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**Psychological risk factors for compulsive exercise:  
A longitudinal investigation of adolescent boys and girls**

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Running head: COMPULSIVE EXERCISE

### Abstract

Compulsive exercise is associated with unhealthy outcomes and is common among eating disorder populations. This study aimed to replicate previous cross-sectional work by considering psychological characteristics as longitudinal predictors of compulsive exercise. A sample of 369 adolescents (n = 221 female, n = 148 male) completed measures of compulsive exercise, eating disorder psychopathology, obsessive-compulsiveness, perfectionism, anxiety, and depression at baseline, and a measure of compulsive exercise two years later. For boys, greater obsessive-compulsiveness and self-oriented perfectionism predicted compulsive exercise, whilst among girls only baseline compulsive exercise was a significant predictor. Compulsive exercise prevention work among boys may benefit from targeting their levels of obsessive-compulsiveness and self-perfectionism. For girls, further risk factor research into compulsive exercise is required.

**Keywords:** compulsive exercise; obsessive-compulsiveness; perfectionism; eating disorder; longitudinal.

## **Psychological risk factors for compulsive exercise: A longitudinal investigation of adolescent boys and girls**

Unhealthy excessive exercise affects community samples (e.g., Lipsey, Barton, Hulley, & Hill, 2006) and is implicated in the development and maintenance of clinical eating disorders (Davis, Kennedy, Ravelski, & Dionne, 1994). Approximately 31 terms can describe this unhealthy exercise, including compulsive exercise, exercise addiction, and exercise dependence (Adkins & Keel, 2005). There is consensus that measurement of such exercise must focus on qualitative (i.e., compulsivity) rather than on quantitative (i.e., volume) dimensions (Meyer & Taranis, 2011). Meyer, Taranis, Goodwin, and Haycraft (2011, p.184) conceptualised it as a compulsive behaviour, which is “characterised by an association with weight and shape concerns, and persistent continuation in order to: (a) mitigate the experience of extreme guilt and/or negative affect when unable to exercise; and (b) avoid the perceived negative consequences of stopping”.

In line with Meyer and colleagues’ (2011) model, compulsive exercise has been associated with increased anxiety, depression, obsessionality, and eating psychopathology among eating disordered (Shroff et al., 2006) and non-clinical groups (Hausenblas & Symons Downs, 2002). Despite the problems associated with compulsive exercise, underpinning research is relatively scarce. In particular, the specific risk factors for compulsive exercise remain unknown.

A preliminary cross-sectional study found self-oriented perfectionism, socially prescribed perfectionism, obsessive-compulsiveness and drive for thinness significantly predicted compulsive exercise among adolescent boys, while in girls compulsive exercise was predicted by self-perfectionism, obsessive-compulsiveness, and a drive for thinness (Goodwin, Haycraft, Willis, & Meyer, 2011a). These findings support Meyer et al.’s (2011) model of compulsive exercise, but given the cross-sectional design of Goodwin et al.’s

(2011a) study, it is unknown whether such psychological variables could be risk factors for compulsive exercise, or whether they simply co-occur. Therefore, it is important to examine the model's hypothesised risk factors using a longitudinal design, to establish whether they are associated with future levels of compulsive exercise.

The current study aimed to test the proposed associations between compulsive exercise and psychological factors among boys and girls. Adolescents were chosen as the onset of psychological disorders is typically around early to mid-adolescence (Kessler et al., 2007), and also as this investigation extends previous work into correlates of compulsive exercise (Goodwin et al., 2011a). Based on this previous work, and in line with the model of compulsive exercise (Meyer et al., 2011), it was predicted that eating psychopathology, negative affect, obsessive-compulsiveness, and perfectionism would significantly and positively predict compulsive exercise, and after controlling for baseline levels of compulsive exercise.

## METHODS

### Participants

148 boys and 221 girls (N=369) from six UK schools completed baseline (T1) and follow-up assessments 24 months later (T2). The sample, aged 12-14 years old at T1 (mean 12.89; SD .69), and 14-16 years old at T2 (mean 14.84; SD .67), was predominantly White British (93.2%). Self-reported Body Mass Index (BMI) values were converted to age- and gender-adjusted z-scores (BMI z-scores; Child Growth Foundation, 1996). These BMI z-scores at T1 were 0.28 (SD 1.67) for boys and -0.10 (SD 1.31) for girls, and at T2 were 0.48 (SD 1.06) for boys and 0.17 (SD 1.13) for girls. Participating schools were in areas of average to low levels of economic deprivation (Office for National Statistics, 2008).

