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2 Running head: Exercise Dependence  
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12 **Motives for Exercise Participation as Predictors of Exercise**  
13 **Dependence Among Endurance Athletes**

14  
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1 **Background.** To investigate whether motives for exercise participation predicted  
2 exercise dependence (ED) among endurance athletes. The rationale for the study  
3 centred upon a test of the affect regulation model utilising constructs that form part of  
4 the Self-Determination Theory as predictors of ED. It was hypothesised that non self-  
5 determined motivation, specifically external regulation, would be predictive of ED.

6 **Methods. Design:** correlational design, with a time gap between predictor and  
7 dependent variables. **Settings:** competitive sports environment. **Participants:** 188  
8 competitive endurance athletes were recruited from amateur sports clubs.

9 **Interventions:** none. **Measures:** the Behavioural Regulation in Exercise Questionnaire  
10 was administered before a training session to measure the predictor variables (motives  
11 for exercise participation), and the Running Addiction Scale was administered before a  
12 similar training session, one week later, to measure the dependent variable (ED).

13 **Results.** Multiple regression analysis revealed that the strongest predictor variable of  
14 ED was introjected regulation ( $\beta = .29, p < .001$ ), followed by identified regulation ( $\beta =$   
15  $.19, p < .05$ ). External regulation and intrinsic motivation were weak and non-  
16 significant predictors. The total variance in ED explained by the exercise participation  
17 motives was 15% ( $R^2 = 0.15$ ).

18 **Conclusions.** ED was predicted by motives that did not support the tenets of the affect  
19 regulation model. Results are discussed in light of the potential influence of exercise  
20 participation motives on ED and their implications for intervention strategies and  
21 diagnosis of the ED syndrome.

22  
23 **KEY WORDS:** Exercise dependence - Exercise participation motives - Endurance athletes.

24  
25 Exercise dependence (ED) has been reported to be prevalent among endurance athletes and

1 may result in serious psychological and physiological consequences.<sup>1</sup> Conceptually,  
2 dependence or addiction to sport and exercise may be viewed as a process that compels an  
3 individual to continue with an activity in spite of obstacles, such as medical contra-  
4 indications, work or family commitments. Withdrawal from participation may result in  
5 physical and psychological symptoms, such as insomnia, irritability, and depression.<sup>2</sup>  
6 However, the prevalence and existence of ED as a pathological disorder remains  
7 controversial. For example, Veale<sup>3</sup> has argued that primary ED is exceptionally rare, whilst  
8 other researchers<sup>4 5</sup> have reported extremely high prevalence rates. Therefore, the  
9 identification of the antecedents of ED may provide valuable information for clinicians to  
10 reach more accurate diagnosis and to implement successful intervention strategies for  
11 exercise dependent individuals.

12 In an attempt to identify the antecedents of ED, researchers have proposed several  
13 hypotheses which include the  $\beta$ -endorphin hypothesis,<sup>6</sup> the sympathetic arousal hypothesis,<sup>7</sup>  
14 the anorexia analogue hypothesis,<sup>8</sup> and the affect regulation model.<sup>9</sup> The  $\beta$ -endorphin  
15 hypothesis,<sup>6</sup> which is based on reports of acquired physical dependence on endogenous  
16 opiates, released during exercise,<sup>10</sup> remains in doubt on the grounds that the insulating  
17 function provided by the blood-brain barrier may preclude any association between plasma  
18 endorphins and central nervous system activity.<sup>6</sup> The anorexia analogue hypothesis<sup>8</sup> is based  
19 upon the premise that compulsive exercisers closely resemble anorexics in terms of their  
20 personality characteristics where both phenomena represent an attempt to establish an  
21 identity. The anorexia analogue hypothesis has been supported by research<sup>11</sup> demonstrating  
22 that exercise dependent runners displayed significantly higher levels of 'perfectionism' and  
23 'trait anxiety' in comparison with a control group; however, no differences were observed for  
24 'sense of identity' and 'trait anger'. Other workers<sup>12 13</sup> have rejected the anorexia analogue  
25 hypothesis on the premise that obligatory runners demonstrated no evidence of

1 psychopathology in comparison with anorexic patients. The affect regulation model has been  
2 supported by evidence provided from the exercise deprivation literature,<sup>2 14 15 16 17</sup> and  
3 represents a framework that is closely linked with motivation theory.

