

This item was submitted to Loughborough's Institutional Repository (<https://dspace.lboro.ac.uk/>) by the author and is made available under the following Creative Commons Licence conditions.



CC creative commons
COMMONS DEED

Attribution-NonCommercial-NoDerivs 2.5

You are free:

- to copy, distribute, display, and perform the work

Under the following conditions:

 **Attribution.** You must attribute the work in the manner specified by the author or licensor.

 **Noncommercial.** You may not use this work for commercial purposes.

 **No Derivative Works.** You may not alter, transform, or build upon this work.

- For any reuse or distribution, you must make clear to others the license terms of this work.
- Any of these conditions can be waived if you get permission from the copyright holder.

Your fair use and other rights are in no way affected by the above.

This is a human-readable summary of the [Legal Code \(the full license\)](#).

[Disclaimer](#) 

For the full text of this licence, please go to:
<http://creativecommons.org/licenses/by-nc-nd/2.5/>

Sociocultural correlates of compulsive exercise: Is the environment important in fostering a compulsivity towards exercise among adolescents?

Huw Goodwin ^a

Emma Haycraft ^{a*}

Caroline Meyer ^a

^aLoughborough University Centre for Research into Eating Disorders

Loughborough University, Leicestershire, UK

* Address correspondence to: Dr Emma Haycraft, Loughborough University Centre for

Research into Eating Disorders, School of Sport, Exercise and Health Sciences,

Loughborough University, Leicestershire LE11 3TU, UK

Email: e.haycraft@lboro.ac.uk

Tel.: +44(0)1509 228160 Fax.: +44(0)1509 223940.

COMPULSIVE EXERCISE

Abstract

Sociocultural factors hypothesised to be influential in eating disorders were assessed for their relationship with compulsive exercise. A sample of 828 adolescent boys and girls completed measures assessing sociocultural messages to change body shape as well as pressure to be thin, and also measures of compulsive exercise and disordered eating. Results showed that the sociocultural influences differed slightly between boys and girls. Hierarchical regressions showed that, after controlling for disordered eating and BMI, messages to become more muscular and media pressure to be thin significantly predicted compulsive exercise in boys, while the same regression in girls reported only media pressure to be thin as a significant predictor of compulsive exercise. These findings demonstrate the influence of the media in boys' and girls' compulsive exercising, as well as highlight the influence of body shape messages to become more muscular on boys' compulsive exercise.

Keywords: Socio-cultural; Environment; Compulsive Exercise; Eating Disorders; Media; Muscularity.

COMPULSIVE EXERCISE

Introduction

The environment has been shown to play a key role in the development of eating disorders (e.g., Polivy & Herman, 2003; Stice & Agras, 1998), with sociocultural factors being closely linked to eating disorder symptomatology (Kiang & Harter, 2006). Further, in the dual pathway model of bulimia, a social pressure to be thin was shown to contribute to bulimic symptoms, and this perceived pressure to be thin has predicted the onset of specific bulimic behaviours (Stice & Agras; 1998; Stice, Nemeroff, & Shaw, 1996). One such eating disordered behaviour, which was not included in those studies nor many other studies, but which is widely found in both anorexia nervosa and bulimia nervosa patients (Davis, Katzman, Kaptein, Kirsh, & Brewer, 1997), is compulsive exercise. Compulsive exercise has been defined as a problematic drive to exercise closely associated with disordered eating, which is often performed in a rigid fashion, and invariably continued even when exercise is contraindicated due to injury or illness (Meyer, Taranis, Goodwin, & Haycraft, in press). It has been regarded as problematic in the development, treatment, and outcome of eating disorders (Davis et al., 1997; Solenberger, 2001), and yet little to no research has investigated the risk factors for this behaviour.

Research into compulsive exercise, and its associated correlates, among adolescent boys and girls is of paramount importance. Compulsive exercise has been shown to have a role in the pathogenesis of the eating disorders (e.g., Davis, Kennedy, Ravelski, & Dionne, 1994; Epling & Pierce, 1992). This has clinical implications primarily among adolescent girls, as research has shown that pre-morbid levels of exercising are significantly associated with current clinical levels of activity among girls with anorexia nervosa, and that their problems with exercise began before the onset of any problems with eating (Davis et al., 1997). Compulsive exercise is also problematic for boys, as leading into young adulthood, compulsive exercise is more prevalent among men than women (Guidi et al., 2009).

COMPULSIVE EXERCISE

Compulsive exercise is also a key feature of muscle dysmorphia (Murray, Maguire, Russell, & Touyz, 2011) and a drive for muscularity, principally found in male populations, and which is associated with decreased social functioning, increased steroid use, and increased drug and alcohol use (Pope, Gruber, Choi, Olivardia, & Phillips, 1997; Pope, Katz, & Hudson, 1993). Therefore, it can be seen that compulsive exercise negatively affects both male and female samples.

