Running head: SELF-DETERMINATION THEORY AND EXERCISE DEPENDENCE SYMPTOMATOLOGY

Examining Exercise Dependence Symptomatology from a Self-Determination Perspective

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Abstract

Background Based on the theoretical propositions of Self-Determination Theory (SDT; Deci & Ryan, 1985) this study examined whether individuals classified as "nondependent-symptomatic" and "nondependent-asymptomatic" for exercise dependence differed in terms of the level of exercise-related psychological need satisfaction and self-determined versus controlling motivation they reported. Further, we examined if the type of motivational regulations predicting exercise behaviour differed among these groups.

Methods Participants (N = 339), recruited from fitness, community, and retail settings, completed measures of exercise-specific psychological need satisfaction, motivational regulations, exercise behaviour and exercise dependence.

Results Individuals who were nondependent-symptomatic for exercise dependence reported higher levels of competence need satisfaction and all forms of motivational regulation, compared to nondependent-asymptomatic individuals. Introjected regulation approached significance as a positive predictor of strenuous exercise behaviour for symptomatic individuals. Identified regulation was a positive predictor of strenuous exercise for asymptomatic individuals.

Conclusions The findings reinforce the applicability of SDT to understanding engagement in exercise.

Keywords

Physical activity, motivation, motivational regulations, psychological needs, autonomy disturbances.

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An impressive body of evidence associates exercise with improved physical and psychological well-being (Biddle & Mutrie, 2001). Paradoxically however, it has also been suggested that if exercise becomes excessive, serious detrimental physical and psychological consequences may accrue (e.g., anaemia, depressed immune response, menstrual irregularity, anxiety and depression; Hall, Kerr, Kozub & Finnie, 2004). Researchers examining the negative consequences of regular physical activity have focused primarily on the issue of exercise dependence (Hausenblas & Symons Downs, 2002a). Exercise dependence represents a condition in which moderate to vigorous physical activity becomes a compulsive behaviour. Based on the Diagnostic and Statistical Manual for Mental Disorders (DSM) criteria for substance dependence (APA, 1994), it has been argued that exercise dependence has biomedical (e.g., withdrawal) and psychosocial (e.g., interference with social functioning) components (Veale, 1987, 1995).

To date, the prevalence of exercise dependence in the general population is not known. Whilst some authors suggest that exercise dependence is a far more serious condition than many professionals currently recognize (e.g., Yates, 1996), others have criticised such claims and have pointed to an “eagerness to pathologise exercise dependence” (e.g., Bamber, Cockerill & Carroll, 2000; Bamber, Cockerill, Rodgers & Carroll, 2003). Although only a very small percentage of regular exercisers are likely to be affected by exercise dependence (Veale, 1987; Morris, 1989), it has recently been argued that the pattern of exercise behaviour observed among a more substantial number of exercisers may be considered both physically and psychologically debilitating (Hall et al., 2004). Thus, it seems important to examine the predictors of such maladaptive exercise engagement as reflected in reported dependence symptomatology.

There has been considerable work focused upon the measurement of exercise dependence. A recent literature review identified twelve instruments assessing various aspects of exercise dependence (Hausenblas & Symons Downs, 2002b), such as the Obligatory Exercise Questionnaire (Pasman & Thompson, 1988), the Commitment to Exercise Scale (Davis, Brewer & Ratusny, 1993) and the Exercise Dependence Questionnaire (Ogden, Veale & Summers, 1997). However, many of the available measures have been criticised. For example, some measures define and measuring exercise dependence as a unidimensional construct and conceptualise exercise dependence within a continuum. Thus, these assessment tools are unable to identify or classify exercise dependent individuals. Further, they majority fail to utilize the Diagnostic and Statistical Manual of Mental Disorders-IV (DSM-IV; APA, 1994) criteria for substance dependence (Hausenblas & Symons Downs, 2002b). Such limitations led Adams and Kirkby (1998) to affirm that "further refinement of exercise dependence scales, or the development of a more sensitive instrument, appears necessary before research can progress in this area."

In an attempt to rectify these shortcomings, Hausenblas and Symons Downs (2002b) developed the Exercise Dependence Scale (EDS), a measurement instrument incorporating DSM criteria for substance dependence (APA, 1994). The measure conceptualises exercise dependence as a cluster of cognitive, behavioural and physiological symptoms (Hausenblas and Symons Downs, 2002a). The scale provides mean total and sub-scale scores, and allows individuals to be classified as "at risk", those that show some signs of dependence (i.e., "nondependent-symptomatic") and those that have no symptoms of exercise dependence (i.e., "nondependent-asymptomatic") (Hausenblas & Symons Downs, 2002b).

Preliminary investigations utilising the EDS provide evidence to suggest that at risk individuals report more perfectionism when compared to the nondependent groups (Hausenblas & Symons Downs, 2002b). Moreover, neuroticism, extraversion,

conscientiousness, and agreeableness (Hausenblas & Giacobbi, 2004), as well as appearance imagery and energy imagery (Hausenblas & Symons Downs, 2002c) have been shown to positively predict symptoms of exercise dependence. Despite these recent advances however, research examining the precipitating and perpetuating factors of exercise dependence, as well mechanisms to prevent and treat it, remains limited (Hausenblas & Symons Downs, 2002b, 2002c). Understanding the aetiological and maintenance factors of exercise dependence clearly has important implications for clinical practice (Loumidis & Roxborough, 1995). That is, if we can delineate the underlying factors that energize excessive exercise engagement we should be able to more easily recognise symptomatology, and thus prevent the development of a more serious manifestation. Motives for exercise have been proposed as key antecedents of exercise dependence (Ogles, Masters & Richardson, 1995) and offer one avenue for potential exploration. However, no studies have yet to adopt a theoretical framework to examine how at risk, nondependent-symptomatic and nondependent-asymptomatic individuals differ motivationally in terms of exercise engagement.

