

# The pathological status of exercise dependence

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## Abstract

**Objectives**—This study was concerned with the concept of exercise dependence. Levels of psychological morbidity, personality profiles, and exercise beliefs were compared among subjects screened for exercise dependence and eating disorders.

**Method**—Adult female exercisers were allocated on the basis of questionnaire screening to one of the following groups: primary exercise dependence (n = 43); secondary exercise dependence, where there was the coincidence of exercise dependence and an eating disorder (n = 27); eating disorder (n = 14); control, where there was no evidence of either exercise dependence or eating disorder (n = 110). Questionnaire assessment was undertaken of psychological morbidity, self esteem, weight and body shape dissatisfaction, personality, and exercise beliefs.

**Results**—Aside from a higher incidence of reported menstrual abnormalities, the primary exercise dependence group was largely indistinguishable from the controls. In stark contrast, the secondary exercise dependence group reported higher levels of psychological morbidity, neuroticism, dispositional addictiveness, and impulsiveness, lower self esteem, greater concern with body shape and weight, as well as with the social, psychological, and aesthetic costs of not exercising than the controls, but differed little from the eating disorder group.

**Conclusions**—In the absence of an eating disorder, women identified as being exercise dependent do not exhibit the sorts of personality characteristics and levels of psychological distress that warrant the construction of primary exercise dependence as a widespread pathology.

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Keywords: exercise dependence; eating disorders; personality; self esteem; neuroticism; psychological morbidity

It has been argued that exercising has the potential to become an all consuming and damaging obsession.<sup>1</sup> Reported characteristics of an unhealthy preoccupation with exercise have included: experience of withdrawal symptoms on cessation of exercise; increasing toler-

ance; disturbed psychological functioning; exercising despite medical contraindications; interference with relationships or work.<sup>1-3</sup> Analogies have been drawn between such characteristics and those that typify behavioural dependencies, for example, pathological gambling and substance dependence. Labels such as “negative addiction”,<sup>1</sup> “obligatory exercising”,<sup>4</sup> and “exercise dependence”,<sup>5</sup> have been used to describe seemingly problematic exercising. Indeed, it has been proposed that “primary exercise dependence” warrants recognition as a clinical disorder in its own right, with the defining characteristics summarised in table 1.<sup>6</sup>

However, the eagerness to “pathologise” exercise dependence may be somewhat premature; there is, as yet, little systematic empirical evidence to support the concept of primary exercise dependence.

Further, it remains possible that what has been interpreted as primary exercise dependence may be an expression of an underlying eating disorder. Excessive exercising is widely reported to co-exist with eating disorders.<sup>7</sup> Indeed, many of the reported characteristics of exercise dependence are also common among eating disorder sufferers.<sup>8</sup> For example, one study described 28% of eating disorder patients as “compulsive exercisers”,<sup>9</sup> while another reported that 93% of eating disorder patients felt their need to be physically active was out of control, with 78% described as exercising excessively.<sup>10</sup> The concept of “secondary exercise dependence” has been used to describe instances of excessive exercising associated with an eating disorder.<sup>6</sup>

Estimates of the prevalence of exercise dependence vary appreciably. It has been argued that primary exercise dependence is exceptionally rare,<sup>6</sup> and the sizeable number of single case studies in the literature may be considered as supportive of this contention.<sup>11 12</sup> Indeed, one study of 188 male and female exercisers and runners concluded that none could be considered to be extremely addicted.<sup>13</sup> In contrast, other studies have reported alarmingly high prevalence rates. For example, studies have classified 22% of 49 male and female runners as “highly addicted”,<sup>14</sup> 26% of 240 male and 25% of 84 female runners as “obligatory exercisers”,<sup>15</sup> and 77% of a sample of 40 male runners as “moderately or highly addicted to running”.<sup>16</sup> However, it is difficult to

Table 1 Operational criteria for primary exercise dependence<sup>6</sup>

1. Preoccupation with exercise becomes stereotyped and routine
2. Significant withdrawal symptoms in the absence of exercise (e.g. mood swings, irritability, insomnia)
3. The preoccupation causes clinically significant distress or impairment in their physical, social, occupational, or other important areas of functioning.
4. The preoccupation with exercise is not better accounted for by another mental disorder (e.g. as a means of losing weight or controlling calorie intake as in an eating disorder).

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know how much credence to attach to such estimates of prevalence, given the limitations of previous measuring tools and the possible confusion between commitment and dependence.<sup>17</sup> Further, as none of these studies screened for symptoms of eating disorders, they are undoubtedly confounding primary and secondary exercise dependence and, accordingly, exaggerating the prevalence of primary exercise dependence.