Risk factor research into compulsive exercise is relatively absent from the literature, although it has been suggested that common risk factors might underpin both eating disorders in general as well as compulsive exercise (Eisler & le Grange, 1990). Potential risk factors for compulsive exercise, therefore, need to be explored from the corresponding risk factor research into eating disorders, which can largely be categorised into individual and sociocultural risks (e.g., Striegel-Moore & Bulik, 2007). In relation to individual risks and compulsive exercise, a recent study of adolescents identified certain individual personality variables that were significantly associated with reports of compulsive exercise (Goodwin, Haycraft, Willis, & Meyer, 2011). However, few studies have specifically studied sociocultural influences in the development of compulsive exercise. These sociocultural influences can be separated into three key environmental sources, namely the family, peers, and more cultural messages through the media (Keery, van den Berg, & Thompson, 2004). These different environmental influences have all been implicated in the development of disordered eating behaviours and weight concerns (Dunkley, Wertheim, & Paxton, 2001), although their role in compulsive exercise remains unclear.

Firstly, parental and family effects have been widely researched in the eating disorders. For example, dysfunctional family dynamics have been related to eating disorder pathology (Casper & Troiani, 2001). The results, though, are not conclusive, and it could be that it is not the general functioning that is important in the development of disordered eating

COMPULSIVE EXERCISE

attitudes and behaviours, but rather the direct family communication and attitudes around appearance, eating, and exercise (Young, Clopton, & Bleckley, 2004). Attitudes specific to weight and shape communicated by family members have been found to be related to the bulimic behaviours of young women (Young et al., 2004). Weight and shape concerns transmitted from parents can also affect boys, with parental pressure to be thin being related to adolescent boys' body satisfaction (Muris, Meesters, van de Blom, & Mayer, 2005).

In addition to the effects of the family environment, the influence of peers on eating disturbances has also been researched (e.g., Farrow, Haycraft, & Meyer, in press; Shroff & Thompson, 2006), albeit to a lesser extent in the early adolescent age group (Hutchison, Rapee, & Taylor, 2009). The adolescent research conducted suggests that the peer environment is important in influencing adolescents' weight-related attitudes and behaviours (Hutchinson & Rapee, 2007). For example, friendship groups have been found to be highly influential in affecting adolescent girls' body image concerns and their extreme weight-loss behaviours (Paxton, Schutz, Wetheim, & Muir, 1999). In addition, other research found that the greater the emphasis a peer group placed on thinness, the more likely that an adolescent girl would engage in purging behaviours (Field et al., 1999). Likewise, for boys, the peer group is seemingly important in shaping their body image and dieting behaviours (Muris et al., 2005).

These dieting and weight control behaviours could occur as a result of the internalisation of the "thin ideal" that is present in Western culture, as it leads to greater weight and shape dissatisfaction (Knauss, Paxton, & Alsaker, 2007). Messages from peers about weight and shape can be internalised by the individual, although moreover, the cultural thin ideal also can be transmitted by media messages, which is a risk factor for the development of adolescent girls' weight concerns and disordered eating behaviours (Taylor et al., 1998). The reading of fashion magazines has been shown to increase the desire for

COMPULSIVE EXERCISE

thinness among adolescent girls (Levine, Smolak, & Hayden, 1994), whilst media information about weight loss methods has also been linked to dietary restraint among girls of a similar age (Dunkley et al., 2001). This media effect is not restricted to girls. Among boys, the media influence on shaping eating and exercise behaviours (such as to increase muscle size) has also been demonstrated (McCabe & Ricciardelli, 2003; McCabe, Ricciardelli, Mellor, & Ball, 2005; Ricciardelli & McCabe, 2003), as has the media's role in developing boys' weight and shape self-perceptions (Field et al., 2001).

Compulsive exercise is seen as a problematic behaviour in relation to the eating disorders, negatively impacting on treatment outcome, as well as being a key factor in increasing the risk of relapse. Compulsive exercise has also been shown to be influential in the development of eating disorders. However, it is unknown whether the risk factors for eating disorders can be applied specifically to compulsive exercise, or whether the exercise element of the eating disorders has a different aetiological path. The focus of this study is on the compulsive exercise cognitions rather than on excessive exercise behaviour, as it is the exercise cognitions that have been associated with eating disorders (Seigel & Hetta, 2001; Steffen & Brehm, 1999).

In order to identify sociocultural factors associated with a compulsivity towards exercise, a cross-sectional study of compulsive exercise and sociocultural factors previously shown to be influential in the development of more general eating disordered attitudes will be investigated. Identifying early risk factors is important in the early intervention and prevention of eating disorders (Jacobi, Hayward, De Zwaan, Kraemer, & Agras, 2004). Therefore, given that adolescence represents a key risk for the development of eating disorders (Striegel-Moore & Bulik, 2007), a sample of adolescents will be used in this study, with a view to identifying risk factors during this early and key age for the development of disordered eating concerns (Shisslak, Crago, & Estes, 1995). Given the close link between

COMPULSIVE EXERCISE

compulsive exercise and disordered eating attitudes which has already been identified in adolescents (Goodwin, Haycraft, Taranis, & Meyer, in press), disordered eating will be controlled for in the analysis, in order to ensure that any relationships found with sociocultural factors are direct associations with compulsive exercise, and not simply through a link with more general disordered eating attitudes. Further, the effects of sociocultural influences on weight concerns and dieting among adolescents have been shown to be gender-specific (Field et al., 2001). Therefore, relationships will be studied separately for each gender.