One potential theory of human motivation applicable to the understanding of exercise engagement is Deci and Ryan's (1985) Self-Determination Theory (SDT). Essentially, SDT proposes that human motivation varies in the extent to which it is autonomous/ self-determined versus controlling. Behaviours and actions that are autonomous are freely initiated and emanate from within ones self (Reeve, 2002). In contrast, when controlled, behaviour is not chosen by the individual, it is regulated by an external force and it is non-volitional. Based on these distinctions, SDT proposes that three distinct forms of motivation exist, namely, intrinsic motivation, extrinsic motivation and amotivation[1] which, based on the level of autonomy inherent in them, lie on a continuum of high to low self-determination.

Intrinsic motivation is considered to be the most autonomous form of motivation and refers to an inherent tendency possessed by all humans to seek out novelty and challenges, to

extend and exercise one's capabilities, to explore and to learn (Ryan & Deci, 2000). It is encapsulated in the innate energy demonstrated when people pursue a goal or activity because it is enjoyable or interesting (Koestner & Losier, 2002). Individuals who are intrinsically motivated to exercise would do so because they consider it to be fun.

Not all human behaviours are intrinsically enjoyable, and to explain how such behaviours are regulated, SDT proposes extrinsic motivation, and a process called internalization. Extrinsic motivation refers to behaviours that are carried out to attain contingent outcomes outside the activity (Deci, 1971). Internalization refers to an inherent tendency possessed by all humans to integrate within themselves the regulation of extrinsically motivated activities that are useful for effective functioning in the social world, but are not inherently interesting (Deci, Eghrari, Patrick & Leone, 1994). SDT proposes that the extent to which extrinsic motives are internalized can vary. Thus, four different forms of extrinsic regulation are proposed to exist, each reflecting a different level of internalization, and thus, experienced self-determination.

External regulation reflects the least autonomous of these regulations whereby the person engages in the activity to obtain external rewards or to avoid punishments (Deci & Ryan, 1985). An example of external regulation would be exercising because you have been told to do so by a health professional. Introjection refers to a regulation that is partially taken in, but is not fully accepted as one's own (Ryan & Deci, 2000). With introjection, behaviour is undertaken in an attempt to avoid negative emotions (e.g., anxiety or guilt) or to support conditional self-worth and attain ego enhancement (Ryan & Deci, 2000). When guided by introjected regulation an internal demand pressures and coerces people to act (Ryan, Deci & Grolnick, 1995). People that are guided by introjected regulation would exercise because of feelings of guilt or shame about not exercising. Identified regulation is an autonomous form of extrinsic motivation, and reflects participation in an activity because one holds certain

outcomes of the behaviour to be personally significant, although one may not enjoy the activity itself. Individuals guided by identified regulation would exercise because they value the benefits associated with exercise (e.g., improved health). Finally, the most autonomous form of extrinsic motivation is integrated regulation. Integrated regulation occurs when identified regulations are fully assimilated into the self and are brought into congruence with one's other values and needs (Deci & Ryan, 2000). Individuals guided by integrated regulation would exercise as it is an important aspect of how they perceive themselves.

As well as specifying the different types of regulation that may guide behaviour, SDT also specifies their psychological antecedents. Essentially SDT postulates that the type of motivational regulation guiding behaviour is dependent upon the satisfaction of three basic psychological needs. A need for *autonomy* reflects a desire to engage in activities of one's own choosing and to be the origin of one's own behaviour (deCharms, 1968; Deci & Ryan, 1985). A need for *relatedness* involves feeling connected, or feeling that one belongs in a given social milieu (Deci & Ryan, 1985). Finally, a need for *competence* implies that individuals have a desire to interact effectively with the environment and to experience a sense of competence in producing desired outcomes and preventing undesired events (Deci & Ryan, 1985). The greater the extent of need satisfaction derived in a given domain, the more self-determined the regulation of behaviour should be (Deci & Ryan, 1985).

SDT further suggests that the extent to which the three psychological needs are satisfied will result in diverse cognitive, affective and behavioural consequences (Deci & Ryan, 1985). According to Vallerand (1997), the three needs influence such outcomes indirectly via the promotion of different types of motivational regulation. Satisfaction of the three basic psychological needs, and ensuing self-determined motivation, is proposed to result in maintained/ enhanced health, psychological growth and well-being, and an absence of pathology and ill-being (Ryan & Deci, 2000). In contrast, when the needs are thwarted,

less autonomous regulations are hypothesized to guide behaviour, and a variety of non-optimal outcomes are likely to accrue.

Supporting these propositions, research has implicated inadequate need satisfaction in the aetiology of numerous adjustment problems and mental illnesses (e.g., anorexia, bulimia, morbid obesity, obsessive-compulsive disorder; Ryan, Deci & Grolnick, 1995). Further, Shapiro (1981) suggested that autonomy deviations are common to many forms of psychopathology. For example, both bulimic and restrictive anorexics have been shown to exhibit more controlling forms of self-regulation, and to experience more pressure to conform to internal standards reflective of "introjected" perfectionist strivings, than individuals showing no symptoms of an eating disorder (e.g., Strauss & Ryan, 1987).