If primary exercise dependence is pathological, sufferers should display clear evidence of psychological morbidity at levels comparable with those documented for other behavioural pathologies.<sup>18</sup> For example, a recent study of pathological gamblers showed that 60% had a lifetime mood disorder, 40% a lifetime anxiety disorder, and 87% a personality disorder.<sup>19</sup> Similarly, 60% of heroin addicts have been found to meet the criteria for a lifetime anxiety disorder, and 41% were diagnosed with a depressive illness.<sup>20</sup> With regard to exercise dependence, there have been extensive reports of negative affect associated with exercise withdrawal; the most commonly reported symptoms were guilt, anxiety, depression, and irritability.<sup>1, 2, 8</sup> However, the severity of such psychological distress and its clinical status remain to be determined. Moreover, if exercise dependence is a primary clinical disorder, then disturbed psychological functioning would be expected to be associated with involvement in exercise. As yet, however, studies of negative affect have tended to focus on psychological responses to exercise withdrawal; there has been little attention paid to whether psychological disturbance and distress are generally characteristic of exercise dependence.

Certain personality dispositions have been found to be common among those with behavioural pathologies. For example, pathological gamblers have been reported to score significantly more highly than non-pathological gamblers on measures of psychoticism and impulsivity.<sup>21, 22</sup> Similarly, high levels of psychoticism have also been widely reported among heroin addicts.<sup>21</sup> Drug addicts have also been found to score significantly more highly than non-addicts on addictiveness as measured by the Eysenck personality questionnaire.<sup>23</sup> If exercise dependence is indeed pathological, sufferers should display personality traits similar to those observed in other pathologies. As yet, there has been little exploration of the personality characteristics of people regarded as being exercise dependent. Indeed, the one study that has examined addictiveness in this context found an inverse relation between addictiveness and obligatory exercise.<sup>24</sup> Patients with eating disorders are also characterised by particular personality profiles. As with pathological gamblers, people with bulimia have been found consistently to show high levels of impulsivity,<sup>25</sup> and the addictiveness scores of bulimics resemble those of drug addicts.<sup>26</sup> The presence of mood disturbance and anxiety in patients with an eating disorder is also well established.<sup>27</sup> These findings suggest that secondary exercise dependence, given its co-occurrence with eating disorders, should be

associated with disturbances in affect and a personality profile characteristic of other behavioural pathologies. However, there is little or no indication as to whether similar patterns of psychological distress and personality typify those identified as being primary exercise dependent.

Remarkably, no studies of exercise dependence have examined psychological disturbance and personality while screening for symptoms of eating disorders in a systematic fashion. This study measured the levels of psychological morbidity and the personality profiles of people screened for eating disorders and, accordingly, identified as being either primary or secondary exercise dependent. For comparison, the study also included people with eating disorders but no evidence of exercise dependence and those without either exercise dependence or an eating disorder.

## Methods

### PARTICIPANTS

Questionnaires were administered to 291 young adult women, recruited from a variety of sources: aerobic dance classes; university and community sports centres; university cross country and athletics clubs; local running clubs; members of the Eating Disorders Association; referrals from a psychiatrist; inpatients and outpatients at a private eating disorder clinic; university counselling services; readers of *Athletics Weekly* magazine; the *Runners World* magazine buddy scheme; and athletes involved with the United Kingdom Athletics Organisation. As, in part, interest lay with the interaction of exercise dependence and eating disorders, this study focused on women, given the relatively high prevalence of eating disorders in women. Completed questionnaires were returned by 194 (67%) who, accordingly, comprised the effective sample. Their mean (SD) age was 28.8 (8.39) years, mean (SD) body mass index 21.7 (3.08), and mean (SD) age at menarche 13.4 (1.75) years. The vast majority of participants were white (90.2%); 6.7% identified themselves as Afro-Caribbean, and 2.1% as Asian. In terms of marital status, 73.1% were single and 26.9% were married or had a partner.

### MATERIALS

The questionnaire package administered contained the following instruments.

#### *Exercise dependence questionnaire (EDQ)*

The EDQ is a 29 item measure designed to examine possible relations between exercise dependence and eating disorders and to differentiate between primary and secondary exercise dependence.<sup>17</sup> Dependence is calculated on the basis of scores on eight subscales. The internal reliability (Cronbach's  $\alpha$ ) of each subscale is: withdrawal symptoms,  $\alpha = 0.80$ ; exercise for weight control,  $\alpha = 0.78$ ; positive reward,  $\alpha = 0.80$ ; stereotyped behaviour,  $\alpha = 0.52$ ; interference with family/social life,  $\alpha = 0.81$ ; positive reward,  $\alpha = 0.80$ ; insight into problem,  $\alpha = 0.76$ ; exercise for health reasons,  $\alpha = 0.70$ ; total score,  $\alpha = 0.84$ . Participants

were considered possibly to be exercise dependent if their scores on the EDQ were  $\geq 116$ . As items were scored on a 1–7 point Likert scale, this cut off represents an average of a score of at least 4 per item.