4 *Affect Regulation Model.* The affect regulation model was developed by Tomkins<sup>9</sup> as  
5 a theory of smoking behaviour, although more recently, it has been used to explain exercise  
6 dependent behaviour.<sup>18</sup> The model is based upon the means-end paradigm, the implications  
7 being that individuals who develop ED view exercise initially as a method to avoid or reduce  
8 negative affect. Thus, there is a means-end relationship between exercise and negative affect.  
9 The experience of needing to reduce negative affect without being able to exercise may then  
10 transform this relationship into a dependency. This suffering from not being able to exercise  
11 increases, replacing and attenuating the original suffering from needing to reduce negative  
12 affect; the means has for the moment become much more important than the end. The  
13 individual is far more concerned about not being able to exercise than about reducing present  
14 negative affect, which the exercise would normally provide. The underlying mechanism of  
15 this change is the shift of attention towards the missing exercise and the now rapidly  
16 increasing negative affect that this generates.

17 *Motivation and Exercise Dependence.* The relationship between exercise motivation  
18 and ED has received little attention in the literature. It has been suggested<sup>19</sup> that motives for  
19 exercise may be a key antecedent of ED. Specifically, such motives represent extrinsic  
20 motivation, which is characterised by participation to gain a reward, which is external to the  
21 process of participation. This is the conceptual opposite of intrinsic motivation, which is  
22 characterised by engagement in an activity for the pleasure and satisfaction that can be  
23 derived from the process of participation. Deci and Ryan's<sup>20 21 22</sup> Self-Determination Theory  
24 (SDT) postulates that behaviour can be either extrinsically motivated, intrinsically motivated,  
25 or amotivated. In contrast to the traditional unidimensional conceptualisations of extrinsic

1 motivation, Deci and Ryan have proposed that four types of extrinsic motivation exist;  
2 “external regulation”, “introjected regulation”, “identified regulation” and “integrated  
3 regulation”. The identified and integrated regulations are self-determined in nature. That is,  
4 under such forms of extrinsic motivation, individuals experience a greater sense of choice in  
5 participating in an activity when compared to the remaining forms of extrinsic motivation.  
6 Behaviour is externally regulated when it is determined by reasons external to the process of  
7 participation such as gaining rewards or avoiding the negative consequences of not  
8 exercising. For example, exercising in order to avoid negative consequences that may include  
9 the reduction of negative affect. Introjected regulation represents internalisation of external  
10 control, which is applied to the self through the administration of sanctions, pressures and  
11 other controlling behaviours. An example is an athlete who sets unrealistically high goals  
12 owing to a fear of social rejection from fellow athletes. Identified regulation is behaviour that  
13 is considered to be important to an individual and highly valued by them. An example is  
14 someone who is aware of the potential health benefits of regular exercise and chooses to  
15 participate to accrue such benefits. Finally, integrated regulation is also characterised by  
16 choice as the behaviour is in total coherence with other aspects of the self such as needs and  
17 values. In summary, SDT highlights the importance of self-determined behaviour for  
18 constructive social development and personal well-being. Thus, the more positive behavioural  
19 consequences are produced by self-determined forms of motivation (intrinsic motivation,  
20 integrated regulation, and identified regulation) whereas the more negative consequences are  
21 produced by non self-determined forms of motivation (introjected and external regulation).

22         The purpose of the present study was to test the affect regulation model by utilising  
23 the constructs that form part of the SDT as predictors of ED. Accordingly, since the affect  
24 regulation model describes a type of behavioural regulation it may be integrated into the  
25 framework of SDT. The affect regulation model represents a form of non self-determined

1 behaviour and more specifically, externally regulated behaviour, since the exercise dependent  
2 individual performs exercise to avoid negative affect with an externally perceived locus of  
3 causality. Affect regulation behaviour is controlled by an external factor that is the avoidance  
4 of negative affect that results from not exercising. Therefore, it was hypothesised that the  
5 relationship between ED and motives for exercise would demonstrate a continuum, where the  
6 more non self-determined the motivation, the stronger it would predict ED. Thus, external  
7 regulation would be the strongest and most positive predictor of ED, followed by introjected  
8 regulation, whereas the more self-determined forms of motivation (identified regulation and  
9 intrinsic motivation) would demonstrate weak or no association with ED among endurance  
10 athletes. In summary, the affect regulation model is based upon a non self-determined type of  
11 motivation, which, as suggested by SDT, will promote negative behavioural consequences, of  
12 which ED is considered as such.<sup>14</sup>