The study aims to identify whether sociocultural factors are related to compulsive exercise in an adolescent sample, after controlling for disordered eating attitudes. It is hypothesised that sociocultural factors (pressure to be thin from family, peers and the media; messages to lose weight; messages to be more muscular) will be significantly and positively associated with compulsive exercise. The study also aims to identify which is the best cross-sectional predictor of compulsive exercise. Due to a lack of current evidence, no a priori hypotheses will be given for this second aim.

Method

Participants and Procedure

Participants were pupils recruited from secondary schools across the United Kingdom, with schools invited to participate as part of a wider study investigating exercise and eating attitudes. Following institutional review board approval, participating schools were sent questionnaire packs for distribution. The packs contained background information questions and established measures, which assessed the study's variables of interest (see *Measures* section below). Questionnaire packs were distributed to all pupils aged between 13

COMPULSIVE EXERCISE

and 15 years old, who completed them during a single class period. The completed packs were returned to the research team.

The final sample comprised 828 adolescents, with boys and girls being evenly represented (boys $n = 371$, girls $n = 457$). The participants ranged from 13 to 15 years old ($m = 14.07$, $SD = .71$), and the sample consisted of 98.6% British adolescents. The self-reported height and weights were converted to Body Mass Index (BMI) scores. The mean BMI score for boys was 20.36 ($SD = 3.42$, range = 11.18 – 31.74) and for girls it was 19.89 ($SD = 3.07$, range = 12.80 – 30.06). These BMI scores were then converted to age and gender appropriate BMI z scores (Child Growth Foundation, 1996). The BMI z score for boys was 0.37 ($SD = 1.37$, range = - 6.99 – 2.90) and .00 ($SD = 1.13$, range = - 4.24 – 2.74) for girls.

Measures

Background information, including adolescent age, gender and nationality, as well as self-reported height and weight, was gathered before the following established questionnaires were administered in the order presented below:

Perceived Sociocultural Pressure Scale (PSPS; Stice & Bearman, 2001). The PSPS is a measure of the perceived pressure to be thin that the respondent feels from sociocultural sources. The three sources are family (e.g., “I’ve felt pressure from my family to lose weight”), friends (e.g., “I’ve felt pressure from my friends to lose weight”), and the media (e.g., “I’ve noticed a strong message from the media to have a thin body”). The 10-item measure is answered using a 5-point Likert scale that is anchored with “1 = none” and “5 = a lot”, and responses are averaged to form a single total scale score. Higher scores represent greater perceived pressure to be thin from sociocultural influences. Previous studies have shown the PSPS to be a reliable scale for use with adolescents (e.g., Presnell, Bearman, & Stice, 2004; Stice & Whitenton, 2002). As this study aimed to identify which

COMPULSIVE EXERCISE

were the key sources of sociocultural messages influencing adolescents' compulsive exercising, the items relating to family pressure, peer pressure, and media pressure were separated to form three subscales. The reliability (internal consistency) figures for these subscales were .72, .78, and .88, for family, peer, and media, respectively.

Compulsive Exercise Test (CET; Taranis, Touyz, & Meyer, in press). The CET comprises five subscales that sum together to form a total CET score (sum of average item score for each subscale), which is a measure of an individual's compulsivity towards exercise. The subscales are: Avoidance and Rule-Driven Behaviour, Weight Control Exercise, Mood Improvement, Lack of Exercise Enjoyment, and Exercise Rigidity. Each item on the measure asks the respondent to assess how true each statement is for them, and responses are answered on a 6-point Likert scale, ranging from "0 – never true" to "5 – always true". Only the CET total score will be used in this study. The CET has good psychometrics (Taranis et al., in press), and has been validated for use in adolescent samples, with a Cronbach's alpha figure of .88 for total CET (Goodwin et al., in press). The internal consistency for this sample was .89 for CET Total score.