#### *Eating disorder examination self report questionnaire (EDE-Q)*

The EDE-Q, a 36 item questionnaire version of the eating disorders examination, was used to screen for symptoms of eating disorders.<sup>28</sup> For women, the EDE-Q subscales have acceptable internal consistency and test-retest reliability: restraint,  $\alpha = 0.84$ ,  $r = 0.81$ ; shape concern,  $\alpha = 0.93$ ,  $r = 0.94$ ; weight concern,  $\alpha = 0.89$ ,  $r = 0.92$ ; eating concern,  $\alpha = 0.78$ ,  $r = 0.87$ .<sup>29</sup> Assessments of the key behavioural features of eating disorders (for example, binge eating, self induced vomiting, abuse of laxatives) using the EDE-Q have been found to correlate highly with those derived from interview based eating disorders examination, as have scores for the subscales.<sup>28</sup> The EDE-Q is scored using a 7 point Likert scale, and frequencies of eating disorder related behaviours are assessed by the number of days, over the past 28 days, each of the behaviours occurred. Participants were considered to be displaying symptoms of a possible eating disorder if they reported self induced vomiting, four or more objective bulimic episodes (defined as objective overeating with a sense of loss of control), or registered total scores  $\geq 60$  on items 1–15 and scores  $\geq 32$  on items 29–36.

#### *General health questionnaire (GHQ-28)*

The GHQ-28 is a widely used instrument for detecting psychological distress associated with acute problems in medical settings. The 28 items yield four robust factors with acceptable psychometric properties: somatic symptoms; anxiety and insomnia; social dysfunction; and severe depression. High internal consistency has been reported with  $\alpha$  ranging from 0.82 to 0.93; reliability coefficients as high as 0.90 have also been reported.<sup>30</sup> Of the three possible scoring methods, the simple Likert method (0-1-2-3) was selected as it assesses both symptomatology and intensity.

#### *The Rosenberg self esteem scale (RSES)*

The RSES is a 10 item measure of attitudes concerning general self worth.<sup>31</sup> It uses a 4 point Likert format, with lower scores being indicative of greater self esteem. Internal consistency and test-retest reliability are acceptable,  $\alpha = 0.77$ – $0.87$ ,  $r = 0.73$ – $0.85$ .<sup>32</sup>

#### *Menstrual dysfunction*

Participants were asked to indicate their age at menarche, any history of amenorrhoea, current menstrual status, and oral contraceptive use.

#### *The Eysenck personality questionnaire-revised (EPQ-R)*

The EPQ-R is a 106 item measure of major dimensions of personality. The subscales have the following reported psychometric properties for women: extraversion,  $\alpha = 0.85$ ,  $r = 0.89$ ; neuroticism,  $\alpha = 0.85$ ,  $r = 0.81$ ; psychoticism,

$\alpha = 0.76$ ,  $r = 0.81$ ; lie scale (social desirability),  $\alpha = 0.79$ ,  $r = 0.80$ ; addictiveness,  $\alpha = 0.84$ ,  $r = 0.80$ ; impulsiveness,  $\alpha = 0.83$ ,  $r = 0.86$ ; venturesomeness,  $\alpha = 0.84$ ,  $r = 0.90$ ; empathy,  $\alpha = 0.69$ ,  $r = 0.77$ .<sup>33</sup>

#### *Body shape questionnaire (BSQ)*

The BSQ measures concerns with body shape and how they relate to psychopathology.<sup>34</sup> It has 34 items in a 6 point Likert format. For women, internal consistency is high,  $\alpha = 0.96$ .<sup>35</sup>

#### *Weight dissatisfaction and fluctuation*

Weight dissatisfaction and fluctuation were explored by having participants register their current, maximum, minimum, and ideal weights at their current height. Weight dissatisfaction was operationalised as the numerical difference in kg between ideal and current weight; weight fluctuation was computed as the numerical difference between maximum and minimum weight.

#### *Exercise beliefs questionnaire (EBQ)*

The EBQ is a 21 item measure of people's beliefs about the consequences of not exercising.<sup>36</sup> It has been validated against formal clinical measures of psychological distress. The EBQ has four factors with the following internal reliabilities (Cronbach's  $\alpha$ ) and test-retest reliabilities (Pearson's  $r$ ): social desirability,  $\alpha = 0.87$ ,  $r = 0.76$ ; physical appearance,  $\alpha = 0.83$ ,  $r = 0.77$ ; mental and emotional functioning,  $\alpha = 0.89$ ,  $r = 0.70$ ; vulnerability to disease and aging,  $\alpha = 0.67$ ,  $r = 0.67$ .

