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The predictive ability of perfectionistic traits and self-presentational styles in relation to exercise dependence

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Abstract

Exercise dependence is a harmful pattern of exercise behaviour that research suggests is associated with trait perfectionism. The current study extends previous research by examining the relationship between symptoms of exercise dependence, trait perfectionism (self-oriented, socially prescribed, and other-oriented perfectionism) and perfectionistic self-presentational styles (perfectionistic self-promotion, non-display of imperfection, and non-disclosure of imperfection). In doing so, we examined the unique predictive ability of the three trait dimensions of perfectionism; the relationship between perfectionistic self-presentational styles and exercise dependence symptoms; and the incremental predictive ability of perfectionistic self-presentational styles beyond trait perfectionism. Two-hundred and forty-eight gym members (age *M* = 25.74, *SD* 11.38, range 18-75) completed paper-and-pencil measures of the variables of interest. Analyses revealed that of the traits, self-oriented perfectionism was the most important unique predictor of exercise dependence. In addition, perfectionistic self-presentational styles were all positively related to symptoms of exercise dependence. Finally, after controlling for trait perfectionism, perfectionistic self-presentational styles explained additional variance in four of seven symptoms of exercise dependence (withdrawal, lack of control, reduction, and time). The findings suggest that, beyond exhibiting trait perfectionism, when exercisers are committed to portraying an image of perfection it may contribute to an unhealthy commitment to exercise.

It is well-documented that regular exercise has a number of physical and psychological health benefits and, unfortunately, too few people participate in recommended amounts of exercise (World Health Organisation, 2010). However, there are also individuals who engage in excessive amounts of exercise, become dependent on exercise, and for who exercise has a negative influence on their health (Veale, 1995). As described by Hausenblas and Symons Downs (2002), exercise dependence is a craving for leisure-time physical activity that results in uncontrollable excessive exercise behaviour and physiological and/or psychological symptoms. Its symptoms include *withdrawal* (withdrawal symptoms for exercise or use of exercise to relieve or avoid withdrawal symptoms), *continuance* (exercise is continued despite knowledge of having a persistent or recurrent physical or psychological problem that is likely to have been caused or exacerbated by the exercise) *tolerance* (a need for increased amounts of exercise to achieve the desired effect or diminished effect with continued use of the same amount of exercise), *lack of control* (a desire or unsuccessful effort to cut down exercise), *reduction* (social, occupational, or recreational activities are given up or reduced because of exercise), *time* (a great deal of time is spent in activities necessary to obtain exercise), and *intention effects* (exercise is taken in larger amounts or over a longer period than was intended). Other models and measures of exercise dependence exist (e.g., Ogden, Veale, & Summers, 1997). However, this is the most commonly used and has the advantage of capturing a range of symptoms based on clinical criteria for substance dependence (Hausenblas & Symons, 2002; Symons Down, Hausenblas, & Nigg, 2004).

Exercise dependence can be an end in itself (primary exercise dependence) or associated with an eating disorder (secondary exercise dependence) (Veale, 1995). Its development has been explained using both psychobiological and psychosocial mechanisms (Hamer, & Karageorghis, 2007; Szabo, 2010). In terms of the latter, this includes eating disorder aetiology and personality factors that encourage a reliance on exercise behaviour.

For instance, Hausenblas and Giacobbi (2004) suggested that primary exercise dependence may develop through two related psychological processes. Firstly, it may develop when individuals use exercise as a coping mechanism to ameliorate worry regarding health, appearance, and other stressors. Secondly, it may develop due to irrational beliefs regarding how improvements in physical appearance might be used to gain increased attention, expressions of love, and self-esteem. Both mechanisms heavily implicate factors that predispose individuals to high stress, promote an excessive focus on appearance, or engender a belief that self-worth is contingent on appearance. In accord, factors such as trait anxiety (Spano, 2001), neuroticism (Hausenblas & Giacobbi, 2004), and perfectionism (Hausenblas & Symons Downs, 2002) have been found to predict exercise dependence symptoms.

Perfectionistic traits and exercise dependence

Perfectionism is a multidimensional personality trait that entails the perceived or actual need to perform perfectly (Hewitt & Flett, 2004). According to Hewitt and Flett (1991), trait perfectionism can be imposed on the self (self-oriented perfectionism), imposed on others (other-oriented perfectionism), and believed to be imposed by others (socially prescribed perfectionism). Research has supported the distinction between these forms of perfectionism and suggests they predict different outcomes. Self-oriented perfectionism is highly motivating but is also considered a vulnerability factor for psychological difficulties under conditions of stress (Flett & Hewitt, 2006). Other-oriented perfectionism is typically unrelated to personal problems but is strongly related to interpersonal difficulties (e.g., Stoeber, 2014). Finally, socially prescribed perfectionism is the most problematic trait and is related to various pathological outcomes, such as depression and suicide ideation (O'Connor, 2007).

A number of studies have examined the relationship between trait perfectionism and exercise dependence. These studies have illustrated that trait dimensions of perfectionism

predict exercise dependence or similar forms of excessive exercise such as obligatory exercise. This has been illustrated in students, clinical groups, recreational runners, and other regular exercisers. However, most of these studies used unidimensional measures of perfectionism (e.g., Bratland-Sanda et al., 2011; Hagan & Hausenblas, 2003; Hausenblas & Symons Downs, 2002) and/or exercise dependence (e.g., Coen & Ogles, 1993; Hall, Kerr, Kozub, & Finnie, 2007). These studies therefore failed to capture a full range of perfectionism dimensions alongside a full range of exercise dependence symptoms.