To date, and in accordance with SDT's propositions (Deci & Ryan, 1985), research investigating the applicability of the basic tenets of SDT within the exercise domain has shown exercise behaviour to be associated with intrinsic motivation and, to a greater extent, identified regulation (Edmunds et al., 2004; Wilson, Rodgers, Blanchard & Gessell, 2003; Wilson, Rodgers & Fraser, 2002). Identified regulation has also been shown to partially mediate a relationship between competence need satisfaction and strenuous exercise behaviour (Edmunds, Ntoumanis & Duda, 2004). In addition, and as evidenced in other domains (e.g., education and politics; see Koestner & Losier, 2002), introjected regulation has emerged as a positive predictor of exercise behaviour (Edmunds et al., 2004). However, existing research in the exercise domain has considered the relationship between need satisfaction, motivational regulations, and adaptive behavioural outcomes only. No consideration has been given to whether less autonomous regulatory styles and thwarting of the psychological needs actually relate to less adaptive exercise outcomes. Thus, the main aim of the current study is to examine the utility of SDT in explaining variability in exercise dependence.

Previous research has provided preliminary evidence to link exercise dependence with reduced self-determination. There is some evidence to suggest that body image motives, which reflect introjected regulations for exercise involvement (Frederick & Ryan, 1993), have a major role to play in the genesis and maintenance of exercise addiction for example (Sewell, Clough & Robertshaw, 1995). Further, Hamer, Karageorghis and Vlachopoulos (2002) examined the relationship between motivational regulations and exercise dependence among endurance athletes using an adaptation of the Running Addiction Scale (Chapman & DeCastro, 1990). Introjected and identified regulations emerged as positive predictors of exercise dependence. Whilst these findings suggest that involvement in obligatory exercise involves some degree of self-determination (Hall et al., 2004), the fact that introjected regulation also predicted dependence supports the claims of Morgan (1979). He suggested that a perceived lack of volitional control over exercise may result in the occurrence of physically demanding practices. It should be noted, however, that Hamer et al. (2002) did not consider the relationship between the satisfaction of the three psychological needs proposed by SDT and the level of exercise dependence. Furthermore, the Hamer et al., (2002) study is limited by the fact that it utilised a sport-specific, unidimensional measure of exercise dependence, which does not consider DSM criteria (APA, 1994).

Aims and hypotheses

The current study aims to further delineate preliminary evidence associating exercise dependence with identified and introjected regulations. Specifically, we aim to determine whether, utilizing the classification system proposed by Hausenblas and Symons Downs (2002b), those individuals who are at risk of exercise dependence, those who are nondependent-symptomatic, and those who are nondependent-asymptomatic, differ in terms of the level of psychological need satisfaction they derive from exercise, their motivational regulations, and their exercise behaviour. Further, the present study will also examine which

motivational regulations predict the exercise behaviour of at risk, nondependent-symptomatic and nondependent-asymptomatic individuals.

Previous studies have shown that at risk individuals report more self-efficacy for exercise than nondependent-symptomatic individuals, who in turn, report more self-efficacy than nondependent-asymptomatic individuals (Hausenblas & Symons Downs, 2002a). Supporting this, high obligatory exercisers have been found to report higher perceived ability than their low obligatory counterparts (Hall et al., 2004). These findings are likely to be attributable to the fact that at risk and nondependent-symptomatic individuals report engaging in exercise more often than nondependent-asymptomatics (Hausenblas & Symons Downs, 2002a) and, thus, are more likely to feel capable in this domain. Given conceptual similarities between self-efficacy, perceived ability and competence (Roberts, 2001), it is hypothesized that at risk, and nondependent-symptomatic individuals will report higher competence need satisfaction via exercise than nondependent-asymptomatic individuals.

Obligatory runners have been shown to be uninterested in maintaining close relationships and are likely to display ‘separation maintenance’. They are more likely to sustain a discrete distance from others through physical activity (Yates, 1991), and become socially withdrawn (Cockerill & Riddington, 1996). Thus, it is hypothesised that at risk individuals will report less relatedness need satisfaction than both of the nondependent groups. However, given that nondependent-symptomatics report higher levels of engagement that nondependent-asymptomatics (Hausenblas & Symons Downs, 2002a), and thus may have more opportunity to form relationships in the exercise domain, we also hypothesise that nondependent-symptomatic individuals will report more relatedness need satisfaction than nondependent-asymptomatics.

With regards to autonomy, it has been suggested that compulsive exercisers feel a pressure and compulsion to engage (Morgan, 1979). Thus, we further predict that those

individuals at risk of, and those showing signs of exercise dependence, will report less autonomy need satisfaction, lower levels of self-determined regulation and higher levels of controlling motives (i.e., introjected and external regulation) than nondependent-asymptomatics. In addition, it is hypothesised that “at risk” and “non-dependent symptomatic” individuals will, in accordance with this symptomatology, report higher levels of exercise behaviour than “non-dependent asymptomatic” individuals. We expect that reported exercise behaviour among at risk and nondependent-symptomatic individuals will be predicted by introjected regulation. In contrast, for nondependent-asymptomatic individuals we hypothesised that identified regulation and intrinsic motivation will emerge as significant predictors of exercise behaviour.