#### *Physical activity*

Estimates of actual levels of physical activity levels were obtained as follows. Participants listed physical activities engaged in over the last 12 months. They then specified, for each activity, the average number of weeks a year, the average number of sessions a week, and the average duration of each session in minutes. Scores were derived for each activity by multiplying weeks a year by frequency a week by duration (in half hour units, where 1 = up to 30 minutes, 2 = 31–60 minutes, etc). These data were then summed across activities to yield a total physical activity score. This method has been used in several published studies of eating disorders and physical activity.<sup>10 24</sup>

#### PROCEDURE

Participants were allocated to four groups on the basis of the EDQ and EDE-Q criteria described above. Those meeting the EDQ criteria but with no evidence from the EDE-Q of a possible eating disorder were designated the exercise dependence group (EX). The eating disorder group (ED) comprised those women who met the EDE-Q possible eating disorder criteria, specified above, but not the criteria for possible exercise dependence. Participants who met the criteria for both possible eating disorder and possible exercise dependence were designated as the BOTH group. The control group (CON) was made up of participants with no evidence of either possible exercise dependence or possible eating disorders.

Table 2 Exercise dependence questionnaire (EDQ) total and subscale scores

	EX (n = 43)	ED (n = 14)	BOTH (n = 27)	CON (n = 110)
EDQ total score	129.7 (14.05)	97.0 (15.53) <sup>a</sup>	135.2 (11.78) <sup>b</sup>	95.0 (14.72) <sup>a,c</sup>
EDQ subscales				
Interference social/family/work	18.3 (6.39)	10.1 (3.84) <sup>a</sup>	19.8 (5.20) <sup>b</sup>	12.0 (5.46) <sup>a,c</sup>
Positive reward	22.1 (3.48)	20.2 (5.01)	23.7 (3.94)	18.5 (4.78) <sup>a,c</sup>
Withdrawal symptoms	5.7 (3.65)	12.5 (5.35) <sup>a</sup>	14.3 (4.55) <sup>a</sup>	4.2 (4.12) <sup>a,b,c</sup>
Exercise for weight control	17.3 (4.15)	17.3 (4.84)	21.1 (4.74) <sup>a,b</sup>	11.6 (4.72) <sup>a,b,c</sup>
Insight into problem	8.6 (4.72)	7.1 (6.18)	9.3 (5.45)	5.6 (3.73) <sup>a,c</sup>
Exercise for social reasons	11.7 (3.68)	7.6 (3.23) <sup>a</sup>	10.3 (4.42)	8.0 (3.71) <sup>a,c</sup>
Exercise for health reasons	18.4 (10.57)	15.8 (3.72)	16.7 (3.36)	16.3 (3.62)
Stereotyped behaviour	10.7 (2.89)	5.7 (2.61) <sup>a</sup>	11.0 (2.72) <sup>b</sup>	9.3 (3.14) <sup>a,b,c</sup>

Values are mean (SD). EX, exercise dependent group; ED, eating disorder group; BOTH, exercise dependent and eating disorder; CON, control group.

<sup>a</sup>Significantly different from EX.

<sup>b</sup>Significantly different from ED.

<sup>c</sup>Significantly different from BOTH.

#### DATA ANALYSIS

For nominal data,  $\chi^2$  analyses were performed. For interval level data, one way analysis of variance was used to compare groups, followed, where appropriate, by post hoc comparisons, using the Newman-Keuls method. Occasional data loss for individual subscales and scale total scores are reflected in the slightly varying degrees of freedom. To check whether any group differences may reflect variations among groups in physical activity levels, analysis of covariance was performed with the physical activity score as a covariate. A 5% significance level was adopted in all tests.

#### Results

##### VALIDATING ALLOCATION TO GROUPS

Based on the criteria described previously, 43 participants were allocated to the EX group, 14 to the ED group, 27 to the BOTH group, and 110 to the CON group. This pattern of distribution of participants among groups almost certainly reflected our recruitment strategy, which focused on exercising populations. The groups did not differ significantly on any of the major demographic variables: age, body mass index, and age at menarche. Group means (SD) for total EDQ scores were 129.7 (14.05), 97.0 (15.63), 135.2 (11.78), and 95.0 (14.72) for the EX, ED, BOTH, and CON groups respectively. Analysis of variance applied to the EDQ total scores yielded a significant groups effect ( $F[3,186] = 97.17, p < 0.05$ ). As would be expected, post hoc analysis using the Newman-Keuls method confirmed that the EX and BOTH groups scored significantly more highly on the EDQ than the ED and CON groups; no other differences emerged.