Two recent exceptions that adopted Hewitt and Flett's (1991) model of perfectionism found that both self-oriented and socially prescribed perfectionism were associated with higher symptoms of exercise dependence (Hall et al., 2009; Miller & Mesagno, 2014). However, there are a number of limitations of these two studies. Notably, in the case of Hall et al. (2009), a measure of exercise dependence was used that is not based on clinical criteria for substance dependence (EDQ; Ogden et al., 1997) and other-oriented perfectionism was not included. The inclusion of other-oriented perfectionism is warranted for two reasons. Firstly, its inclusion provides a test of discriminant validity of this model of perfectionism (i.e., as an interpersonal dimension of perfectionism one would not expect other-oriented perfectionism to predict exercise dependence). Secondly, as other-oriented perfectionism is typically positively correlated to self-oriented perfectionism, the inclusion of other-oriented perfectionism is required in order to examine the *unique* predictive ability of self-oriented perfectionism having controlled for this shared variance.

This latter issue is also evident in Miller and Mesagno's (2014) study. Specifically, while a suitable measure of exercise dependence was used, when regressing exercise dependence on trait perfectionism they included only self-oriented perfectionism. The predictive ability of self-oriented perfectionism was consequently examined without controlling for its relationship with the other two dimensions of perfectionism and its unique

predictive ability, along with the unique predictive ability of the other two traits, were unexamined. Miller and Mesagno (2014) also reported only on total exercise dependence, rather than individual symptoms which may have different patterns of association with perfectionism. Overall, then, despite the valuable contributions of these two studies, the unique predictive ability of the three trait dimensions of perfectionism in relation to clinical criteria based exercise dependence symptoms are unclear.

Perfectionistic self-presentational styles and exercise dependence

An additional limitation of research more broadly is that, so far, research examining the association between perfectionism and exercise dependence has focused solely on trait perfectionism and ignored its other important elements. In Hewitt and Flett's model (Hewitt et al., 2003), perfectionism can also manifest in how people seek to present themselves to others. Perfectionistic self-presentational styles capture attempts to create and maintain an image of perfection in public settings. They include perfectionistic self-promotion (seeking opportunities to demonstrate one's perfection), non-display of imperfection (minimising the public display of mistakes, flaws, and shortcomings), and non-disclosure of imperfection (minimising admission of mistakes, flaws, and short-comings). These are distinct from the three traits of perfectionism in that they are not concerned with whether perfectionism is imposed on the self, others, or perceived to be imposed by others, rather they are focused on whether, instead, an individual seeks to project a perfect image to others (Hewitt et al., 2003). As such, those who report higher levels of these styles stake considerable self-esteem on presenting oneself perfectly and gaining acceptance of others (Hewitt et al., 2003). These are features that are central to experiences of those who exhibit exercise dependence (Bamber, Cockerill, & Carroll, 2000).

To date, no study has examined the relationship between perfectionistic self-presentational styles and exercise dependence. However, there are a number of notable

findings in this regard. Firstly, perfectionistic self-presentational styles are associated with a range of adverse outcomes, including more pronounced negative emotional experiences, such as general negative affect, anxiety, and depression (Hewitt et al., 2003). This emotion will require additional regulation and exercise offers a means of doing so. Secondly, perfectionistic self-presentational styles are associated with factors that may precede exercise dependence, such as low levels of self-esteem (Hewitt et al., 2003), appearance-related concerns (Sherry, Vriend, Hewitt, Sherry, Flett, & Wardrop, 2009), and eating disorder symptomology (McGee, Hewitt, Sherry, Parkin, & Flett, 2005). Finally, perfectionistic self-presentation predicts a range of outcomes beyond trait perfectionism (Hewitt et al., 2003). Based on this evidence, perfectionistic self-presentational styles may be associated with higher exercise dependence, and may predict exercise dependence after controlling for trait perfectionism.

In summary, the current study had three purposes: (1) to examine the unique predictive ability of the three trait dimensions of perfectionism (self-oriented, socially prescribed, and other oriented perfectionism) in relation to exercise dependence symptoms; (2) to examine the relationship between perfectionistic self-presentational styles and exercise dependence symptoms; and (3) to examine the incremental predictive ability of perfectionistic self-presentational styles beyond trait perfectionism. Based on the aforementioned reasoning and research, it was hypothesised that self-oriented perfectionism would be the largest unique predictor of exercise dependence relative to socially prescribed perfectionism and other oriented perfectionism would not predict exercise dependence. Perfectionistic self-presentational styles (perfectionistic self-promotion, non-display of imperfection, and non-disclosure of imperfection) would be positively related to exercise dependence. Finally, perfectionistic self-representational styles would predict variance in exercise dependence beyond that explained by trait perfectionism.

Method

Participants

Participants were 248 gym members (age *M* = 25.74, *SD* 11.39, males = 146, females = 102, range 18-75) who were recruited using advertisements and canvassing at commercial gyms and university sports facilities of the authors. Participants were given a hardcopy multi-section questionnaire and returned it at their convenience. Two participants were excluded from an initial sample (n = 250) because exercise dependence is considered a craving for leisure-time physical activity and they reported that they did not spend any time attending a gym (zero days and hours per week). The participants reported that they had been a member of a gym for 4.16 years (*SD* = 3.98), spent 3.34 days (*SD* = 1.53) per week attending the gym, and spent 4.52 hours (*SD* = 2.77) per week at the gym.