### Procedure

Following ethical clearance, questionnaires were sent to participating schools. At T1, background/demographic information, and the measures described below were included. At T2, compulsive exercise, age, height and weight were assessed. Following informed consent, questionnaires were completed during a class period. Standardised instructions were given to administering teachers. Completed packs were assigned an identification code, and the procedure was repeated approximately 24 months later. Participants at T1 and T2 were included in the analyses.

### Measures

Compulsive Exercise Test (CET; Taranis, Touyz, & Meyer, 2011). The CET assesses an individual's compulsivity towards exercise ("I feel extremely guilty if I miss an exercise session"). CET total score was used, with higher scores representing greater compulsive exercise. The CET is validated for adolescents (Goodwin, Haycraft, Taranis, & Meyer, 2011b). Cronbach's alpha values for the current sample were .89 (T1) and .88 (T2).

Eating Disorder Inventory-2 (EDI-2; Garner, 1991). The EDI-2 Drive for Thinness, Bulimia, and Body Dissatisfaction subscales were used to assess eating disorder psychopathology. The EDI-2 has been used with adolescents (Grylli, Hafferl-Gattermayer, Schober, & Karwautz, 2004). Cronbach's alpha values for this sample were .86 (Drive for Thinness), .71 (Bulimia), and .90 (Body Dissatisfaction).

Child and Adolescent Perfectionism Scale (CAPS; Flett, Hewitt, Boucher, Davidson, & Munro, 1992). The CAPS comprises two subscales: Self-Oriented Perfectionism (CAPS-Self), measuring self-imposed levels of perfectionistic standards and behaviours; and, Socially Prescribed Perfectionism (CAPS-Social), measuring the degree to which perfectionism is imposed on individuals by external sources (parents, friends, and/or teachers). The CAPS has been used with adolescents (Hewitt, Newton, Flett, & Callander, 1997), and demonstrated satisfactory reliability among the current sample (CAPS-Self  $\alpha$  .82; CAPS-Social  $\alpha$  .87).

Spence Child Anxiety Scale–Obsessive Compulsive Subscale (SCAS-OC; Spence, 1998). The SCAS-OC comprises six items assessing levels of obsessive-compulsiveness (e.g., “I can’t seem to get bad or silly thoughts out of my head”). The SCAS-OC has good reliability among adolescents (Spence, 1998) and in the current sample ( $\alpha .79$ ).

Hospital Anxiety and Depression Scale (HADS; Zigmond & Snaith, 1983). The HADS measures anxiety (“Worrying thoughts go through my mind”) and depression (“I feel as if I am slowed down”). It has been validated for adolescents (White, Leach, Sims, Atkinson, & Cottrell, 1999). The Anxiety subscale demonstrated satisfactory reliability in the current sample ( $\alpha .73$ ) but reliability of the Depression subscale was .60, so caution regarding interpretation is advised.

### Data Analysis

As levels of T2 CET were found to differ across participating schools ( $F = 7.05_{(5, 362)}$ ,  $p < .001$ ), “school” was recoded into dummy variables, which were included in the regressions. T-tests found significant gender differences on the outcome variable (CET). Therefore, all subsequent analyses were conducted separately for boys and girls. BMI z-scores were not significantly associated with CET and so were not entered into the regressions. A hierarchical multiple regression was performed with T2 CET as the outcome variable. The school dummy variables were entered in the first step, baseline compulsive exercise score (T1 CET) was entered into the second step, and all other predictors were entered in the third step of the model. Significance was set at  $p < .05$ .

## RESULTS

### Descriptive Statistics

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TABLE 1

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The variables' mean scores are presented in Table 1. The means for T1 and T2 CET for boys and girls demonstrate low to mid-point scoring ("sometimes true of me") and therefore do not reflect high levels of compulsive exercising. These values are lower than expected in a clinical sample (Naylor, Mountford, & Brown, 2011). EDI scores were below clinical cut-offs (Grylli et al., 2004). In comparison to norms (Snaith & Zigmond, 1994), levels of anxiety were *mild*, whereas levels of depression were *healthy*. CAPS-Self, CAPS-Social and SCAS scores are similar to comparable data (e.g., Spence, 1998).