Table 2 gives the mean (SD) scores for the EDQ subscales. Analysis of variance conducted on these data showed significant group

effects for all subscales; F values ranged from 7.82 to 50.9, with the exception of the exercise for health reasons subscale. Post hoc analysis indicated that, for the most part, the EX and BOTH groups differed from the ED and CON groups. However, for the positive reward and the insight into problem subscales, the EX and BOTH groups differed from the CON group but not the ED group. Further, for the exercise for weight control subscale, the BOTH group registered significantly higher scores than the other three groups, and the CON group had significantly lower scores than the other three groups; the EX and ED groups did not differ on this subscale.

##### PSYCHOLOGICAL MORBIDITY, SELF ESTEEM, AND MENSTRUAL DYSFUNCTION

Table 3 gives the mean (SD) scores for the four subscales of the GHQ-28. Analysis of variance confirmed significant variations among groups in total GHQ scores ( $F[3,187] = 12.88, p < 0.05$ ). Post hoc analysis showed significantly higher GHQ total scores in the BOTH group than the EX or the CON groups and higher scores in the ED group than the CON group. A similar pattern of effects emerged for the anxiety and insomnia subscale ( $F[3,190] = 10.07, p < 0.05$ ). For the somatic symptoms subscale, groups varied ( $F[3,188] = 4.27, p < 0.05$ ), but, in post hoc analysis, the only group difference was between the BOTH and CON groups. Analysis of variance also yielded a groups effect for social dysfunction ( $F[3,190] = 5.73, p < 0.05$ ), with the EX and the CON groups registering lower scores than the BOTH group. There were also group differences for the severe depression subscale ( $F[3,189] = 15.59, p < 0.05$ ); the BOTH group had significantly poorer scores than the other three groups.

Mean (SD) self esteem scores on the RSES were 19.7 (5.15), 25.2 (6.00), 26.9 (7.02), and 17.8 (4.82) for the EX, ED, BOTH, and CON groups respectively. Groups varied significantly ( $F[3,188] = 25.71, p < 0.05$ ). Post hoc analysis indicated significantly higher self esteem in the EX and CON groups than the ED and BOTH groups, a pattern of effects broadly similar to that reported above for psychological morbidity as measured by the GHQ.

Self reported history of amenorrhoea varied between groups ( $\chi^2[3] = 26.42, p < 0.05$ ); the percentage of positive reporting was 51.2%, 35.7%, 66.7%, and 20.9% for the EX, ED,

Table 3 General health questionnaire (GHQ-28) total and subscale scores

	EX (n=43)	ED (n=14)	BOTH (n=27)	CON (n=110)
GHQ-28 total score	20.9 (11.18)	26.6 (19.83)	32.5 (19.02) <sup>a</sup>	16.9 (8.95) <sup>b,c</sup>
GHQ-28 subscales				
Anxiety and insomnia	6.8 (4.10)	7.3 (5.08)	9.5 (4.94) <sup>a</sup>	4.8 (3.98) <sup>a,b,c</sup>
Somatic symptoms	5.4 (4.11)	6.7 (5.46)	6.7 (5.26)	4.1 (3.60) <sup>c</sup>
Social dysfunction	6.8 (2.45)	8.5 (4.96)	9.1 (4.80) <sup>a</sup>	6.7 (2.13) <sup>c</sup>
Severe depression	2.1 (3.82)	4.1 (6.23)	7.2 (6.74) <sup>a,b</sup>	1.3 (2.86) <sup>c</sup>

Values are mean (SD). EX, exercise dependent group; ED, eating disorder group; BOTH, exercise dependent and eating disorder; CON, control group.

<sup>a</sup>Significantly different from EX.

<sup>b</sup>Significantly different from ED.

<sup>c</sup>Significantly different from BOTH.

Table 4 Eysenck personality questionnaire-revised (EPQ-R) subscale scores

	EX (n=43)	ED (n=14)	BOTH (n=27)	CON (n=110)
Extraversion	16.2 (3.09)	13.8 (4.46)	13.2 (4.59) <sup>a</sup>	16.4 (3.99) <sup>c</sup>
Neuroticism	14.2 (5.27)	16.6 (7.11)	18.8 (4.93) <sup>a</sup>	10.5 (5.67) <sup>ab,c</sup>
Psychoticism	21.5 (4.15)	21.0 (2.08)	21.8 (1.83)	20.9 (1.60)
Lie (social desirability)	17.5 (1.40)	17.5 (1.34)	17.4 (1.45)	17.5 (1.65)
Addictiveness	11.8 (3.98)	13.2 (4.90)	15.9 (4.31) <sup>a</sup>	9.3 (4.39) <sup>ab,c</sup>
Impulsiveness	14.0 (2.18)	14.4 (2.82)	15.4 (1.94) <sup>a</sup>	13.2 (2.24) <sup>ab,c</sup>
Venturesomeness	12.1 (0.97)	12.6 (2.13)	11.3 (1.16) <sup>ab</sup>	11.8 (1.22) <sup>b</sup>
Empathy	14.9 (3.63)	13.9 (1.10)	14.0 (1.48)	14.5 (1.87)

Values are mean (SD). EX, exercise dependent group; ED, eating disorder group; BOTH, exercise dependent and eating disorder; CON, control group.