Instruments

Exercise dependence. Symptoms of exercise dependence were measured using Symons Downs et al.'s (2004) Exercise Dependence Scale-Revised (EDS-R). This includes 21-items that measure seven symptoms: withdrawal ("I exercise to avoid feeling irritable"), continuance ("I exercise when injured"), tolerance ("I continually increase my exercise duration to achieve the desired effects/benefits"), lack of control ("I am unable to reduce how long I exercise"), reduction ("I would rather exercise than spend time with family and friends"), time ("I spend a lot of time exercising"), and intention effects ("I exercise longer than I intend"). Participants respond on a six-point Likert scale (1 = *never* to 6 = *always*). Participants can be classified as at-risk to exercise dependence (5 to 6 on the Likert scale for at least three symptoms), nondependent-symptomatic (3 to 4 on the Likert scale for at least three symptoms), or nondependent-asymptomatic (1 to 2 on the Likert scale for at least three symptoms). Evidence to support the validity and reliability of the scale has been provided by

Symons Downs and colleagues (Hausenblas & Symons Downs, 2002; Symons Downs et al., 2004). This includes factorial structure, internal consistency, and test–retest reliability.

Multidimensional Perfectionism. Self-oriented ("I am perfectionistic in setting goals."), socially prescribed ("People expect nothing less than perfection from me"), and other-oriented ("I do not have very high standards for those around me" [reversed item]) perfectionism were measured using the short version of Hewitt and Flett's (1991) Multidimensional Perfectionism Scale (Cox, Enns, & Clara, 2002). It includes five-items per subscale and measures responses on a seven-point Likert scale (1 = *strongly disagree* to 7 = *strongly agree*). Evidence to support the validity and reliability of the scale has been provided by Cox et al (2002) and includes factorial structure, internal consistency and test-retest reliability has previously been reported in student and general samples. The scale has also previously been used in exercisers (e.g., Hall et al., 2009; Miller & Mesagno, 2014).

Perfectionistic self-presentational styles. Perfectionistic self-presentation was measured using the Perfectionistic Self-presentation Scale developed by Hewitt et al. (2003). It includes 27-items that measure perfectionistic self-promotion (10-items; "I strive to look perfect to others"), non-display of imperfection (10-items; "I hate to make errors in public"), and nondisclosure of imperfection (7-items; "Admitting failure to others is the worst possible thing"). Responses are measured on a seven-point Likert scale (1 = *strongly disagree* to 7 = *strongly agree*). Evidence of the validity and reliability of the instrument has been provided in student, clinical, and general samples (Hewitt et al., 2003). This includes factorial structure, internal consistency and test–retest reliability.

Body mass index. Body mass index (BMI) was calculated using self-reported height and weight data (BMI = weight [kg] / height^2 [m]).

Results

Preliminary analysis

All analyses were conducted using IBM SPSS Statistics version 20. Variables were screened for univariate and multivariate outliers using procedures described by Tabachnick and Fidell (2007). One univariate outlier (z-score >3.29, p <.001, two-tailed) and five multivariate outliers (Mahalanobis distance > χ^2 [13] = 34.53) were removed. A number of the variables remained significantly skewed. Consequently, subsequent bivariate correlations and multiple regression analyses, including standard errors and hypothesis tests, are based on 95% bias-corrected accelerated (BCa) bootstrap estimates (1000 resamples). These are preferable when analysing non-normal data and provide conservative estimates. Internal reliabilities were assessed for the scales (Cronbach's alpha) and were acceptable (Table 1).

Descriptive statistics and bivariate correlations

Descriptive statistics following the removal of outliers are reported in Table 1. Participants reported moderate levels of trait perfectionism and perfectionistic self-presentation styles (3-5 on a 7-point Likert scale). They also reported moderate-to-low levels of exercise dependence symptoms (2-4 on a 6-point Likert scale). Based on scores for symptom scores, 23 (9.5%) participants were classified as at-risk to exercise dependence, 90 (37.2%) were classified as nondependent-symptomatic, and 117 (48.3%) were classified as nondependent-asymptomatic (12 participants were not classified due to incomplete scores). This is broadly consistent with the distributions observed when developing the instrument (e.g., at-risk 3.4% to 13.4%, nondependent-symptomatic 25.6% to 71.3%, and nondependent-asymptomatic 14.0% to 69.5%; Hausenblas & Symons Downs, 2002). In order to examine the distribution of males and females across the 3 groups, a chi-square test was used. This indicated that there was a small, marginally significant, association between gender and group membership with males more greatly represented in the at-risk and nondependent-symptomatic groups, and females more greatly represented in the nondependent-asymptomatic group than expected: χ^2 (2) = 5.99, p = .05, Cramer's V = .16, p =.05.

Bivariate correlations between dimensions of perfectionism and exercise dependence symptoms for the total sample are presented in Table 2. These indicated that both self-oriented perfectionism, socially prescribed perfectionism, and perfectionistic self-presentational styles typically displayed positive, medium sized correlations with exercise dependence symptoms (r = ~.30; Cohen, 1992). The only notable exceptions were non-display of imperfection that included a number of negligible correlations (continuance, time, and intention) and other-oriented perfectionism that was not correlated with any exercise dependence symptom. Finally, we assessed the homogeneity of the covariance matrix of psychological variables (perfectionism and exercise dependence) using a Box's M test. This revealed that the covariance matrix was homogenous across male and female athletes, Box's M (91, 11220) = 116.79, p >.05.