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14

## Materials and Methods

### *Participants*

16 The sample comprised 188 volunteers who were endurance athletes of club level  
17 ability. There were 147 males (77.5%) and 41 females (22.5%). The age of the participants  
18 ranged from 18 to 69 yrs [ $M = 35.8$  ( $SD = 9.9$  yrs)]. Participants were recruited from a variety  
19 of amateur sports clubs that included: St. Albans Striders Running Club, Tri-Force Herts  
20 Triathlon Club, and City of St. Albans Swimming Club. They were also recruited at the 1999  
21 National Cross-Country Championships, Newark and at the 1999 Guernsey Powerman  
22 Duathlon (running and cycling).

23

## 1 *Materials*

2           *Behavioural Regulation in Exercise Questionnaire (BREQ)*. — The BREQ is a 15-  
3 item questionnaire used to identify the motives for which people participate in exercise.<sup>23</sup>  
4 Four types of motivation are measured; external regulation (EXT: e.g., “I exercise because  
5 other people say I should”), introjected regulation (IJ: e.g., “I feel like a failure when I haven’t  
6 exercised for a while”), identified regulation (ID: e.g., “I value the benefits of exercise”), and  
7 intrinsic motivation (IM: e.g., “I find exercise a pleasurable activity”). Participants are  
8 requested to register their degree of agreement on a 5-point Likert-type scale from “not true  
9 for me” = 0, to “very true for me” = 4. Mullan *et al.*<sup>23</sup> provided evidence of the psychometric  
10 integrity of the BREQ with a sample of 310 exercise participants. Using confirmatory factor  
11 analysis, the BREQ factor structure demonstrated a good fit to the data (Satorra-Bentler  
12 Scaled  $X^2 = 172.93$ ,  $df = 84$ ,  $p < 0.001$ ,  $GFI = .91$ ,  $NNFI = .92$ ,  $RMSEA = .07$ ) and the  
13 subscales demonstrated satisfactory internal consistency indices using Cronbach’s (1951)  $\alpha$   
14 (EXT = .79, IJ = .78, ID = .79, and IM = .90).

15           *Running Addiction Scale (RAS)*. — The RAS is an 11-item questionnaire used to  
16 assess ED,<sup>24</sup> consisting of statements regarding the characteristics associated with running  
17 addiction; for example, running with an injury. The questionnaire was modified slightly, by  
18 replacing the term “running” with “training”, in order to make the statements specific to all  
19 athletes in the present sample. Participants were asked to respond to each item using a 5-point  
20 Likert-type scale ranging from “strongly agree” = 1 to “strongly disagree” = 5. Using a  
21 sample of 32 male and 15 female club runners, Chapman *et al.*<sup>24</sup> demonstrated that the RAS  
22 possessed an acceptable level of internal consistency ( $\alpha = 0.82$ ). The authors also claimed  
23 that the RAS possessed strong concurrent validity since significant correlations were obtained  
24 between the RAS and self-rated addiction for males and females, respectively (males:  $r =$   
25  $0.664$ ,  $p < 0.05$ ; females:  $r = 0.753$ ,  $p < 0.05$ ). In addition, evidence for construct validity was

1 also demonstrated through correlations between the RAS and scores for discomfort when a  
2 scheduled run was missed for males and females (males:  $r = 0.475$ ,  $p < 0.05$ ; females:  $r =$   
3  $0.391$ ,  $p < 0.05$ ).

#### 4 *Procedure*

5 The study was approved by the Brunel University, Department of Sport Sciences  
6 ethics committee. Amateur endurance athletes were approached at their clubs. The general  
7 purpose of the study was explained and assurances were made to the participants that the  
8 study did not involve any potential danger. Confidentiality was assured and subsequently,  
9 informed consent was sought from all volunteers. The BREQ was administered prior to  
10 initiation of that day's training session. The RAS was administered before initiation of a  
11 training session exactly one week later. This decision was made to help establish the validity  
12 of the relationship.<sup>25</sup>

#### 13 *Statistical Analysis*

14 First, multivariate outliers were identified using the Mahalanobis' distance method.  
15 Cases with  $X^2_5 > 15.0$  ( $p < 0.001$ ) were deleted from the sample. In addition, univariate  
16 outliers were identified by checking for z scores  $> \pm 3.29$ .<sup>26</sup> Such cases were transformed by  
17 reducing the raw score by one unit, until the z score was within the normal range ( $\pm 3.29$ ).<sup>26</sup>

18 The second stage involved the use of standard multiple regression analysis to predict  
19 the criterion of ED score from the predictors comprising the four BREQ subscales. Owing to  
20 the correlational design employed in the present study, a statistically significant relationship  
21 between variables could not be inferred to represent causality; however, the configuration of  
22 the present design, with a time gap between the predictor and dependent variables, does  
23 increase confidence regarding the directionality of the relationships.<sup>25</sup>

24

## Results

### *Removal of Outliers*

Four multivariate outliers were identified and removed using the Mahalanobis' distance method. Two univariate outliers were identified and transformed.