<sup>a</sup>Significantly different from EX.

<sup>b</sup>Significantly different from ED.

<sup>c</sup>Significantly different from BOTH.

BOTH, and CON groups respectively. The prevalence of current menstrual irregularities also varied ( $\chi^2[6] = 13.85, p < 0.05$ ); irregularities were reported by 28.6%, 23.1%, 37.0%, and 13.6% of the EX, ED, BOTH, and CON groups. The groups did not vary in oral contraceptive use.

#### BODY SHAPE CONCERN AND WEIGHT DISSATISFACTION AND FLUCTUATION

Mean (SD) BSQ scores were 80.8 (27.68), 120.0 (37.10), 130.3 (39.66), and 68.0 (30.21) for the EX, ED, BOTH, and CON groups respectively. Analysis of variance confirmed significant between group variation ( $F[3,183] = 32.57, p < 0.05$ ). There was significantly greater concern with body shape among the ED and BOTH groups than the EX and CON groups. In addition, the EX group reported greater concern with body shape than the CON group. As indicated, weight dissatisfaction was measured as the difference between ideal and current weight. The mean (SD) discrepancies in kg were -3.3 (3.42), -7.5 (5.76), -5.4 (0.96) and -2.9 (4.06) for the EX, ED, BOTH, and CON groups respectively. The group effect was statistically significant ( $F[3,184] = 7.07, p < 0.05$ ). Post hoc comparisons indicated significantly greater discrepancies between ideal and current weight for the ED and BOTH groups than for the EX and CON groups. Mean (SD) weight fluctuation (kg), computed as the difference between maximum and minimum adult weight, were 11.6 (6.35), 13.7 (8.07), 17.8 (12.23), and 10.4 (9.07) for the EX, ED, BOTH, and CON groups respectively. These means varied significantly ( $F[3,183] = 4.90, p < 0.05$ ); the BOTH group showed significantly greater weight fluctuation than the EX and CON groups but not the ED group.

#### PERSONALITY

Table 4 presents the group averages for the EPQ-R personality variables. Analysis of variance applied to these data yielded no significant group effects for the psychoticism, social desirability, and empathy subscales. For extraversion, there was a significant group effect ( $F[3,177] = 5.82, p < 0.05$ ). Post hoc testing showed that the BOTH group was significantly more introverted than the EX and CON groups. Groups also varied in terms of neuroticism ( $F[3,185] = 19.13, p < 0.05$ ). The CON group registered significantly lower neuroticism than the other three groups. In addition, the EX group had significantly lower neuroticism scores than the BOTH group. Analysis of variance yielded a significant group effect for the EPQ-R addictiveness subscale ( $F[3,177] = 17.54, p < 0.05$ ). In line with the findings for neuroticism, the CON group had significantly lower addictiveness scores than the other three groups, and the EX group had lower scores than the BOTH group. Similarly, for the EPQ-R impulsiveness subscale, analysis of variance disclosed significant group variation ( $F[3,184] = 7.79, p < 0.05$ ), with the CON group being less impulsive than the other three groups and the EX group being less impulsive than the BOTH group. Finally, venturesomeness also varied among groups ( $F[3,182] = 3.90, p < 0.05$ ). Post hoc comparisons indicated that the ED group had higher venturesomeness scores than the BOTH and CON groups, and that the EX group had higher scores than the BOTH group.

#### EXERCISE BELIEFS

Table 5 presents the group means for the EBQ total and four subscales. Groups varied significantly in EBQ total scores ( $F[3,186] = 41.18, p < 0.05$ ). Post hoc analysis indicated that the BOTH group had more maladaptive beliefs about not exercising than the other three groups. In addition, the EX and the ED groups had higher scores, suggestive of more maladaptive beliefs, than the CON group. Precisely the same pattern of results emerged for the social desirability subscale ( $F[3,188] = 34.39, p < 0.05$ ); the EX, ED, and BOTH groups all had stronger beliefs than the CON group that exercise is necessary for social desirability, and the BOTH group had stronger beliefs than the EX and ED groups. Beliefs that exercise is essential for physical appearance also varied among groups ( $F[3,188] = 33.23, p < 0.05$ ). Post hoc analysis showed that the CON group