Regression of symptoms of exercise dependence on trait perfectionism and perfectionistic self-presentational styles

A series of hierarchical regression analyses were used to assess the unique predictive ability of the three traits of perfectionism and whether perfectionistic self-presentational styles explained additional variance in symptoms of exercise dependence after controlling for trait dimensions of perfectionism. As gender and age were associated with symptoms of exercise dependence, these were used as covariates in the main analysis. In each analysis, a predictor block consisting of gender (dummy coded as female = 0 and male = 1) and age was entered first. Next, a predictor block consisting of trait perfectionism was entered (to assess to unique predictive ability of the three traits). Finally, a predictor block of perfectionistic self-presentational styles was entered (to evaluate the incremental predictive ability of perfectionistic self-presentational styles).

The results of the analyses are reported in Table 2. The analyses revealed that, in total, between 10% and 20% of variance in each exercise dependence symptom was explained by

the predictor variables. In terms of assessing the relative predictive ability of the trait dimensions of perfectionism, after controlling for gender and age which predicted between 3% and 12% variance of six of seven symptoms, the regression analyses revealed that the set of traits significantly predicted all symptoms of exercise dependence. Collectively, the traits accounted for an additional 6% to 10% variance in each symptom. For all symptoms, self-oriented perfectionism was a significant unique predictor and displayed a typically small or small-to-moderate relationship (β = .15 to .24). For two symptoms, reduction and intention, socially prescribed perfectionism was also a significant unique predictor and displayed a small relationship (β =.16 and .15). Other oriented perfectionism displayed no unique relationship with any symptom of exercise dependence.

In terms of assessing the incremental predictive ability of the perfectionistic self-presentational styles, the regression analyses revealed that after controlling for other predictor variables, perfectionistic self-presentation styles explained additional variance in four of seven symptoms (withdrawal, lack of control, reduction, and time). The additional variance accounted for ranged from 3% to 4%. In the case of withdrawal, perfectionistic self-promotion was the only significant unique predictor. In the case of reduction, non-disclosure of imperfection was the only significant unique predictor. In the cases of lack of control and time, there were no significant unique predictors. Rather, the significant increase in explained variance is the result of the unique and shared variance among the perfectionistic self-presentation styles, not any of the three uniquely.

Discussion

The first purpose of the current study was to examine the unique predictive ability of three trait dimensions of perfectionism in relation to exercise dependence symptoms. The second purpose was to examine the relationship between perfectionistic self-presentational styles and exercise dependence symptoms. The third purpose was to examine the incremental

predictive ability of perfectionistic self-presentational styles beyond trait perfectionism. The results revealed that self-oriented perfectionism was the only consistent unique predictor of all exercise dependence symptoms, socially prescribed perfectionism was a unique predictor of two symptoms (reduction and intention), and other-oriented perfectionism did not predict any symptoms. In addition, perfectionistic self-presentational styles were positively related to exercise dependence symptoms, particularly perfectionistic self-promotion and non-disclosure of imperfection. Finally, perfectionistic self-representational styles predicted variance in exercise dependence beyond trait perfectionism for four of seven symptoms (withdrawal, lack of control, reduction, and time).

Perfectionism and exercise dependence symptomology

Self-oriented and socially prescribed perfectionism have previously been found to be related to exercise dependence among exercisers (Hall et al., 2009; Miller & Mesagno, 2014). The current study replicates these studies and in doing so affirms the potential importance of perfectionism in terms of exercise dependence symptomology. The study also provides three important novel insights. Firstly, the findings illustrate that relative to other trait forms of perfectionism it is self-imposed perfectionism that is most important when considering *unique* relationships with exercise dependence symptoms. Secondly, believing that others expect perfection is also a unique predictor of exercise dependence but to a much lesser degree. Thirdly, perfectionism that is characterised by imposing unrealistic standards on others is unrelated to exercise dependence symptoms.

The study also illustrates that perfectionistic self-presentational styles may have some relevance when considering exercise dependence symptoms. Perfectionistic self-presentational styles have been found to predict a wide array of adverse outcomes (e.g., anxiety and depression; Hewitt et al., 2003). This is the first study to indicate that when individuals seek to portray an image of perfection, they may also be vulnerable to increased

exercise dependence symptoms. Current understanding of the psychosocial mechanisms underpinning the development of exercise dependence suggest that the need to manage additional emotionality and boost a sense of self-worth by managing appearance may be possible pathways to explain this relationship (Flett et al., 2002; Hewitt et al., 2003). As such, excessive exercise may be both a coping strategy and impression management strategy associated with a desire for an image of perfection.

The possible importance of perfectionistic self-presentational styles was further illustrated by the incremental predictive ability for some symptoms. This mirrors research that has found perfectionistic self-presentational styles to predict other indicators of maladjustment beyond trait perfectionism (e.g., Hewitt et al., 2003). Feelings of withdrawal and the reduction of other life activities are particularly noteworthy symptoms in this regard as they reflected unique relationships with perfectionistic self-promotion and non-disclosure of imperfection. One might speculate that, beyond demanding perfection from oneself, when exercise is central to the portrayal of a perfect self, exercise becomes increasingly important, one's life is structured around it, and other activities more readily sacrificed to undertake it. In addition, when individuals are unable to do so, its absence is more acutely felt. Future research of a longitudinal nature would be valuable in terms of testing these assertions.