Method

Participants

Three hundred and seventy three participants, recruited from fitness, community and retail settings, provided informed consent to take part in the current study. Data were screened according to the recommendations of Tabachnick and Fidell (2001). Seventeen cases were removed due to missing data and 5 multivariate outliers were removed from the sample based on the Mahalonobis distance criterion (see Tabachnick & Fidell, 2001, p.92), leaving a sample of 351 participants. Subsequent analysis revealed that only 12 participants (3.4%) met the criteria for being “at risk” of exercise dependence. This number, which is similar to that observed in previous studies utilising the EDS-21 (e.g., Hausenblas & Symons Downs, 2002a), was insufficient to ensure generalizability of results from subsequent multivariate analysis of variance (MANOVA) and regression analysis (Tabachnick & Fidell, 2001). Therefore, data from these participants were also removed from the data set, leaving a final sample of 339 participants.

From the final sample of 339 participants, 198 (56.4%) were classified as nondependent-symptomatic and 141 (40.1%) were classified as nondependent-asymptomatic. Those classified as nondependent-symptomatic ranged in age from 17 – 64 years (M = 30.49; SD = 10.84); 52.5% were male and 46.5% were female. Participants classified as nondependent-asymptomatic ranged in age from 16 – 60 years (M = 34.49; SD = 11.79); 39% were male and 59.6% were female.

Measures

Psychological need satisfaction. Psychological need satisfaction was measured via the 21-item Basic Need Satisfaction at Work Scale (Deci et al., 2001), amended by the authors to make it relevant to the exercise domain. This 21-item scale is based on a 15-item measure developed by Kasser, Davey and Ryan (1992) to tap autonomy, relatedness and competence in the work domain. In the development of the original 15-item measure some items were taken from the Intrinsic Motivation Inventory (Ryan, 1982), a multidimensional measure of subjects' experience with experimental tasks, support for which has been garnered in the physical domain (McAuley, Duncan & Tammen, 1989). The 21-item Basic Need Satisfaction at work scale has been shown to display alphas of .73 for competence, .84 for relatedness and .79 for autonomy in a sample of US workers (Deci et al, 2001).

Akin to the 21-item scale utilised by Deci et al., (2001), in the current study 6 items measured competence (e.g., "Most days I feel a sense of accomplishment from exercising"), 8 measured relatedness (e.g., "People I exercise with take my feelings into consideration"), and 7 measured autonomy (e.g., "I feel like I am free to decide for myself how to exercise") need satisfaction. Following the stem "Please indicate how true each of the following statements is for you given your experiences of exercise," participants responded to each item on a 7-point scale ranging from 1 (*not true for me*) to 7 (*very true for me*).

Motivational Regulations for Exercise. Participants completed the Behavioural Regulation in Exercise Questionnaire (BREQ; Mullan, Markland & Ingledew, 1997), a 15-item self-report measure assessing the reasons why people exercise. The BREQ includes scales assessing external, introjected, and identified regulation and intrinsic motivation. Following the stem "Why do you exercise?" participants respond to each item on a 5-point scale ranging from 1 (*not true for me*) to 5 (*very true for me*). Previous research provides support for the BREQ's factorial validity, the invariance of its factor structure across gender, and the internal consistency of each subscale (α's ranged from .76 to .90; Mullan et al., 1997; Mullan & Markland, 1997). As the BREQ does not have a sub-scale tapping the construct of Integrated Regulation, we also included the integrated regulation sub-scale of Li's (1999) Exercise Motivation Scale (using the same 1-5 scale as that described above). Past research supports the internal consistency of this subscale (α's >.75; Li, 1999).

Exercise Behaviour. Self-reported exercise behaviour was measured via The Godin Leisure Time Exercise Questionnaire (GLTEQ; Godin & Shepard, 1985). The GLTEQ assesses the frequency of mild, moderate and strenuous exercise engaged in, for a minimum of 15 minutes, during a typical week. Exercise behaviour scores are calculated by multiplying weekly frequencies of strenuous (e.g., running, vigorous gym workout), moderate (e.g., easy cycling) and mild activities (e.g., easy walking), by nine, five and three METS, respectively. An overall exercise behaviour score (units of metabolic equivalence) is calculated by averaging the weighted product of each question as follows: (mild x 3) + (moderate x 5) + (strenuous x 9). The GLTEQ has been shown to be a reliable and valid measure with which to assess leisure time exercise behaviour (Jacobs, Ainsworth, Hartman & Leon, 1993).

Exercise Dependence. Exercise dependence was measured using the 21-item Exercise Dependence Questionnaire (EDS-21; Hausenblas & Symons Downs, 2002b). Consistent with DSM criteria (APA, 1994), the EDS-21 operationalises exercise dependence as a

multidimensional maladaptive pattern of exercise leading to clinically significant impairment or distress, as manifested by three or more of the following: (1) *tolerance*: a need for significantly increased amounts of exercise to achieve a desired effect, or the experience of diminished effect with the continued use of the same amount of exercise; (2) *withdrawal*: withdrawal symptoms for exercise (e.g. anxiety, fatigue) are evidenced, or exercise is undertaken to relieve or avoid withdrawal symptoms; (3) *intention effects*: exercise is often taken in larger amounts or over longer period than was intended; (4) *loss of control*: there is a persistent desire or unsuccessful effort to cut down or control exercise; (5) *time*: a great deal of time is spent in activities conducive to the obtainment of exercise; (6) *conflict*: important social, occupational, or recreational activities are given up or reduced because of exercise; (7) *continuance*: exercise is continued despite knowledge of persistent or recurrent physical or psychological problems that are likely to have been caused or exacerbated by exercise.