Modified Perceived Sociocultural Influences on Body Image and Body Change Questionnaire (mSCIQ; McCabe & Ricciardelli, 2001). The SCIQ was modified in a previous investigation (Meesters, Muris, Hoefnagels, & van Gemert, 2007), and the modified version was used in this study. The mSCIQ used in this study consisted of six items assessing perceived encouragement from the respondent's father, mother, and best friend, to lose weight and/or to become more muscular. Sociocultural messages have been shown to emphasise a thin body for both boys and girls, as well as a more muscular body for boys (McCabe & Ricciardelli, 2003). Therefore, to identify which message was more influential for compulsive exercise, the items relating to losing weight (e.g., "Does your mother encourage you to lose weight?") were averaged to form one subscale (mSCIQ Lose Weight),

COMPULSIVE EXERCISE

whilst the items relating to becoming more muscular (e.g., “Does your father encourage you to become more muscular?”) were averaged to form another subscale (mSCIQ More Muscular). Responses were given on a 6-point Likert scale ranging from “1 = Never” to “6 = Always”, with higher scores equating to a greater sociocultural influence to lose weight or to become more muscular. The reliability (internal consistency) of the scales were shown by adequate Cronbach’s alphas (SCIQ-Lose Weight = .78; SCIQ More Muscular = .78).

Eating Disorder Inventory-2 (EDI-2; Garner, 1991). The short form of the EDI-2 measured disordered eating attitudes. The three subscales comprising the short form of the EDI-2 are Drive for Thinness (e.g., “I am preoccupied with the desire to be thinner”), Bulimia (e.g., “I have gone on eating binges where I have felt that I could not stop”), and Body Dissatisfaction (e.g., “I think that my stomach is too big”). Responses are answered on a 6-point Likert scale, ranging from “never” to “always”. Greater scores equate to greater levels of disordered eating attitudes. The EDI-2 has been used among adolescents (Grylli, Hafferl-Gattermayer, Schober, & Karwautz, 2004). The current sample reported good reliability (internal consistency), with Cronbach’s alphas of .85 for Drive for Thinness, .69 for Bulimia, and .91 for Body Dissatisfaction.

Data Analysis

All analyses were conducted separately for boys and girls, as sociocultural influences have been shown to be gender-specific (Field et al., 2001), and this was supported by gender differences found in the current sample (see Table 1). It has been previously shown that sociocultural pressures to be thin are also related to BMI, given that those individuals who are further from the societal norm would feel greater pressure to lose weight and be thin (Stice et al., 1996). Therefore, preliminary investigations assessed the relationship between BMI z scores and the study variables, to see whether BMI z scores needed to be controlled for in the

COMPULSIVE EXERCISE

regression analyses. Correlation coefficients (Spearman's rho) showed that BMI z scores were indeed significantly correlated ($p < .01$) with the majority of the study variables, albeit reporting rather weak correlations (significant r ranging from .12 to .32). Therefore, BMI z scores were entered into the regression as a control variable.

A hierarchical multiple regression was performed with Total Compulsive Exercise (CET Total) as the dependent variable. In the first step, the three EDI-2 subscales of Drive for Thinness, Bulimia, and Body Dissatisfaction, as well as BMI z scores, were entered to control for their effect on compulsive exercise. The second step then had the sociocultural predictors (i.e., PSPS and mSCIQ subscales) entered to identify their unique contribution to compulsive exercise, having already controlled for the effects of disordered eating attitudes and BMI. The aim of this analysis technique was to identify the specific and direct link between sociocultural factors and compulsive exercise.

Finally, correlations (Spearman's rho, two-tailed) were conducted on the individual items of the mSCIQ subscales (relating to messages from father, mother, or best friend) with CET Total to establish whether the source of the messages came from one or more significant others. These correlations were only run if an mSCIQ subscale (lose weight or more muscular) had shown a significant unique prediction of Total Compulsive Exercise in the previous hierarchical regressions. Significance levels were set at $p < .01$ for all tests to reduce the risk of Type I error, given the number of predictor variables and the relatively large size of the sample.

Results

Descriptives

The descriptive statistics and tests of difference between boys and girls can be seen in Table 1. The results for the mSCIQ subscales were similar to the previous study that used

COMPULSIVE EXERCISE

this measure (Meesters et al., 2007). Boys scored significantly higher than girls on BMI z scores and mSCIQ More Muscular, while girls scored significantly greater than boys on mSCIQ Lose Weight, PSPS Media, PSPS Family, PSPS Peers, EDI Body Dissatisfaction, EDI Drive for Thinness, and CET Total. There was no gender difference on EDI Bulimia. The EDI means were all well below suggested cut-offs for clinical severity (e.g., Grylli et al., 2004) and in general were slightly lower than a previous study of adolescents (Kostanski & Gullone, 1998). The CET means represent a mid-point scoring average for both boys and girls.

Sociocultural predictors of CET Total

Boys. The hierarchical multiple regression model can be seen in Table 2. The final regression model showed that the independent variables collectively predicted CET Total, accounting for 31% of CET Total variance (R^2). The sociocultural factors alone had added a significant increase of 16% of additional variance (R^2 change = .16, F change $(5, 223) = 10.49$, $p < .001$) in the second step of the regression. In the initial step, when the EDI variables and BMI z scores were entered, only EDI Drive for Thinness was significantly associated with CET Total. When the sociocultural factors were entered in the second step, mSCIQ More Muscular and PSPS Media were significant predictors, along with EDI Drive for Thinness, which remained significant. There were no other significant predictors of CET Total.