Despite these findings, some caution is required. The amount of additional variance explained in exercise dependence by perfectionistic self-presentational styles was small (3-4%) and incremental predictive ability was limited to four of seven symptoms. In terms of the small amount of variance, as noted elsewhere one would not necessarily expect large amounts of additional variance to be explained after controlling for trait perfectionism (Hill & Appleton, 2011). In addition, the amount of additional variance accounted for is similar to that accounted for when assessing anxiety and depression (4-6%; Hewitt et al., 2003). In terms of dependence symptoms, it appears that perfectionistic self-presentational styles may

be relevant for some but not all symptoms. The symptoms not accounted for appear to focus on when exercise is undertaken (continuance) and in what amount over time (tolerance and intention effects). Although again speculative, it may be that perfectionistic self-presentational styles speak more to the act of undertaking exercise and how this appears to others, rather than when or what amount of exercise is undertaken per se, at least when the internal drive captured by self-oriented perfectionism is already accounted for. Even in light of these restrictions, the current findings provide an indication that perfectionistic self-presentational styles are worthy of further examination in terms of exercise dependence.

There are number of noteworthy limitations of the study. First, though the distinction is contentious (see Bamber et al., 2000), in the current study no screening for primary and secondary exercise dependence took place. Therefore, it is not clear whether perfectionistic traits and self-presentational styles are more important in terms of predicting primary or secondary dependence. Secondly, due to the design of the study inferences are limited to the notion that exercise dependence co-occurs with perfectionism (causal statements cannot be made nor reciprocal/opposing effects be discounted). Although we included gender and age as control variables, other variables also warrant consideration (e.g., eating disorder symptoms). Thirdly, the EDS-R is a screening tool, not a diagnostic tool (Symons Downs et al., 2004). Therefore, the current findings are limited to discussing risk to exercise dependence symptoms, not dependence per se. Finally, we examined the relationships in gym-users. It is possible these effects do not generalise to other exercisers used in other studies (e.g., recreational runners; Hall et al., 2009). Future research should address these limitations.

Conclusion

The current study suggests that self-oriented perfectionism is particularly important trait in terms of exercise dependence symptoms. In addition, perfectionistic self-

presentational styles are also associated with exercise dependence symptoms and account for variability beyond trait perfectionism. These dimensions of perfectionism may therefore warrant attention when considering exercise dependence symptomology.

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References

Bamber, D., Cockerill, I. M., & Carroll, D. (2000). The pathological status of exercise dependence. *British Journal of Sports Medicine, 34,* 125–132.

Bratland-Sanda, S., Martinsen, E. W., Rosenvinge, J. H., Ro, O., Hoffart, A., & Sundgot-Borgen, J. (2011). Exercise dependence score in patients with longstanding eating disorders and controls: The importance of affect regulation and physical activity intensity. *European Eating Disorders Review, 19,* 249-255.

Coen, S.P. and Ogles, B.M. (1993). Psychological characteristics of the obligatory runner: a critical examination of the anorexia analogue hypothesis. *Journal of Sport and Exercise Psychology, 15,* 338–354.

Cohen, J. (1988). *Statistical Power Analysis for the Behavioral Sciences, 2nd Edition*. Hillsdale: Lawrence Erlbaum.

Cox, B. J., Enns, M. W., & Clara, I. P. (2002). The multidimensional structure of perfectionism in clinically distressed and college student samples. *Psychological Assessment, 14,* 365-373.

Flett, G. L., & Hewitt, P. L. (2006). Positive versus negative perfectionism in psychopathology. *Behaviour Modification, 30,* 472-495.

Hagan, A. L., & Hausenblas, H. A. (2003). The relationship between exercise dependence and perfectionism. *American Journal of Health Studies, 18,* 133–137.

Hill, A. P. & Appleton, P. R. (2011). The predictive ability of the frequency of perfectionistic cognitions, self-oriented perfectionism and socially prescribed perfectionism in relation to symptoms of burnout in youth rugby players. *Journal of Sports Sciences, 29,* 695-703.

Hall, H. K., Hill, A. P., Appleton, P. R., & Kozub, S. A. (2009). The mediating influence of unconditional self-acceptance and labile self-esteem on the relationship between

multidimensional perfectionism and exercise dependence. *Psychology of Sport and Exercise, 10,* 35–44.

Hall, H. K., Kerr, A. W., Kozub, S. A., & Finnie, S. B. (2007). Motivational antecedents of obligatory exercise: The influence of achievement goals and multidimensional perfectionism. *Psychology of Sport and Exercise, 8,* 297–316.

Hamer, M. & Karageorghis, C. I. (2007). Psychobiological mechanisms of exercise dependence. *Sports Medicine 37,* 477- 484.

Hausenblas, H. A., & Giacobbi, P. R. (2004). Relationship between exercise dependence symptoms and personality. *Personality and Individual Differences, 36,* 1265–1273.

Hausenblas, H. A., & Symons Downs, D. (2002). How much is too much? The development and validation of the exercise dependence scale. *Psychology and Health, 17,* 387–404.

Hewitt, P. L., & Flett, G. L. (1991). Perfectionism in the self and social contexts: Conceptualization, assessment, and association with psychopathology. *Journal of Personality and Social Psychology, 60,* 456-470.

Hewitt, P. L., & Flett, G. L. (2004). The Multidimensional Perfectionism Scale: Technical Manual. Toronto: Multihealth Systems Inc.

Hewitt, P., Flett, G., Sherry, S., Habke, M., Parkin, M., Lam, R., et al. (2003). The interpersonal expression of perfection: Perfectionistic self-presentation and psychological distress. *Journal of Personality and Social Psychology, 84,* 1303–1325.