Items, based on the aforementioned criteria, refer to respondents' "current exercise beliefs and behaviours that have occurred in the past 3 months" and are rated on a 1 (*never*) to 6 (*always*) point scale. The EDS – 21 provides total and subscale scores, with higher scores indicating more symptomatology. The scale also differentiates between at risk, nondependent-symptomatic and nondependent-asymptomatic individuals. Studies have shown the scale to possess acceptable test-retest ($r = 0.92$, $p = .001$) and internal reliability ($\alpha = 0.95$) whilst supporting its content and concurrent validity (e.g., Hausenblas & Symons Downs, 2002b).

Procedures

The current study was approved by the ethics subcommittee of a major University in the United Kingdom and constitutes a part of a larger data set reported elsewhere (author information will be disclosed if the manuscript is accepted). Participants were recruited in a number of different settings (e.g., sports clubs, public leisure centres, private fitness clubs and

retail outlets) in the West Midlands, UK. Participants were approached by the first author, who explained the purpose of the study, and asked if they were willing to complete a short questionnaire packet. Those who agreed to take part provided informed consent, responded to the multi-section inventory and returned the completed packet to the first author.

Results

Internal reliability, descriptive statistics and demographic differences

Internal consistency estimates (Cronbach's coefficient α) and descriptive statistics were computed for all variables (see Table 1). The results indicated that the assessment of competence need satisfaction, each of the motivational regulations and exercise dependence exhibited acceptable internal reliability. However, the alpha values for two of the psychological need satisfaction scales were marginal (autonomy α = .66; competence α = .63), and thus results based on these two variables should be interpreted with caution. The mean exercise dependence score was 57.50 (*SD* = 10.84) for symptomatic individuals and 33.70 (*SD* = 7.35) for asymptomatic individuals. For both symptomatic and asymptomatic participants, autonomy was the most highly satisfied psychological need, followed by relatedness and then competence. Intrinsic motivation was the most strongly endorsed exercise regulation for all participants, closely followed by identified regulation and integrated regulation.

An independent samples t-test revealed that males reported significantly higher exercise dependence scores (*M* = 49.65, *SD* = 15.25) than females (*M* = 45.49, *SD* = 14.67; $t(333) = 2.54$, $p = .01$). In addition, when participants were classified into 3 equal age groups (i.e., $\leq$24, 25-34, and $\geq$35), a one-way ANOVA revealed that exercise dependence scores decreased significantly with age ($F(2,314) = 9.55$, $p = .00$). Post hoc comparison using Tukey HSD test indicated that the mean exercise dependence score of participants below 24

years of age (*M* = 51.46, *SD* = 14.65), and those aged 25-34 (*M* = 48.58, *SD* = 16.04), were significantly higher than those over 35 years of age (*M* = 42.90, *SD* = 13.37).

Differences between symptomatic and asymptomatic participants on exercise need satisfaction, motivational regulations, and exercise behaviour

Separate one-way between-groups multivariate analyses of variance (MANOVA) were performed to investigate whether nondependent-symptomatic and asymptomatic exercise dependent participants differed in terms of a) reported exercise related psychological need satisfaction, b) motivational regulations for exercise, and c) exercise behaviour. Prior to running these analyses, an examination of the assumptions associated with MANOVA (Tabachnick & Fidell, 2001) revealed no serious violations.

There was a significant difference between symptomatic and asymptomatic individuals in need satisfaction via exercise: $F(3, 335) = 5.55$, $p = .00$; Pillai's Trace = .05; partial eta squared = .05. Follow-up univariate tests showed that the only difference to reach statistical significance was competence need satisfaction (Table 1). Symptomatic individuals (*M* = 5.13, *SD* = 0.90) reported significantly higher perceptions of competence need satisfaction via exercise than asymptomatic individuals (*M* = 4.76, *SD* = 0.94). A significant multivariate difference also emerged between symptomatic and asymptomatic individuals in terms of their motivational regulations: $F(5,333) = 21.52$, $p = .00$; Pillai's Trace = .24; partial eta squared = .24. Follow-up univariate tests revealed that symptomatic individuals reported higher external, introjected, identified and integrated regulations and intrinsic motivation than asymptomatic individuals (Table 1). A significant difference also emerged between symptomatic and asymptomatic individuals in terms of their exercise behaviour: $F(3,335) = 5.55$, $p = .00$; Pillai's Trace = .05; partial eta squared = .05. Follow-up univariate tests revealed that symptomatic individuals reported higher total and strenuous exercise behaviour than asymptomatic individuals (Table 1).

Predicting exercise behaviour of symptomatic and asymptomatic participants

To determine which motivation related variables predicted mild, moderate, strenuous and total self-reported exercise, separate hierarchical multiple regression analyses were conducted for both the nondependent-symptomatic and nondependent-asymptomatic groups. Examination of the assumptions associated with regression analyses (Tabachnick & Fidell, 2001) revealed no serious violations. Given their influence on exercise dependence, and the role they have been shown to play in predicting exercise behaviour in previous studies (e.g., DoH, 2004), gender and age were entered in the first step. Next, each of the 3 psychological needs were entered, as they are postulated to affect behavioural outcomes indirectly via the motivational regulations (Vallerand, 1997), which were entered in the final step.