Subsequent correlations (Spearman's rho, two-tailed) between Total CET and the mSCIQ More Muscular items, revealed that all three sources of influence (i.e., Father, Mother, and Best Friend) were significantly correlated with Total CET, although it was the influence from the Father that recorded the greatest correlation coefficient ($r = .39$, $p < .001$).

COMPULSIVE EXERCISE

Girls. The hierarchical multiple regression for girls can be seen in Table 3. The final model produced a significant prediction for CET Total and accounted for 39% ($R^2 = .37$) of CET Total variance. The sociocultural factors alone had added a significant increase of 10% of additional variance (R^2 change = .10, F change $(5, 244) = 8.26$, $p < .001$) in the second step of the regression. Only EDI Drive for Thinness was a significant predictor of CET Total in the first step. In the second step, when the sociocultural factors were entered into the model, EDI Drive for Thinness remained a significant predictor and PSPS Media was an additional significant predictor. No other predictors reported a significant relationship with CET Total.

Discussion

This study aimed to identify whether sociocultural factors were related to compulsive exercise in an adolescent sample, after controlling for disordered eating attitudes and BMI. The results suggest that compulsive exercise is aligned more with a drive to be thin, i.e. anorexic attitudes, than it is with bulimic attitudes, and this is true for both boys and girls, regardless of current body size. Importantly, this study demonstrated that the messages that adolescents receive from different sociocultural sources are associated with their compulsive exercise, which itself can be used as an extreme weight loss behaviour. Importantly, the sociocultural influences differed slightly between boys and girls.

For boys, it would appear that messages from significant others to become more muscular could lead to a greater compulsivity towards exercise. This is worrying, given that a drive for muscularity and compulsive exercise have both been associated with the physically and psychologically harmful form of body dysmorphic disorder, called muscle dysmorphia (Murray et al., 2011; Pope et al., 1997). The current findings also demonstrated that boys perceiving general media messages about having a thinner body and losing weight, as well as reporting their own drive to be thinner, could be at an increased risk of compulsive

COMPULSIVE EXERCISE

exercise cognitions. These environmental pressures to achieve an ideal body could potentially lead to a downward spiral of disordered eating concerns and compulsive exercise attitudes, which could lead to an engagement in negative health-risk behaviours such as food restriction and/or compulsive exercise behaviour. These cross-sectional associations need to be replicated longitudinally and experimentally to identify whether these specific environmental influences have a causal effect on the development of compulsive exercise cognitions.

The potential environmental pressures identified among the boys are also present for girls. These adolescent girls reported that a pressure to be thin from the media, as well as their own drive for thinness, contributed to a compulsivity towards exercise. These findings support previous investigations demonstrating that the Western culture of the “thin ideal” is being reinforced by media messages (Field et al., 2001) which, these findings suggest, are then being picked up by adolescent girls. It is possible that these messages are then contributing to the development of potentially detrimental exercise attitudes, which could be physically and psychologically harmful to the individual in the medium- and long-term.

The practical implications of these findings centre around those professionals working with adolescents. Previous studies have found that social reinforcement of the thin-ideal can facilitate eating disordered behaviours, such as bingeing and purging (Stice & Agras, 1998). The findings from the current study demonstrate that the pressure to achieve this largely unobtainable Westernised ideal about body weight and shape may also lead to an unhealthy and potentially dangerous compulsion towards exercise, both among girls and boys. This risk from the cultural messages is relevant to all adolescents regardless of their current weight status. Therefore, school teachers, parents, and professionals working with any children and adolescents need to be aware of the messages that they are transmitting, particularly around exercise. Encouragement of exercise is predominantly a good thing, and should not be

COMPULSIVE EXERCISE

avoided. However, it requires adults to be cognisant of the messages that they are transmitting to adolescents and not to reinforce nor promote the potentially dangerous compulsivity to exercise. This is particularly true of promoting messages to boys to become more muscular, as these findings suggest that this could lead to a detrimental compulsivity to exercise.

The study did have limitations worth noting. First, the ordering of the self-report measures could have led to an ordering effect, which may have biased results. It is suggested that a random ordering of questionnaires in future investigations would be preferable. Second, although the paper's focus was on compulsive exercise cognitions rather than on exercise behaviour, the lack of a measure of exercise behaviour is a possible limitation. It is not known from the findings how much exercise behaviour was actually being performed, and whether it was at levels that may cause physical harm. Future research would benefit from including a measure of exercise behaviour alongside the compulsive exercise cognitions' assessment. Third, the limitations of this study are also apparent in its cross-sectional design, as causality cannot be established. It therefore remains uncertain as to whether an individual develops compulsive exercise cognitions and attitudes as a result of sociocultural pressures, or whether an individual with an existing compulsivity towards exercise simply feels greater pressure from these sociocultural sources than someone without such a compulsive drive to exercise. An investigation with a longitudinal design assessing the temporal precedence of these factors needs to be conducted.