Table 5 Exercise beliefs questionnaire (EBQ) total and subscale scores

	EX (n=43)	ED (n=14)	BOTH (n=27)	CON (n=110)
EBQ total score	863.7 (301.49)	844.6 (377.42)	1186.1 (346.87) <sup>ab</sup>	460.0 (340.20) <sup>ab,c</sup>
EBQ subscales				
Social desirability	160.5 (131.06)	193.5 (157.10)	306.9 (155.29) <sup>ab</sup>	69.9 (84.94) <sup>ab,c</sup>
Physical appearance	219.4 (92.47)	251.2 (76.44)	307.2 (69.62) <sup>a</sup>	127.9 (99.81) <sup>ab,c</sup>
Mental and emotional functioning	339.4 (147.87)	253.5 (160.88)	438.3 (134.14) <sup>ab</sup>	161.7 (180.00) <sup>ac</sup>
Vulnerability to disease and aging	134.1 (59.80)	141.8 (78.19)	133.7 (69.51)	103.6 (65.69) <sup>ab,c</sup>

Values are mean (SD). EX, exercise dependent group; ED, eating disorder group; BOTH, exercise dependent and eating disorder; CON, control group.

<sup>a</sup>Significantly different from EX.

<sup>b</sup>Significantly different from ED.

<sup>c</sup>Significantly different from BOTH.

was significantly less concerned about the effects that not exercising would have on their physical appearance than were the other three groups. In addition, the EX group was less concerned than the BOTH group. Analysis of variance also disclosed group differences in the belief that exercise was necessary for mental and emotional functioning ( $F[3,188] = 25.85$ ,  $p < 0.05$ ). Again, the BOTH group harboured significantly stronger beliefs than the other three groups, and the EX group's beliefs were stronger than those of the CON group. Finally, the vulnerability to disease and aging subscale scores varied among groups ( $F[3,190] = 3.70$ ,  $p < 0.05$ ). Post hoc comparisons indicated that the CON group was significantly less concerned about the effects of not exercising on health and decline than the other three groups.

#### PHYSICAL ACTIVITY

The group means (SD) for total physical activity scores were 1282.4 (899.93), 498.5 (361.32), 1453.0 (790.12), and 869.1 (804.65) for the EX, ED, BOTH, and CON groups respectively.

As might be expected, reported levels of physical activity differed significantly among groups ( $F[3,174] = 6.46$ ,  $p < 0.05$ ). Post hoc analysis confirmed that the EX and BOTH groups exercised significantly more than the ED and CON groups. Given that psychological well being, self esteem, and body image are affected by physical activity, analysis of covariance, using the physical activity total score as the covariate, was performed on the major outcome variables. All group effects remained significant with the exception of the effects for the somatic symptoms subscale of the GHQ-28 and the weight fluctuation measure, which no longer quite met the criterion for statistical significance ( $F[3,175] = 2.46$ ,  $p = 0.07$ , and  $F[3,171] = 2.17$ ,  $p = 0.09$ ) respectively.

#### Discussion

This study compared levels of psychological morbidity and personality profiles of women identified as being primary and secondary exercise dependent with those of women who exhibited symptoms of an eating disorder but no exercise dependence, as well as with those of women with neither exercise dependence nor an eating disorder. The EDQ and the EDE-Q would seem to be satisfactory means for allocating participants to groups, and in particular, distinguishing between those with primary and secondary exercise dependence.

Overall, the data from this study testify to higher levels of psychological morbidity in people with symptoms of eating disorders, particularly when they are associated with exercise dependence. The secondary exercise dependent group (BOTH) showed significantly higher total GHQ scores, anxiety/insomnia, social dysfunction, and severe depression subscale scores than the group identified as being primary exercise dependent (EX) and the group without either exercise dependence or symptoms of an eating disorder (CON). In contrast, the secondary exercise dependent group was not distinguishable from the eating

disorder group (ED) on any of the GHQ measures, with the exception of severe depression. Further, primary exercise dependent women did not differ significantly from controls on any of the GHQ indicators of psychological morbidity. Parallel effects emerged from the analysis of self esteem, with the two eating disorder groups registering significantly lower levels of self esteem than either the primary exercise dependence group or the control group. Concern with body shape, weight dissatisfaction, and weight fluctuation showed a similar pattern of effects. Taken together, these results suggest that people identified as being primary exercise dependent show unremarkable levels of psychological morbidity and healthy levels of self esteem. As such, they argue against the notion that primary exercise dependence is a pathology, and certainly undermine the claim that it is a prevalent pathology.<sup>14 15</sup>