### *Descriptive Statistics*

An examination of the means showed that the present sample reported that they participated predominantly for identified and intrinsic reasons rather than for external and introjected reasons. The mean ED score of 35.55 for the sample represented an average response of three on the Likert scale for each item on the RAS. The proportion of the sample with scores  $\geq 44$  on the RAS (representing a response of four or more on the Likert scale for each item) was 11%. Table I provides a summary of the descriptive statistics for the exercise motives and exercise dependence variables.

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Insert Table I about here

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### *Multiple Regression Analysis*

Multiple regression analysis to predict ED from the BREQ scores indicated that, introjected regulation was the strongest predictor of ED ( $\beta = 0.29$ ,  $p < 0.001$ ), followed by identified regulation ( $\beta = 0.19$ ,  $p < 0.05$ ). External regulation and intrinsic motivation were weak and not statistically significant predictors of ED. The total variance in ED explained by the exercise participation motives was 15%. Table II provides a summary of the multiple regression analysis.

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Insert Table II about here

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## Discussion

The purpose of the present study was to test the affect regulation model<sup>9</sup> in the context of SDT.<sup>20 21 22</sup> The results provided partial support for the research hypothesis. Specifically, introjected regulation, a non self-determined form of extrinsic motivation, demonstrated a positive association with self-reports of ED, and was the strongest predictor variable; intrinsic motivation, the most self-determined form of motivation was not a significant predictor variable. However, the strongest non self-determined form of extrinsic motivation, external regulation, was a weak and non-significant predictor. Also, identified regulation demonstrated an unexpected positive association with ED, and was the second strongest predictor variable despite the fact that the prediction was very weak.

The finding that external regulation was not a predictor of ED suggests that the implications of the affect regulation model are not supported by the present data. As introjected regulation was found to be the strongest predictor of ED, this suggests that behaviour which is performed to avoid guilt or anxiety, and/or to attain ego-enhancements such as pride, is more closely related to exercise dependent-type behaviour. Introjected behaviour is closely comparable to the type of behaviour described in the anorexia analogue hypothesis,<sup>8</sup> which draws comparisons between obligatory runners and anorexia nervosa. Yates *et al*<sup>8 27</sup> describe five functions that are derived from these behaviours. Self-control is the primary function of both anorexics and obligatory exercisers, where pursuing an ideal self is a means of achieving ego-enhancement and establishing self-identity. For example, an individual with an uncertain identity and low self-esteem may experience exaggerated anxiety about physical ineffectiveness, thus the solution is a fanatic devotion to physical prowess. Thus, the motive of the obligatory exerciser is to have control, but eventually, they are themselves controlled by the exercise. Their behaviour is therefore internally driven but has an external perceived locus of causality and is not really experienced as part of self. Yates *et*

1 *al* further describe obligatory exercisers as displaying defence against receptive pleasure,  
2 suggesting that obligatory exercisers resist anything which provides gratification, thus they  
3 are unable to enjoy doing things for their own sake. This demonstrates a type of behaviour  
4 that is strongly non self-determined. It does remain possible that what has been interpreted as  
5 primary exercise dependence may be an expression of an underlying eating disorder; research  
6 has documented the role of physical activity and exercise in the development of eating  
7 disorders.<sup>28</sup> Also, significantly higher levels of psychological morbidity, neuroticism,  
8 dispositional addictiveness, impulsiveness, and lower self esteem have been observed among  
9 individuals identified with secondary ED (coincidence of ED and an eating disorder)  
10 compared with those identified with primary ED.<sup>29</sup> This suggests that in the absence of an  
11 eating disorder, primary ED does not warrant pathological status.