Conclusions

The media appears to play an important role in fostering a desire to become thinner and lose weight among adolescent boys and girls, and this environment could potentially lead to greater compulsive exercising. Messages to become more muscular from significant

COMPULSIVE EXERCISE

others, particularly fathers, could also be influential in the development of a tendency towards more compulsive exercise among boys. These findings need to be replicated using a longitudinal design to establish true cause and effect of these possible sociocultural risk factors.

COMPULSIVE EXERCISE

References

- Casper, R. C., & Troiani, M. (2001). Family functioning in anorexia nervosa differs by subtype. *International Journal of Eating Disorders, 30*, 338-342.
- Child Growth Foundation. (1996). Cross Sectional Stature and Weight Reference Curves for the UK. London, United Kingdom: Child Growth Foundation.
- Davis, C., Katzman, D. K., Kaptein, S., Kirsh, C., & Brewer, H. (1997). The prevalence of high-level exercise in the eating disorders: Etiological implications. *Comprehensive Psychiatry, 38*, 321-326.
- Davis, C., Kennedy, S. H., Ravelski, E., & Dionne, M. (1994). The role of physical activity in the development and maintenance of eating disorders. *Psychological Medicine, 24*, 957-967.
- Dunkley, T. L., Wertheim, E. H., & Paxton, S. J. (2001). Examination of a model of multiple sociocultural influences on adolescent girls' body dissatisfaction and dietary restraint. *Adolescence, 36*, 265-280.
- Eisler, I., & le Grange, D. (1990). Excessive exercise and anorexia nervosa. *International Journal of Eating Disorders, 9*(4), 377-386.
- Epling, W. F., & Pierce, W. D. (1992). *Solving the anorexia puzzle*. Toronto, Canada: Hogrefe & Huber Publishers.
- Farrow, C., Haycraft, E., & Meyer, C. (in press). Similarities between eating attitudes among friendship groups in childhood: The moderating role of child anxiety. *Journal of Pediatric Psychology*. doi:10.1093/jpepsy/jsp105. Advance Access published November 27, 2009.
- Field, A. E., Camargo Jr, C. A., Taylor, C. B., Berkey, C. S., Roberts, S. B., & Colditz, G. A. (2001). Peer, parent, and media influences on the development of weight concerns and

COMPULSIVE EXERCISE

frequent dieting among preadolescent and adolescent girls and boys. *Pediatrics*, *107*, 54.

Garner, D. M. (1991). *EDI-2: Professional manual*. Odessa, FL: Psychological Assessment Resources.

Goodwin, H., Haycraft, E., Taranis, L., & Meyer, C. (in press). Psychometric evaluation of the Compulsive Exercise Test (CET) in an adolescent population: Links with eating psychopathology. *European Eating Disorders Review*.

Goodwin, H., Haycraft, E., Willis, A., & Meyer, C. (2011). Compulsive exercise: The role of personality, psychological morbidity, and disordered eating. *International Journal of Eating Disorders*. DOI: 10.1002/eat.20902.

Grylli, V., Hafferl-Gattermayer, A., Schober, E., & Karwautz, A. (2004). Prevalence and clinical manifestations of eating disorders in austrian adolescents with type-1 diabetes. *Wiener Klinische Wochenschrift*, *116*, 230-234.

Guidi, J., Pender, M., Hollon, S. D., Zisook, S., Schwartz, F. H., Predrelli, P., ... Peterson, T. J. (2009). The prevalence of compulsive eating and exercise among college students: An exploratory study. *Psychiatry Research*, *165*, 154-162.

Hutchinson, D. M., & Rapee, R. M. (2007). Do friends share similar body image and eating problems? the role of social networks and peer influences in early adolescence. *Behaviour Research and Therapy*, *45*, 1557-1577.

Jacobi, C., Hayward, C., de Zwaan, M., Kraemer, H. C., & Agras, W. S. (2004). Coming to terms with risk factors for eating disorders: Application of risk terminology and suggestions for a general taxonomy. *Psychological Bulletin*, *130*, 19-65.

Keery, H., van den Berg, P., & Thompson, J. K. (2004). An evaluation of the tripartite influence model of body dissatisfaction and eating disturbance with adolescent girls. *Body Image*, *1*, 237-251.