McGee, B. J., Hewitt, P. L., Sherry, S. B., Parkin, M., & Flett, G. L. (2005) Perfectionistic self-presentation, body image, and eating disorder symptoms. *Body Image,* 29-40.

Miller, K. J. & Mesagno, C. (2014). Personality traits and exercise dependence: Exploring the role of narcissism and perfectionism. *International Journal of Sport and Exercise Psychology, 12,* 368-381.

O'Connor, R. C. (2007). The relations between perfectionism and suicidality: a systematic review. *Suicide and Life-Threatening Behavior, 37,* 698-714.

Ogden, J., Veale, D., & Summers, Z. (1997). The development and validation of the Exercise Dependence Questionnaire. *Addiction Research*, *5*, 343–356.

Sherry, S. B., Vriend, J.L., Hewitt, P. L., Sherry, D. L., Flett, G. L., Wardrop, A. A. (2009) Perfectionism dimensions, appearance schemas, and body image disturbance in community members and university students. *Body Image*, 6, 83-89.

Spano, L. (2001). The relationship between exercise and anxiety, obsessive-compulsiveness, and narcissism. *Personality and Individual Differences, 30*, 87–93.

Stoeber, J. (2014). How other-oriented perfectionism differs from self-oriented and socially prescribed perfectionism. *Journal of Psychopathology and Behavioral Assessment, 36,* 329-338.

Symons Downs, D., Hausenblas, H. A., & Nigg, C. R. (2004). Factorial validity and psychometric examination of the exercise dependence scale-revised. *Measurement in Physical Education and Exercise Science, 8,* 183–201.

Szabo, A. (2010). *Exercise addiction: A symptom or a disorder?* New York: Nova Science Publishers, Inc.

Tabachnick, B. G., & Fidell, L. S. (2007). Using Multivariate Statistics (5th ed.). Boston: Allyn and Bacon

Veale, D. M. W. (1995). Does primary exercise dependence really exist? In J. Annett., B. Cripps., & H. Steinberg. (Eds.), *Exercise addiction: Motivation for participation in sport and exercise* (pp. 1–5) Leicester, UK: British Psychological Society.

World Health Organisation (2010). Global recommendations on physical activity for health. WHO Press, Geneva, Switzerland.

Table 1 *Descriptive statistics and internal reliabilities of perfectionism and exercise dependence*

		Total sample (n = 242)		Males (n =145)		Females (n=97)	
Variable	α	*M*	*SD*	*M*	*SD*	*M*	*SD*
Age	--	25.61	11.35	24.97	10.16	26.57	12.93
BMI	--	23.08	2.39	23.73	2.17	22.09	2.36
Years as a member of a gym	--	4.14	3.90	4.37	3.96	3.79	3.80
Days visiting a gym per week	--	3.32	1.52	3.49	1.46	3.07	1.58
Hours spent at gym per week	--	4.46	2.70	5.06	2.80	3.57	2.28
Self-oriented perfectionism	.88	4.87	1.24	4.90	1.31	4.83	1.07
Socially prescribed perfectionism	.78	3.30	1.21	3.29	1.10	3.31	1.34
Other-oriented perfectionism	.78	4.27	1.02	4.26	0.96	4.28	1.08
Perfectionistic self-promotion	.85	3.99	0.96	3.99	0.97	3.98	0.97
Non-display imperfect	.83	4.20	1.05	4.05	1.04	4.41	1.04
Non-disclosure imperfect	.78	3.42	0.98	3.48	0.96	3.30	1.01
Withdrawal	.83	3.11	1.31	3.12	1.23	3.11	1.38
Continuance	.88	2.65	1.38	2.86	1.34	2.34	1.34
Tolerance	.88	3.28	1.27	3.50	1.24	2.95	1.24
Lack of control	.88	2.37	1.28	2.56	1.35	2.08	1.08
Reduction	.66	2.08	0.92	2.34	1.01	1.72	0.67
Time	.89	2.90	1.25	3.11	1.25	2.56	1.16
Intention effects	.92	2.55	1.31	2.70	1.34	2.35	1.19

Table 2 *Bivariate correlations for perfectionism and exercise dependence symptoms*

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Self-oriented perf.															
2. Socially prescribed perf.	.38**														
3. Other-oriented perf.	.16*	.07													
4. Perfect. self-promotion	.45**	.57**	.15*												
5. Non-display imperfect	.29**	.47**	.08	.71**											
6. Non-disclosure imperfect	.32**	.45**	.07	.66**	.62**										
7. Withdrawal	.30**	.22**	.05	.36**	.24**	.22**									
8. Continuance	.23**	.19**	-.01	.21**	.13	.19**	.43**								
9. Tolerance	.30**	.18**	.06	.27**	.19**	.26**	.56**	.48**							
10. Lack of control	.29**	.20**	.02	.29**	.20**	.28**	.57**	.51**	.60**						
11. Reduction	.24**	.21**	.03	.27**	.15*	.33**	.52**	.50**	.55**	.68**					
12. Time	.26**	.10	.07	.26**	.09	.24**	.54**	.47**	.66**	.44**	.63**				
13. Intention effects	.29**	.22**	.06	.27**	.13	.25**	.55**	.47**	.60**	.68**	.66**	.71**			
14. Gender	.02	.01	.01	.03	-.15*	.11	-.01	.17**	.19**	.18**	.31**	.21**	.13*		

15. Age	-.05	.08	-.01	-.01	-.01	.06	-.08	.05	-.21**	-.09	-.14*	-.19**	-.15*	-.06	
16. BMI	.00	-.08	.08	.06	.01	.07	-.13	.06	.00	.03	.08	-.03	-.00	.37**	.21**