For symptomatic individuals, the regression model was not significant for mild and moderate exercise. However, the model was significant and explained 17% of the variability in strenuous exercise and 9% of the variability in total exercise. Strenuous exercise was negatively predicted by age and positively by competence need satisfaction. Introjected regulation was shown to be a marginal positive predictor of strenuous exercise (Table 2). Age was the only significant predictor of total exercise (Table 2). With respect to asymptomatic individuals, the model was not significant for mild, moderate and total exercise. However, the model was significant and explained 22% of the variability in strenuous exercise behaviour of this group. Specifically, strenuous exercise was negatively predicted by age and positively by identified regulation (Table 3).

Results of the regression analyses suggest that for symptomatic and asymptomatic participants, introjected and identified regulation, respectively, may be mediating a relationship between competence need satisfaction and strenuous exercise. Thus we employed the regression procedures of Baron and Kenny (1986) to examine potential mediation effects. That is, to establish mediation, the predictor variable must have an effect

on the criterion variable, the predictor variable must have an effect on the mediator, and finally, the mediator must effect the criterion, after controlling for the predictor. To establish complete mediation, the effect of the predictor on the criterion should be zero in the third step of the analysis. Partial mediation occurs when this effect is reduced, but remains significant.

For symptomatic participants, introjected regulation was not found to mediate the relationship between competence need satisfaction and strenuous exercise. Whilst all 3 steps proposed by Baron and Kenny (1986) were met, and the standardized ß coefficient for competence dropped from ß = .32 (p = .00) to ß = .25 (p = .00) when introjected regulation was entered into the regression equation (Table 2), the Goodman I version of the Sobel test revealed that this drop was not significant (Z = -0.20, p = .08). For asymptomatic individuals, however, identified regulation was found to completely mediate the effect of competence need satisfaction on strenuous exercise behaviour. The standardized ß coefficient for competence dropped from ß = .26 (p = <.05) to ß = .13 (p = .25) when identified regulation was entered into the regression equation (Table 3). Using the Goodman I version of the Sobel test this was found to be a significant drop (Z = 2.76, p = .01).

Discussion

The current study had two main purposes. Firstly, we aimed to examine whether individuals classified as “at risk”, “nondependent-symptomatic” and “nondependent-asymptomatic” for exercise dependence (Hausenblas & Symons Downs, 2002b) differed in terms of the degree of psychological need satisfaction and self-determined motivation they reported. In addition, the present research aimed to determine whether different forms of motivational regulation predict self-reported exercise behaviour for different exercise dependence groups. However, substantiating claims that exercise dependence is a rare pathology (Veale, 1987; Morris, 1989), only 3.4% of our sample met criteria the criteria to be defined as “at risk” of exercise dependence. This prevented us from including the at risk

group in subsequent analyses. Nonetheless, supporting the suggestions of Hall and colleagues (2004) many more were classified as showing symptomatology of dependence, and thus comparisons could be made between symptomatic versus asymptomatic individuals.

Supporting our hypotheses, individuals classified as nondependent-symptomatic for exercise dependence reported higher levels of competence need satisfaction. As the former group also reported greater exercise involvement it makes sense that they would feel more competent in this domain. However, contrary to what was hypothesised, no differences were observed between symptomatic and asymptomatic individuals on the psychological needs for autonomy and relatedness. Further, symptomatic individuals displayed higher levels of autonomous motivation (i.e., identified and integrated regulation and intrinsic motivation) than asymptomatic participants. To explain these unexpected findings, it is important to consider the characteristics of the sample under investigation. Given that we were able to compare those individuals showing some, versus no symptomatology only, it remains possible that differences would have emerge if those individuals actually displaying this pathological behaviour were compared to non-dependent asymptomatics. Future research might consider securing larger numbers of “at risk” individuals for such comparisons. However, it should be acknowledged that recruiting a sufficient sample of “at risk” individuals for such analyses could be extremely difficult. A random sample of habitual exercisers is likely to contain very few, if any, cases of exercise dependence (Morris, 1989). The fact that only 12 participants in our current investigation met the criteria for “at risk” of exercise dependence, despite attempts to recruit participants from exercise settings where such individuals would most likely “workout,” gives credence to Morris’ (1989) proposition.

As hypothesized, nondependent symptomatic individuals reported higher levels of controlling motivational regulations (i.e., external and introjected regulations) compared to asymptomatics. Further, for individuals reporting some symptomatology of exercise

dependence, introjected regulation was found to a marginally significant predictor of strenuous exercise behaviour. Hall et al. (2004) suggested that perceptions of obligation to exercise may be a function of reduced self-determination, and thus, an increased sense of introjected regulation, anxiety, pressure and guilt may energise the behaviour of obligatory exercisers. Our finding revealing that the behaviour of symptomatic individuals' is regulated by introjected regulation supports these assertions, that is, for symptomatic individuals exercise behaviour is driven by internal pressures or compulsions, and is less volitional in nature. In contrast, asymptomatic individuals were found to be guided by more autonomous, identified, regulations. These findings demonstrate that the attachment of significant value to exercise (i.e., identified regulation), does not in itself appear to be associated with problematic behaviour (Robbins & Joseph, 1985).

The link observed between introjection and exercise behaviour for those showing symptoms of exercise dependence, but not in the case of individuals who are asymptomatic, supports suggestions that the quality of experience is likely to be very different for those guided by different regulatory styles (Ryan & Deci, 2000). To further understand and substantiate the negative effect of thwarted need satisfaction and less autonomous regulation on exercise engagement, future studies might consider investigating other affective and cognitive outcomes (e.g., enjoyment and commitment) associated with decreased self-determination in the exercise domain.