COMPULSIVE EXERCISE

- Kiang, L., & Harter, S. (2006). Sociocultural values of appearance and attachment processes: An integrated model of eating disorder symptomatology. *Eating Behaviors, 7*, 134-151.
- Knauss, C., Paxton, S. J., & Alsaker, F. D. (2007). Relationships amongst body dissatisfaction, internalisation of the media body ideal and perceived pressure from media in adolescent girls and boys. *Body Image, 4*, 353-360.
- Kostanski, M., & Gullone, E. (1998). Adolescent body image dissatisfaction: Relationships with self-esteem, anxiety, and depression controlling for body mass. *Journal of Child Psychology and Psychiatry, 39*, 255-262.
- Levine, M. P., Smolak, L., & Hayden, H. (1994). The relation of sociocultural factors to eating attitudes and behaviors among middle school girls. *The Journal of Early Adolescence, 14*, 471-490.
- McCabe, M. P., & Ricciardelli, L. A. (2001). The structure of the perceived sociocultural influences on body image and body change questionnaire. *International Journal of Behavioral Medicine, 8*, 19-41.
- McCabe, M. P., & Ricciardelli, L. A. (2003). Sociocultural influences on body image and body changes among adolescent boys and girls. *The Journal of Social Psychology, 143*, 5-26.
- McCabe, M. P., Ricciardelli, L., Mellor, D., & Ball, K. (2005). Media influences on body image and disordered eating among indigenous adolescent australians. *Adolescence, 40*, 115-127.
- Meesters, C., Muris, P., Hoefnagels, C., & van Gemert, M. (2007). Social and family correlates of eating problems and muscle preoccupation in young adolescents. *Eating Behaviors, 8*, 83-90.
- Meyer, C., Taranis, L., Goodwin, H., & Haycraft, E. (in press). Compulsive exercise and eating disorders. *European Eating Disorders Review*.

COMPULSIVE EXERCISE

- Murray, S. B., Maguire, S., Russell, J., & Touyz, S. W. (2011). The emotional regulatory features of bulimic episodes and compulsive exercise in muscle dysmorphia: A case report. *European Eating Disorders Review*. DOI: 10.1002/erv.1088.
- Muris, P., Meesters, C., van de Blom, W., & Mayer, B. (2005). Biological, psychological, and sociocultural correlates of body change strategies and eating problems in adolescent boys and girls. *Eating Behaviors*, 6, 11-22.
- Paxton, S. J., Schutz, H. K., Wertheim, E. H., & Muir, S. L. (1999). Friendship clique and peer influences on body image concerns, dietary restraint, extreme weight-loss behaviors, and binge eating in adolescent girls. *Journal of Abnormal Psychology*, 108, 255-266.
- Polivy, J., & Herman, C. P. (2003). Causes of eating disorders. *Annual Reviews*, 53, 187-213.
- Pope, H. G. Jr., Gruber, A. J., Choi, P., Olivardia, R., & Phillips, K. A. (1997). Muscle dysmorphia: An under-recognized form of body dysmorphic disorder. *Psychosomatics*, 38, 548-557.
- Pope, H. G. Jr., Katz, D. L., & Hudson, J. I. (1993). Anorexia nervosa and "reverse anorexia" among 108 male bodybuilders. *Comprehensive Psychiatry*, 34, 406-409.
- Presnell, K., Bearman, S. K., & Stice, E. (2004). Risk factors for body dissatisfaction in adolescent boys and girls: A prospective study. *International Journal of Eating Disorders*, 36, 389-401.
- Ricciardelli, L. A., & McCabe, M. P. (2003). Sociocultural and individual influences on muscle gain and weight loss strategies among adolescent boys and girls. *Psychology in the Schools*, 40, 209-224.
- Seigel, K., & Hetta, J. (2001). Exercise and eating disorder symptoms among young females. *Eating and Weight Disorders*, 6(1), 32-39.

COMPULSIVE EXERCISE

Shisslak, C. M., Crago, M., & Estes, L. S. (1995). The spectrum of eating disturbances.

International Journal of Eating Disorders, 18, 209-219.

Shroff, H., & Thompson, J. K. (2006). Peer influences, body-image dissatisfaction, eating dysfunction and self-esteem in adolescent girls. *Journal of Health Psychology, 11*, 533-551.

Solenberger, S. E. (2001). Exercise and eating disorders:: A 3-year inpatient hospital record analysis. *Eating Behaviors, 2*, 151-168.

Steffen, J. J., & Brehm, B. J. (1999). The dimensions of obligatory exercise. *Eating Disorders, 7*(3), 219-226.

Stice, E., & Agras, W. S. (1998). Predicting onset and cessation of bulimic behaviors during adolescence: A longitudinal grouping analysis. *Behavior Therapy, 29*, 257-276.

Stice, E., & Bearman, S. K. (2001). Body-image and eating disturbances prospectively predict increases in depressive symptoms in adolescent girls: A growth curve analysis. *Developmental Psychology, 37*, 597-607.

Stice, E., Nemeroff, C., & Shaw, H. E. (1996). Test of the dual pathway model of bulimia nervosa: Evidence for dietary restraint and affect regulation mechanisms. *Journal of Social and Clinical Psychology, 15*, 340-363.

Stice, E., & Whitenton, K. (2002). Risk factors for body dissatisfaction in adolescent girls: A longitudinal investigation. *Developmental Psychology, 38*, 669-678.