Note. * $p < .05$, two-tailed; ** $p < .01$, two-tailed

Table 3 *Regression analyses of perfectionism and exercise dependence symptoms*

Model	*B*	*S.E*	*p*	BCa *95% CI*	β
Withdrawal					
Step 1: F (2, 229) = 0.64, $p > .05$; $R^2 = .01$;					
Gender	-.04	.17	.833	[-.40, .33]	-.01
Age	-.01	.01	.283	[-.02. .01]	-.07
Step 2: F (5, 226) = 5.04, $p < .001$; $R^2 = .10$; $\Delta R^2 = .10$, $p < .001$					
Gender	-.05	.17	.742	[-.40, .01]	-.02
Age	-.01	.01	.277	[-.02, .01]	-.07
Self-oriented perfectionism	.25**	.08	.002	[.11, .40]	.24
Socially prescribed Perfectionism	.14	.08	.090	[-.03, .31]	.13
Other-oriented perfectionism	.00	.09	.998	[-.18, .18]	.00
Step 3: F (8, 223) = 4.72, $p < .001$; $R^2 = .15$; $\Delta R^2 = .04$, $p < .05$					
Gender	-.06	.18	.732	[-.41, .33]	-.02
Age	-.01	.01	.314	[-.02, .01]	-.07
Self-oriented perfectionism	.18*	.08	.018	[.03, .34]	.17
Socially prescribed perfectionism	.01	.08	.940	[-.18, .20]	.01
Other-oriented perfectionism	-.03	.09	.723	[-.20, .16]	-.03
Perfectionistic self-promotion	.39**	.14	.003	[.11, .64]	.29
Non-display of imperfection.	-.03	.12	.829	[-.25, .20]	-.02
Non-disclosure of imperfection	-.01	.11	.942	[-.19, .19]	-.01
Continuance					
Step 1: F (2, 229) = 3.80, $p < .05$; $R^2 = .03$;					

Gender	.49*	.18	.011	[.11, .85]	.17
Age	.01	.01	.266	[-.01, .02]	.06
Step 2: F (5, 226) = 4.87, p < .001; R^2 = .10; ΔR^2 = .07, p <.01					
Gender	.47*	.18	.011	[.11, .84]	.17
Age	.01	.01	.270	[-.01, .02]	.06
Self-oriented perfectionism	.21*	.08	.006	[.06, .36]	.19
Socially prescribed Perfectionism	.14	.08	.083	[-.02, .30]	.12
Other-oriented perfectionism	-.08	.08	.359	[.23, .05]	-.06
Step 3: F (8, 223) = 3.21, p < .01; R^2 = .10; ΔR^2 = .01, p >.05					
Gender	.45*	.19	.023	[.06, .84]	.16
Age	.01	.01	.287	[-.01, .02]	.06
Self-oriented perfectionism	.19*	.08	.019	[.02, .34]	.17
Socially prescribed perfectionism	.09	.09	.336	[-.10, .29]	.08
Other-oriented perfectionism	-.08	.08	.302	[-.23, .04]	-.06
Perfectionistic self-promotion	.07	.16	.662	[-.27, .38]	.05
Non-display of imperfection.	-.01	.12	.921	[-.23, .24]	-.01
Non-disclosure of imperfection	.09	.12	.463	[-.15, .32]	.06
Tolerance					
Step 1: F (2, 227) = 9.86, p < .01; R^2 = .08;					
Gender	.44*	.16	.010	[.12, .77]	.17
Age	-.02**	.01	.002	[-.04, -.01]	-.22
Step 2: F (5, 224) = 8.98, p < .001; R^2 = .17; ΔR^2 = .09, p <.001					
Gender	.43*	.16	.009	[.11, .74]	.17
Age	-.02**	.01	.001	[-.03, -.01]	-.21

Self-oriented perfectionism	.24**	.07	.002	[.10, .38]	.23
Socially prescribed Perfectionism	.11	.07	.111	[-.02, .27]	.11
Other-oriented perfectionism	.02	.08	.788	[-.12, .17]	.02
Step 3: F (8, 221) = 6.53, p < .001; R^2 = .19; ΔR^2 = .02, p >.05					
Gender	.40*	.16	.017	[.07, .74]	.16
Age	-.02**	.01	.001	[-.03, -.01]	-.21
Self-oriented perfectionism	.19**	.08	.013	[.05, .35]	.19
Socially prescribed perfectionism	.01	.08	.879	[-.16, .19]	.01
Other-oriented perfectionism	.01	.08	.920	[-.14, .16]	.01
Perfectionistic self-promotion	.14	.14	.307	[-.13, .42]	.11
Non-display of imperfection.	.02	.11	.835	[-.20, .26]	.02
Non-disclosure of imperfection	.12	.11	.260	[-.08, .31]	.10
Lack of control					
Step 1: F (2, 229) = 4.51, p < .05; R^2 = .04;					
Gender	.43**	.16	.007	[.13, .71]	.17
Age	-.01	.01	.089	[-.02, .00]	-.09
Step 2: F (5, 226) = 6.40, p < .001; R^2 = .12; ΔR^2 = .09, p <.001					
Gender	.41**	.15	.007	[.12, .69]	.16
Age	-.01	.01	.112	[-.02, .00]	-.09
Self-oriented perfectionism	.24**	.07	.003	[.11, .38]	.23
Socially prescribed Perfectionism	.12	.07	.059	[-.01, .26]	.12
Other-oriented perfectionism	-.03	.09	.704	[-.20, .13]	-.03
Step 3: F (8, 223) = 5.12, p < .001; R^2 = .16; ΔR^2 = .03, p <.05					
Gender	.38*	.17	.019	[.07, .70]	.15