Consistent with previous research (Edmunds et al, 2004), intrinsic motivation was not a significant predictor of exercise behaviour for either group. This finding supports the proposition that intrinsic motivation may not be the most important predictor of engagement in the exercise domain, as people are unlikely to maintain regular exercise behaviour, with all the organization, commitment and often mundane/repetitive activities it entails, purely for the intrinsic reasons of fun or enjoyment (Mullan et al., 1997). However, Perrin (1979) found

that whereas new participants in physical activity programs reported health benefits as their reason for exercise adoption, long-term participants reported enjoyment as their principal reason for continuing. Future studies should adopt longitudinal methodologies in an attempt to determine the role of intrinsic motivation, and the other motivational regulations, in predicting sustained exercise participation.

In contrast to intrinsic motivation, competence need satisfaction did emerge as an independent predictor of strenuous exercise behaviour for nondependent-symptomatic individuals. Perceived competence can be compared to self-efficacy, that is, one's beliefs about their capabilities to produce performances that will lead to anticipated outcomes (Bandura, 1997). Self-efficacy has been proposed as the strongest cognitive determinant of exercise engagement (Sallis & Owen, 1998). The finding that competence need satisfaction emerged as an independent predictor of behaviour in this and other studies in the exercise domain (e.g., Edmunds et al., 2004), supports such claims.

It is interesting to note that that none of the psychological needs or motivational regulations proposed by SDT predicted mild and moderate exercise behaviours in the current study. However, in explicating this finding, we should keep in mind that the majority of mild and moderate exercise reported by participants in the present research was walking or cycling. Such activities could be considered more habitual in nature and may therefore require less cognitive processing than more structured and vigorous forms of exercise. Future work examining the psychological determinants which are specific to different forms of physical activity and exercise (e.g., habitual physical activity, organized exercise classes, organized sport) is warranted.

In the literature, there has been considerable debate as to whether exercise dependence is an independent disorder, or is a symptom of a deeper, more pervasive disturbance (Casper, Schoellerm Kushner, Hnilicka & Gold, 1991). In support of the latter

perspective, recent research has revealed strong links between exercise addiction and eating disorders (e.g., Davis et al., 1995; Zmijewski & Howard, 2003). In an attempt to resolve confusion surrounding these conditions, Veale (1987, 1995) proposed the terms primary and secondary exercise dependence to differentiate between excessive exercise as an independent pathology and as an associated feature of an underlying eating disorder. Clearly, the distinction between primary and secondary dependence is important when attempting to define, conceptualize and understand the aetiology of exercise dependence (Hausenblas & Symons Downs, 2002b). Hence the fact that we did not assess, and thus control for the effects of an underlying eating disorder in the current study may be considered problematic.

We should also note that few studies have drawn a clear distinction between exercise dependence and commitment to physical activity (Bamber, Cockerill, Rodgers & Carroll, 2000). Failing to include a measure of commitment in the current study prevents us from delineating these constructs and confirming that we are exploring differences in exercise dependence symptomatology as opposed to commitment to exercise. However, we feel that by adopting a classification system based on DSM-IV dependence criteria, rather than a continuum model of dependence, we can be more certain that symptomatology is being assessed in the present research. It has been suggested that the difference between the committed and dependent exerciser is that the former is invigorated and strengthened by exercise, whilst the latter has begun to see exercise as work rather than a source of enjoyment (Cockerill & Riddington, 1996). This description of the dependent exerciser reflects someone driven by introjected regulation, a significant predictor of exercise behaviour for symptomatic individuals in the current study. These similarities add credence to our arguments that we tapped exercise dependence symptomatology.

As a final caveat, we acknowledge that research has yet to clarify why a sense of volitional control becomes diminished in individuals displaying obligatory exercise (Hall et

al., 2004). Given that the present findings did not reveal differences in the psychological needs proposed to underpin self-determined motivation, we cannot unfortunately contribute to this question. In attempting to further understand the role of psychological needs in exercise dependence, future studies may benefit from extending the examination of need satisfaction beyond the exercise domain. Although symptomatic and asymptomatic groups did not differ in terms of the autonomy and relatedness need satisfaction derived from exercise, it remains possible that those showing symptoms of exercise dependence may report thwarted need satisfaction in other aspects of their life.

All in all, the current findings support claims that "social cognitive motivational variables are clearly implicated as antecedents of obligatory exercise" (Hall et al., 2004). Given the links revealed between exercise dependence symptomatology and autonomy disturbances, a number of practical implications can be proposed. Firstly, as previously advocated by Hamer and associates (2002), the motivational regulations proposed by SDT could be considered in the development of inventories designed to assist the successful diagnosis of exercise dependence. Early identification of those showing characteristics or symptoms of exercise dependence may help to halt its development (Bamber, Cockerill, Rodgers & Carroll, 2003). Further, interventions that focus on promoting psychological need satisfaction and self-determined forms of motivation (e.g., via the creation of autonomy supportive environments; Deci & Ryan, 1985) may be beneficial to individuals displaying dependence symptomatology.

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Footnotes

[1] Amotivation has been defined as representing "a state lacking of any intention to engage in behaviour" and constitutes a completely non-self-determined form of motivation (Markland & Tobin, 2004). Given that all participants in the current study engaged in at least some form of exercise, and the measurement tool selected to study motivation in the current study does not include a scale tapping it, amotivation is not discussed further in this study.