Striegel-Moore, R. H., & Bulik, C. M. (2007). Risk factors for eating disorders. *American Psychologist, 62*, 181-198.

Taranis, L., Touyz, S., & Meyer, C. (in press). Disordered eating and exercise: Development and preliminary validation of the Compulsive Exercise Test (CET). *European Eating Disorders Review*.

COMPULSIVE EXERCISE

Taylor, C. B., Sharpe, T., Shisslak, C., Bryson, S., Estes, L. S., Gray, N., ... Killen, J. D.

(1998). Factors associated with weight concerns in adolescent girls. *International Journal of Eating Disorders*, *24*, 31-42.

Young, E. A., Clopton, J. R., & Bleckley, M. K. (2004). Perfectionism, low self-esteem, and family factors as predictors of bulimic behavior. *Eating Behaviors*, *5*, 273-283.

COMPULSIVE EXERCISE

TABLE 1

Descriptive Statistics for Study Variables and Tests of Difference (Mann Whitney U) Between Boys and Girls

Variable	Boys Mean (SD)	Girls Mean (SD)	Test of Difference z
BMI z score	0.37 (1.37)	0.00 (1.23)	4.03**
mSCIQ More Muscular	2.19 (1.15)	1.44 (.71)	11.28**
mSCIQ Lose Weight	1.61 (1.02)	1.68 (.88)	2.97*
PSPS Media	1.52 (.93)	2.50 (1.31)	11.76**
PSPS Family	1.44 (.70)	1.62 (.84)	3.46*
PSPS Peers	1.44 (.65)	1.58 (.72)	3.80**
EDI Drive for Thinness	2.27 (3.88)	5.28 (5.65)	8.69**
EDI Bulimia	1.85 (3.09)	2.18 (3.25)	1.84
EDI Body Dissatisfaction	4.39 (5.68)	10.83 (8.23)	11.86**
CET Total	8.57 (3.79)	9.52 (3.57)	3.50**

Note. BMI = Body Mass Index; mSCIQ = Modified Perceived Sociocultural Influences on Body Image and Body Change Questionnaire; PSPS = Perceived Sociocultural Pressure Scale; EDI = Eating Disorder Inventory; CET = Compulsive Exercise Test.

* $p < .01$. ** $p < .001$ (two-tailed).

COMPULSIVE EXERCISE

TABLE 2

Significant Predictors of CET Total Score (Outcome) for Boys Using a Hierarchical Multiple Regression

Model	<i>F</i> (<i>df</i>)	<i>R</i> ²	<i>Adj R</i> ²	Beta	<i>t</i>
1.	9.74 (4, 228)**	.15	.13		
EDI Drive for Thinness				.38	4.51**
EDI Bulimia				-.03	-0.48
EDI Body Dissatisfaction				.01	0.06
BMI <i>z</i> Score				.03	0.45
2.	11.06 (9, 223)**	.31	.28		
EDI Drive for Thinness				.25	3.05*
EDI Bulimia				-.10	-1.55
EDI Body Dissatisfaction				-.08	-0.98
BMI <i>z</i> Score				.03	0.53
mSCIQ More Muscular				.31	4.90**
mSCIQ Lose Weight				.01	0.19
PSPS Media				.19	2.89*
PSPS Family				.07	0.78
PSPS Peers				.05	0.56

Note. CET = Compulsive Exercise Test; Adj = Adjusted; EDI = Eating Disorder Inventory; BMI = Body Mass Index; mSCIQ = Modified Perceived Sociocultural Influences on Body Image and Body Change Questionnaire; PSPS = Perceived Sociocultural Pressure Scale

p* < .01. *p* < .001.

COMPULSIVE EXERCISE

TABLE 3

Significant Predictors of CET Total Score (Outcome) for Girls Using a Hierarchical Multiple Regression

Model	<i>F</i> (<i>df</i>)	<i>R</i> ²	<i>Adj R</i> ²	Beta	<i>t</i>
1.	24.87 (4, 249)**	.29	.27		
EDI Drive for Thinness				.57	7.51**
EDI Bulimia				-.01	-0.18
EDI Body Dissatisfaction				-.07	-0.94
BMI <i>z</i> Score				.05	0.78
2.	17.25 (9, 244)**	.39	.37		
EDI Drive for Thinness				.45	6.01**
EDI Bulimia				-.06	-1.12
EDI Body Dissatisfaction				-.16	-2.18
BMI <i>z</i> Score				.01	0.23
mSCIQ More Muscular				.04	0.69
mSCIQ Lose Weight				.06	0.91
PSPS Media				.20	3.26**
PSPS Family				.07	1.01
PSPS Peers				.15	2.15

Note. CET = Compulsive Exercise Test; Adj = Adjusted; EDI = Eating Disorder Inventory;

BMI = Body Mass Index; mSCIQ = Modified Perceived Sociocultural Influences on Body

Image and Body Change Questionnaire; PSPS = Perceived Sociocultural Pressure Scale

***p* < .001.