12         The unexpected finding of a weak positive relationship between identified regulation  
13 and ED may be explained in part by Ogles *et al.*<sup>19</sup> who proposed that what is often observed  
14 to be ED overlaps substantially with competitive and achievement motives. Further research<sup>30</sup>  
15 has examined the relationship between competitive and recreational sport structures and  
16 athletes' motivation for sport. The findings suggest a relationship between the competitive  
17 sports structure and identified regulation. The authors<sup>30</sup> related this finding to the fact that  
18 competitive athletes are usually highly committed to their sport and therefore, probably come  
19 to identify with and accept their choice to participate in this type of structure and invest in  
20 demanding sport activities. Therefore, if those subjects in the present study who scored highly  
21 on the ED scale, were highly committed and orientated to high levels of competitiveness and  
22 achievement, this may go some way towards explaining the fact that identified regulation was  
23 a strong predictor of ED. The conceptual issues surrounding the differentiation of ED and  
24 competitive/achievement motives create difficulties in attempting to measure ED.  
25 Competitive athletes display a high level of commitment to their sport; however, this level of

1 commitment may only become detrimental when exercise is contra-indicative to the athlete's  
2 health or perpetuates other social problems. Cockerill *et al.*<sup>31</sup> pointed out that the difference  
3 between the committed and the compulsive exerciser is that the former is invigorated and  
4 strengthened by exercise, while the latter has begun to see exercise as work and no longer  
5 enjoys the pleasure that it once provided. The differentiation of ED and commitment  
6 confounds the controversy surrounding the issue of ED prevalence.<sup>3,4,5</sup> Although it was  
7 impossible to ascertain whether any of the present sample were pathologically exercise  
8 dependent, only 11% of the sample gained scores which were possibly indicative of ED or the  
9 potential to develop ED. As such, this is supportive of the notion that ED is a rare occurrence.<sup>3</sup>

10         The present finding that motives for exercise only accounted for 15% of the total  
11 variance in ED score suggests that the determinants of ED may be multiple. In fact, previous  
12 researchers<sup>27</sup> have stated that an appropriate research model may incorporate biological,  
13 sociocultural, situational, and psychological factors. To this end, an instrument has been  
14 developed [the Self-Perception Inventory (SPI)<sup>31</sup>] that is currently undergoing a rigorous  
15 examination of validity and reliability. As well as providing a global measure of self-  
16 perception, the SPI incorporates six cluster-scale scores that include ED, eating control,  
17 obsessional control, body satisfaction, self-esteem and self efficacy, together with a social-  
18 desirability scale.<sup>31</sup> Although the SPI represents a possible framework for a future ED  
19 inventory, the present findings indicate that motives for exercise are an important antecedent  
20 of ED and must be considered in the development of any future inventory designed to assist  
21 in the successful diagnosis of ED.

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### Conclusions

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The present findings have practical implications as they indicate that the type of motivation displayed among individuals who reported scoring highly on the ED scale is that

1 of introjected regulation. Therefore, if ED is substantiated as a pathological disorder, then  
2 using an approach that considers motives for exercise participation as predictors of ED may  
3 prove successful in both deterring the onset and aiding the treatment of ED. From the present  
4 findings, it would seem appropriate to undertake interventions that promote self-determined  
5 forms of behaviour among various sport and exercise groups, and in those individuals already  
6 demonstrating signs of ED or diagnosed as such. Such interventions may focus upon  
7 situational factors that facilitate perceptions of competence, autonomy and relatedness which,  
8 according to Deci and Ryan,<sup>20-22</sup> will increase the level of situational intrinsic motivation and  
9 self-determined forms of motivation.

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1 Table I.— *Descriptive statistics for exercise motives and exercise dependence (n =188)*

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3 Variable	M	SD	Range
5 External regulation	0.21	0.40	0.00 - 1.50
6 Introjected regulation	1.96	1.12	0.00 - 4.00
7 Identified regulation	3.56	0.45	2.25 - 4.00
8 Intrinsic motivation	3.31	0.59	2.00 - 4.00
9 Exercise dependence	35.52	5.54	22.00 - 51.00

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1 Table II.— *Multiple regression to predict ED from BREQ subscales (n=184)*


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Dependent Variable	Predictor Variable	Standardised
		Beta
ED score	Introjected regulation	0.29*
	Identified regulation	0.19#
	External regulation	-0.13
	Intrinsic motivation	-0.04
R = 0.39		
R <sup>2</sup> = 0.15		

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13 \*p<0.001; # p<0.05. Multiple R and Adjusted R<sup>2</sup> are cumulative.