Table 1

Reliability Analyses (Cronbach's coefficient α), Descriptive Statistics, and Differences in Exercise Dependence, Exercise Behaviour, Psychological Need Satisfaction and Motivational Regulations for Nondependent-symptomatic and Nondependent-asymptomatic Individuals

		Exercise dependence category								
Variable	*N* = 399	Symptomatic (*n* = 198)			Asymptomatic (*n* = 141)					
	α	Range	*M*	*SD*	Range	*M*	*SD*	*F*	*p*	Partial eta square
Exercise dependence	.90	37 – 91	57.50	10.84	21 – 49	33.70	7.35	-	-	-
Total exercise	-	5 - 196	64.31	35.62	0 – 123	41.30	27.23	0.36	.55	.00
Strenuous exercise	-	0 – 171	44.27	30.58	0 – 81	18.38	19.18	1.37	.24	.00
Moderate exercise	-	0 - 42	12.78	17.85	0 – 36	15.07	17.67	78.91	00	.19
Mild exercise	-	0 – 100	7.26	8.96	0 – 85	7.85	9.15	41.51	.00	11
Autonomy	.66	3.43 – 7	5.49	0.83	2.86 – 7	5.47	0.82	.04	.83	.00
Relatedness	.85	1.75 – 7	5.15	1.14	1.75 – 7	4.97	1.21	2.07	.15	.01
Competence	.63	2.17 – 7	5.13	0.90	2.17 – 7	4.76	0.94	13.71	.00	.04
External regulation	.72	1 – 3.25	1.36	0.52	1 – 3.5	1.25	0.43	4.36	.04	.01

Introjected regulation	.69	1 – 4.33	2.09	0.84	1 – 4	1.67	0.73	23.32	.00	.07
Identified regulation	.79	1 – 5	3.73	0.76	1 – 5	2.99	0.90	66.21	.00	.16
Integrated regulation	.77	1 – 5	3.80	0.80	1 – 5	2.27	0.87	96.39	.00	.22
Intrinsic motivation	.92	1 – 5	3.81	0.87	1 - 5	3.13	1.06	41.50	.00	.11

Note: No α values are provided for total, strenuous, mild or moderate exercise as these are single-item variables.

Table 2

Summary of Hierarchical Regression Analyses Predicting Total and Strenuous Exercise Behaviors from Gender, Age, Psychological Need Satisfaction and Motivational Regulations for Individuals Nondependent-symptomatic for Exercise Dependence.

Total Exercise				*Strenuous Exercise*			
Independent variable	*Adj.* R^2	ß	*t*	Independent variable	*Adj.* R^2	ß	*t*
Step 1:	.04			Step 1:	.07		
$F(2, 184) = 4.61$, $p<.01$				$F(2, 184) = 7.82$, $p<.00$			
Gender		.01	.15	Gender		-.11	-1.45
Age		-.22	-3.03**	Age		-.25	-3.49**
Step 2:	.09			Step 2:	.15		
$F(3, 181) = 4.86$, $p<.00$				$F(3, 181) = 7.53$, $p<.00$			
Gender		.07	.99	Gender		-.04	-.53
Age		-.23	-3.10**	Age		-.23	-3.09**
Autonomy		.16	1.79	Autonomy		.01	.17
Relatedness		.01	.05	Relatedness		-.02	-.20
Competence		.16	1.76	Competence		.32	3.70**
Step 3:	.09			Step 3:	.17		
$F(5, 176) = 2.84$, $p<.00$				$F(5, 176) = 4.79$, $p<.00$			
Gender		.04	.48	Gender		-.09	-1.19
Age		-.22	-2.85**	Age		-.21	-2.87**
Autonomy		.15	1.67	Autonomy		.02	.20
Relatedness		-.03	-.27	Relatedness		-.04	-.42
Competence		.11	1.10	Competence		.25	2.55*
External regulation		-.05	-.63	External regulation		-.15	-1.91

Introjected regulation	.05	.61	Introjected regulation	.16	1.94[1]
Identified regulation	.11	1.10	Identified regulation	.03	.27
Integrated regulation	-.07	-.65	Integrated regulation	.03	.30
Intrinsic motivation	.07	.74	Intrinsic motivation	.06	.62

Note: N = 187. * p <.05. ** p <.01. [1] Introjected regulation p = .054

Table 3

Summary of Hierarchical Regression Analyses Predicting Strenuous Exercise Behaviour from Gender, Age, Psychological Need Satisfaction and Motivational Regulations for Individuals Nondependent-asymptomatic for Exercise Dependence.

Independent variable	*Adj.* R^2	ß	t
Step 1: $F(1, 127) = 8.92$, $p<.00$	.11		
Gender		-.06	-.66
Age		-.35	-4.22**
Step 2: $F(3, 124) = 5.16$, $p<.00$	.14		
Gender		-.06	-.73
Age		-.33	-4.03**
Autonomy		-.03	-.28
Relatedness		-.15	-1.60
Competence		.26	2.59*
Step 3: $F(5, 119) = 4.62$, $p<.00$	.22		
Gender		-.15	-1.74
Age		-.37	-4.55**
Autonomy		-.13	-1.36
Relatedness		-.07	-.69
Competence		.13	1.21
External regulation		-.14	-1.50
Introjected regulation		-.03	-.25
Identified regulation		.40	3.12**
Integrated regulation		-.05	-.47
Intrinsic motivation		.00	.01

Note: N = 130. * p <.05. ** p <.01