Age	-.01	.01	.112	[-.02, .00]	-.09
Self-oriented perfectionism	.18*	.08	.020	[.04, .33]	.18
Socially prescribed perfectionism	.01	.07	.873	[-.14, .16]	.01
Other-oriented perfectionism	-.05	.09	.478	[-.22, .10]	-.04
Perfectionistic self-promotion	.23	.15	.124	[-.06, .52]	.18
Non-display of imperfection.	-.01	.12	.902	[-.24, .24]	-.01
Non-disclosure of imperfection	.10	.12	.373	[-.13, .35]	.08
Reduction					
Step 1: F (2, 230) = 16.09, $p < .001$; $R^2 = .12$;					
Gender	.58**	.11	.001	[.37, .79]	.31
Age	-.01*	.00	.013	[-.02, -.00]	-.15
Step 2: F (5, 227) = 10.51, $p < .001$; $R^2 = .19$; $\Delta R^2 = .07$, $p < .01$					
Gender	.57**	.10	.001	[.37, .77]	.31
Age	-.01**	.00	.005	[-.02,-.00]	-.15
Self-oriented perfectionism	.12*	.06	.034	[.01, .22]	.15
Socially prescribed Perfectionism	.12*	.05	.018	[.03, .20]	.16
Other-oriented perfectionism	-.01	.06	.895	[-.14, .12]	-.01
Step 3: F (8, 224) = 8.26, $p < .001$; $R^2 = .23$; $\Delta R^2 = .04$, $p < .05$					
Gender	.50**	.11	.001	[.27, .72]	.26
Age	-.01**	.00	.004	[-.02, -.01]	-.16
Self-oriented perfectionism	.08	.06	.128	[-.02,.19]	.11
Socially prescribed perfectionism	.06	.06	.310	[-.05, .16]	.08
Other-oriented perfectionism	-.02	.06	.796	[-.16, .11]	-.02
Perfectionistic self-promotion	.06	.10	.620	[-.16, .26]	.06

Non-display of imperfection.	-.07	.08	.366	[-.22. .08]	-.08
Non-disclosure of imperfection	.22**	.07	.001	[.11, .35]	.24
Time					
Step 1: F (2, 229) = 9.54, p < .001; R^2 = .08					
Gender	.49**	.16	.004	[.17, .79]	.19
Age	-.02**	.01	.003	[-.03, -.01]	-.19
Step 2: F (5, 226) = 7.25, p < .001; R^2 = .14; ΔR^2 = .06, p <.01					
Gender	.47**	.15	.005	[.15, .76]	.19
Age	-.02**	.01	.005	[-.03, -.01]	-.18
Self-oriented perfectionism	.24**	.07	.002	[.11, .38]	.24
Socially prescribed Perfectionism	.02	.07	.780	[-.13, .16]	.02
Other-oriented perfectionism	.02	.08	.763	[-.13, .16]	.02
Step 3: F (8, 223) = 5.96, p < .001; R^2 = .18; ΔR^2 = .04, p <.05					
Gender	.36*	.16	.023	[.06, .68]	.14
Age	-.02**	.01	.004	[-.03, -.01]	-.18
Self-oriented perfectionism	.18*	.07	.019	[.04, .32]	.18
Socially prescribed perfectionism	-.07	.08	.359	[-.24, .10]	-.07
Other-oriented perfectionism	-.00	.08	.991	[-.16, .14]	.00
Perfectionistic self-promotion	.28†	.16	.069	[-.01, .59]	.22
Non-display of imperfection.	-.18	.12	.082	[-.40, .05]	-.15
Non-disclosure of imperfection	.17	.10	.086	[-.03, .37]	.14
Intention effects					
Step 1: F (2, 231) = 3.62, p < .05; R^2 = .03;					
Gender	.28	.16	.107	[-.07, .64]	.11

Age	-.02*	.01	.027	[-.03, -.00]	-.13
Step 2: F (5, 228) = 6.18, p < .001; R^2 = .12; ΔR^2 = .09, p <.001					
Gender	.25	.15	.119	[-.06, .61]	.10
Age	-.01*	.01	.025	[-.03, -.00]	-.13
Self-oriented perfectionism	.22**	.07	.001	[.08, .37]	.21
Socially prescribed Perfectionism	.16*	.07	.022	[.03, .29]	.15
Other-oriented perfectionism	.01	.09	.888	[-.15, .17]	.01
Step 3: F (8, 225) = 4.87, p < .001; R^2 = .15; ΔR^2 = .03, p >.05					
Gender	.15	.16	.344	[-.18, .50]	.06
Age	-.02*	.01	.018	[-.03, -.00]	-.14
Self-oriented perfectionism	.17*	.07	.014	[.03, .32]	.16
Socially prescribed perfectionism	.09	.08	.245	[-.06, .23]	.08
Other-oriented perfectionism	-.01	.09	.931	[-.16, .15]	-.01
Perfectionistic self-promotion	.23	.15	.112	[-.11, .53]	.17
Non-display of imperfection.	-.20	.12	.100	[.45, .03]	-.16
Non-disclosure of imperfection	.18	.10	.072	[-.02, .37]	.14

Note. * p < .05, ** p < .01, † p <.07, all p values are two-tailed.