Previous research has found that particular patterns of personality characterise behavioural pathologies, such as gambling addiction and substance dependence.<sup>21 22</sup> These include high levels of measured addictiveness, impulsivity, and psychoticism. While psychoticism did not differentiate the current groups, there were substantial group differences in impulsiveness and addictiveness. In both cases, the primary exercise dependence group, while registering higher scores than the control group, showed significantly less impulsiveness and addictiveness than the secondary exercise dependence group. Research has yielded evidence of heterogeneous personality structures among eating disorder sufferers, although it has been suggested that there may be a concentration of personality subtypes in certain subgroups. Impulsive behaviours, for example, stealing, suicide attempts, and self harm may be more prevalent among bulimics, whereas anorexics tend to be more rigid, restrained, and have greater impulse control.<sup>7 25</sup> It is possible that there was an over-representation of bulimic type eating disorders among the secondary exercise dependence group. In terms of addictiveness, the overall mean values for the primary exercise dependent group were substantially lower than those reported previously for female drug addicts, but similar to overall female norms.<sup>23</sup> They were also similar to those reported elsewhere for exercisers and non-exercisers.<sup>37</sup> Again, it was the presence of symptoms of eating disorders, particularly when combined with probable exercise dependence, that was associated with high addictiveness scores.

The control and primary exercise dependence groups were less introverted than the two eating disorder groups. Consistent with the results of a previous study of female runners,<sup>38</sup> the primary exercise dependence group showed higher levels of neuroticism than the control group, although their overall mean was comparable with female norms.<sup>33</sup> The primary exercise dependence group also showed significantly lower neuroticism scores than the secondary exercise dependence group. Both of the eating disorder groups had levels of

neuroticism comparable with those found previously for female drug addicts.<sup>23</sup> Low levels of extraversion and high levels of neuroticism have been reported among restricting and bulimic anorexics.<sup>39</sup> The present study would appear to confirm the notion of a morbid personality associated with eating disorders, particularly when associated with exercise dependence. As many items on the neuroticism scale deal with feelings of anxiety and depression,<sup>23</sup> it is possible that these high scores actually reflect higher levels of psychological distress. In line with this, neuroticism scores have been found to decrease while extraversion scores increase among previous eating disorder sufferers subsequent to weight restoration.<sup>39</sup> In summary, people identified as being primary exercise dependent were largely indistinguishable in terms of disposition from normal controls. In contrast, those who exhibited symptoms of an eating disorder displayed personality profiles broadly similar to those previously reported for people with other behavioural pathologies.

While the primary exercise dependence group registered stronger beliefs about the consequences of not exercising than the control group, they did not differ from the eating disorder group in this regard. However, for a group committed to exercise, strong beliefs in this context are to be expected. Concerns about the consequences of not exercising would only seem to reach maladaptive proportions for those with exercise dependence secondary to an eating disorder. While not particularly concerned about the health and aging benefits of exercise, this group appeared to be preoccupied with the perceived social, psychological, and aesthetic costs of not exercising.

As might be expected, a higher proportion of participants in the primary and secondary exercise dependent groups reported a history of amenorrhoea and current menstrual irregularities. Menstrual disturbance among female exercisers has been widely documented, with reported prevalence rates ranging from 6% to 79%.<sup>40</sup> However, whether or not the high prevalence of menstrual irregularities among the primary and secondary exercise dependence groups is cause for concern is unclear. It has been argued that menstrual disturbance in this context is usually temporary and returns to normal when levels of exercise are reduced.<sup>41</sup> Nevertheless, the co-occurrence of an eating disorder with menstrual dysfunction may represent a more serious health risk; indeed, the coincidence of eating disorders, amenorrhoea, and osteoporosis has been labelled "the female athlete triad".<sup>42</sup>

Menstrual abnormalities aside, there is no evidence in this study that women identified as being exercise dependent, in the absence of an eating disorder, exhibit the sorts of morbid personality and psychological distress that warrant the "pathologising" of exercise dependence. Clearly, this is not the case for those suffering from an eating disorder. Further, the pattern of the present findings cannot be accounted for by group variations in levels of physical activity. It could be argued that the

criteria adopted in this study were insufficiently rigorous and that our primary exercise dependent group included subjects who were not truly exercise dependent. It is possible that with a higher cut off score on the EDQ, subjects who exhibited symptoms of psychological distress and morbid personality characteristics would have emerged. However, only six participants from the EX group equalled or exceeded a cut off point of 145 on the EDQ (corresponding to an average score of 5 on each of the 29 questions, as opposed to the average score of 4 adopted as the criterion in this study). Such small numbers substantially reduce the power to detect effects. We are currently exploring the consequences of adopting different EDQ criteria for exercise dependence. Notwithstanding, if our present criterion failed to capture supposedly exercise dependent subjects, it would suggest that exercise dependence is a rare phenomenon and certainly not one with the prevalence rates reported in some previous studies.<sup>14 15</sup> It should be conceded that our conclusion is limited to female exercisers. A parallel study of male exercisers, currently underway, should prove illuminating.

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