### Risk Factors for Compulsive Exercise

Boys. The final regression model for boys (Table 2) was significant, accounting for 47% of T2 CET variance. In the first two steps, the school dummy variables contributed significantly to the outcome variance ( $R^2$  change = .07;  $F_{(3, 110)}$  change = 2.73,  $p < .05$ ), as did the addition of baseline CET scores ( $R^2$  change = .29;  $F_{(1, 109)}$  change = 48.13,  $p < .001$ ). The psychological predictors also produced a significant change in the model ( $R^2$  change = .17;  $F_{(8, 101)}$  change = 4.51,  $p < .001$ ). In the final model, SCAS and CAPS-Self were significant positive predictors of T2 CET, in addition to the significant predictors of T1 CET, and two school dummy variables. Anxiety was also a significant, negative predictor of T2 CET.

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TABLE 2

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Girls. The final hierarchical regression model for girls (Table 2) was significant, with the overall model accounting for 24% of T2 CET variance. School dummy variables contributed significantly to the outcome variance ( $R^2$  change = .08;  $F_{(5, 162)}$  change = 2.88,  $p < .05$ ) in step 1, as did the addition of baseline CET scores in step 2 ( $R^2$  change = .16;  $F_{(1, 161)}$  change = 34.79,  $p < .001$ ). The addition of the psychological predictors did not produce a significant change in the model ( $R^2$  change = .06;  $F_{(8, 153)}$  change = 1.54,  $p > .05$ ). In the final model, only T1 CET and one school dummy variable were significant predictors of T2 CET.



## DISCUSSION

Results for boys supported Meyer et al.'s (2011) compulsive exercise model by demonstrating that obsessive-compulsiveness and self-perfectionism predicted compulsive exercise, even after controlling for baseline levels of the outcome variable. This suggests that these variables lead to increased compulsive exercise over a two year period, rather than simply being associated with compulsive exercise levels. This finding extends previous cross-sectional research (Goodwin et al., 2011a).

Among boys, anxiety was also a significant predictor but in the opposite direction to our hypotheses, with lower anxiety actually predicting greater compulsive exercise. This may be due to the anxiolytic benefits of exercise (Wipfli, Rethorst, & Landers, 2008), demonstrating the importance of exercise in a non-clinical sample for regulating emotions. Further research should determine whether a reliance on exercise to manage anxiety develops over time, and if so, whether it leads to the maintenance of more problematic compulsive exercise, as stipulated by Meyer et al.'s model (2011).

For girls, psychological predictors did not predict compulsive exercise. Baseline compulsive exercise was a significant predictor, possibly demonstrating some temporal stability of compulsive exercise among girls of this age. Alternatively, it is possible that risk factors for compulsive exercise are less about psychological characteristics, such as obsessive-compulsiveness, perfectionism, or eating disorder psychopathology (as hypothesised by Meyer et al., 2011), and more about other unknown variables. Furthermore, the significant differences in compulsive exercise between schools may indicate environment-specific variables, requiring further investigation.

The findings have important implications for professionals working with adolescents. Specifically, an alarming number of adolescent boys have potentially undiagnosed eating psychopathology (Kjelsas, Bjornstrom, & Gotestam, 2004); and our findings could inform

prevention programmes, directing practitioners towards boys' obsessive-compulsiveness and self-perfectionism levels. Given that high levels of perfectionism are associated with anxiety, depression, and stress (e.g., Schweitzer & Hamilton, 2002), further work should look to focus on boys' achievement orientation and drive to succeed. Another noteworthy finding is that baseline levels of compulsive exercise were significantly related to compulsive exercise two years later. This temporal stability, alongside the greater number of personal correlates identified cross-sectionally (Goodwin et al., 2011a), could suggest that these risk factors are still related to compulsive exercise, but that their association occurred prior to the current baseline age here. Given that compulsive exercise is often the first symptom of eating disorders to appear (Davis et al., 1994), compulsive exercise could occur at an earlier age than was sampled in the current study. Therefore, prevention should target pre-adolescents.

