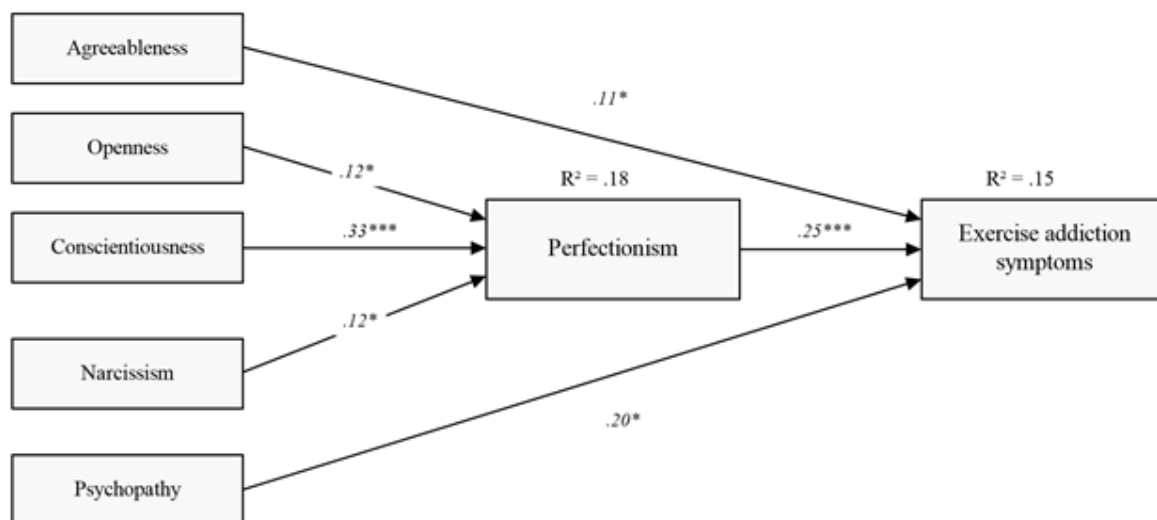


Figure 2. Significant paths in the total-sample model

Note. For clarity, covariances among exogenous variables and nonsignificant paths are not shown. \* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$ .