This study had limitations. First, it is unknown whether baseline compulsive exercise led to increases in the predictor variables, including eating psychopathology, as these were not measured at T2. Second, the sample comprised primarily white British adolescents, hence replication in more diverse samples is needed. Finally, actual exercise behaviours were not measured, therefore precluding discussion of whether compulsive exercise attitudes lead to unhealthy volumes or types of exercise behaviour.

In summary, this is the first investigation to assess longitudinal predictors of compulsive exercise. The findings indicate that obsessive-compulsiveness and self-oriented perfectionism are risk factors for compulsive exercise among boys, while further research is needed to elucidate risk factors among girls. These findings could inform compulsive exercise prevention work.

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TABLE 1: Characteristics of the sample and gender differences

Variables	Mean (SD)		T-test
	Boys	Girls	t (df)
SCAS-OC	0.95 (0.57)	1.01 (0.69)	.93 (332)
CAPS-Self	34.90 (7.77)	33.48 (8.48)	1.56 (334)
CAPS-Social	25.37 (7.89)	23.28 (8.50)	2.28 (334)*
HADS Anxiety	7.96 (3.52)	8.22 (3.57)	.67 (351)
HADS Depression	4.28 (2.86)	3.53 (2.77)	2.45 (351)*
Drive for Thinness	2.94 (4.10)	5.28 (5.87)	4.12 (309)***
Bulimia	2.10 (3.24)	2.04 (3.06)	0.18 (309)
Body Dissatisfaction	5.04 (5.57)	9.14 (7.97)	5.33 (309)***
T1 CET	10.52 (4.12)	10.04 (3.89)	1.02 (302)
T2 CET	7.96 (3.42)	9.78 (3.38)	5.05 (366)***

Note: \*\*\* $p < .001$ ; \*\* $p < .01$ ; \* $p < .05$  (one-tailed); SCAS-OC= Spence Child Anxiety Scale – Obsessive-Compulsive Subscale; CAPS= Child and Adolescent Perfectionism Scale; HADS= Hospital Anxiety and Depression Scale; EDI= Eating Disorder Inventory; CET= Compulsive Exercise Test; T1/T2 = Time 1/Time 2

TABLE 2: Final model of hierarchical multiple regression of T2 CET score (outcome) for boys and girls

Model	Beta	t	F (df)	R <sup>2</sup>	Adjusted R <sup>2</sup>
<i>Boys</i>					
<i>Overall Model</i>			9.28*** <sub>(12, 101)</sub>	.52	.47
School Dummy 1 v 2	-.11	-1.46			
School Dummy 1 v 6	-.19	-2.59*			
School Dummy 1 v 7	-.19	-2.68**			
T1 CET	.47	5.05***			
SCAS-OC	.35	4.05***			
CAPS-Self	.18	2.16*			
CAPS-Social	-.04	-0.44			
HADS-Anxiety	-.21	-2.48*			
HADS-Depression	-.14	-1.72			
EDI-Drive for Thinness	-.08	-0.82			
EDI-Bulimia	-.12	-1.42			
EDI-Body Dissatisfaction	.11	1.34			
<i>Girls</i>					
<i>Overall Model</i>			4.71*** <sub>(14, 153)</sub>	.30	.24
School Dummy 1 v 2	-.08	-1.15			
School Dummy 1 v 3	-.03	-0.35			
School Dummy 1 v 6	-.17	-2.30*			
School Dummy 1 v 7	-.12	-1.63			
School Dummy 1 v 9	.08	1.14			
T1 CET	.36	3.79***			

SCAS-OC	-.12	-1.22
CAPS-Self	.12	1.25
CAPS-Social	-.07	-0.83
HADS-Anxiety	.16	1.64
HADS-Depression	-.13	-1.63
EDI-Drive for Thinness	.07	0.59
EDI-Bulimia	-.15	-1.87
EDI-Body Dissatisfaction	.09	0.91

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Note: \*\*\* $p < .001$ ; \*\* $p < .01$ ; \* $p < .05$ ; CET = Compulsive Exercise Test; School Dummy = Dummy variable created for original categorical school variable; SCAS-OC = Obsessive-Compulsive Subscale; CAPS = Child and Adolescent Perfectionism Scale; HADS = Hospital Anxiety and Depression Scale.