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Psychometric Properties of the Compulsive Exercise Test in an Adolescent Eating Disorder Population

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Abstract

The objective of this study was to evaluate the factor structure, validity, and reliability of the Compulsive Exercise Test (CET) in an adolescent clinical eating disorder population. The data source was the Helping to Outline Paediatric Eating Disorders (HOPE) Project, a prospective ongoing registry study comprising consecutive paediatric tertiary eating disorder referrals. Adolescents (N = 104; 12-17 years) with eating disorders completed the CET and other measures. Factor structure, convergent validity, and internal consistency were evaluated. Despite failing to identify a factor structure, the study provided clear evidence of the multidimensionality of the measure. The total score correlated significantly with measures of eating pathology, perfectionism, and frequency of exercise for shape and weight control (r = 0.32-0.70, ps < 0.05). More research into the multidimensional nature of compulsive exercise in clinical populations is needed, Further, research into compulsive exercise offers promise as an addition to existing cognitive behavioral models and treatments for eating disorders.

Keywords:

Adolescent

Compulsive Exercise Test

Eating disorders

Factor analysis

HOPE Project

1. Introduction

Individuals with eating disorders (EDs) often feel compelled to exercise in excessive amounts despite negative consequences including injury and ill health. The prevalence of unhealthy exercise as a symptom of EDs is as high as 80% (Dalle Grave, Calugi, & Marchesini, 2008; Watson, McCormack, Hoiles, Forbes, & Potts, 2013). The role of compulsive exercise in the development and maintenance of EDs is unclear, however it is thought to be a multidimensional construct (Meyer, Taranis, Goodwin, & Haycraft, 2011; Taranis & Meyer, 2011).

Recently, it has been recognized that exercise may only be problematic within the context of EDs when compulsive in nature and used to influence weight and shape, rather than when simply "excessive" (Meyer & Taranis, 2011). Compulsive exercise has been linked to longer hospital admissions, relapse, suicidal behavior, and treatment drop-out (Carter, Blackmore, Sutandar-Pinnock, & Woodside, 2004; El Ghoch et al., 2013; Smith et al., 2013; Solenberger, 2001). The Compulsive Exercise Test (CET) (Taranis, Touyz, & Meyer, 2011) is based on a cognitive-behavioral model and assesses the cognitive, behavioral, and affective features of compulsive exercise. A five-factor structure has been proposed and confirmed among female exercisers in a college population (Taranis et al., 2011) and 12 to 14 year-old schoolchildren (Goodwin, Haycraft, Taranis, & Meyer, 2011). The measure has not been validated among children or adolescents with clinical EDs.

Compulsive exercise may precede and even predispose to an ED (Davis, Kennedy, Ravelski & Dionne, 1994), so refining understanding may assist in improving interventions and prognosis. A validated measure would also be a useful additional clinical indicator of outcome. This study investigated the psychometric properties of the CET in adolescents with EDs.

2. Method

2.1. Participants

Participants (N = 104) were 12-17 years-old, met ED criteria (American Psychiatric Association, 2013), and were consecutively referred between July 2011 (when the CET was introduced into routine intake) to August 2013. Participants were mostly female (93%), with a mean age of 14.9 (± 1.0) years, BMI z score of -1.50 (± 1.4), duration of illness of 10.7 (± 8.7) months, and had diagnoses of other or unspecified EDs (51%), anorexia nervosa (38%), and bulimia nervosa (11%).

This study is part of the Helping to Outline Paediatric Eating Disorders (HOPE) Project (Watson et al., 2013). Ethics approval was granted by Princess Margaret Hospital for Children HREC.

2.2 Procedure

Data collection for HOPE is prospective and standardized as described in Watson et al. (2013). Data were collected during multidisciplinary routine intake assessment through clinical and research instruments completed by clinicians, parents, and children. Diagnoses were yielded through medical review and child- and parent-informant versions of the Eating Disorder Examination (EDE) (Fairburn & Cooper, 1993; Watson et al., 2013).

2.3. Measures

2.3.1. Compulsive Exercise Test

The 24-item self-report CET (Taranis et al., 2011) was designed to assess core features of compulsive exercise in EDs. Proposed subscales are *avoidance and rule-driven behaviour* (e.g., "I feel like I've let myself down if I cannot exercise"), *weight control exercise* (e.g., "I exercise to burn calories and lose weight"), *mood improvement* (e.g., "Exercise improves my mood"), *lack of exercise enjoyment* (e.g., "I find exercise a chore"), and *exercise rigidity* (e.g., "My weekly exercise pattern is repetitive").

2.3.2. Eating disorder symptoms and related constructs

The EDE (Fairburn & Cooper, 1993) global scale and number of days of 'intense exercise to control weight and shape' were used (timespan of previous 28 days). To evaluate construct validity, the Eating Disorder Inventory (EDI-3) (Garner, 2004) symptom scales (body dissatisfaction, drive for thinness, bulimic symptoms) and perfectionism scale were used.

2.4 Statistical analysis

We used confirmatory factor analysis conducted in Lisrel 8.8. Multivariate normality was violated, hence robust maximum likelihood estimates were used. Four factorial models were evaluated (i) a general factor structure with all items loading on a single factor (ii) a first-order factor structure based on the recommended subscales and allowing correlation as encouraged by Taranis et al. (2011) (iii) the previous model repeated but correlations fixed to zero and (iv) a second-order structure with the five proposed factors allowed to correlate and

loading on a higher-order factor of compulsive exercise. Goodness of fit was tested with χ^2, χ^2/df (≤ 2 or 3), CFI (≥ 0.95), PGFI (< 0.60), and RMSEA (< 0.05 to 0.08 including the confidence interval). The a priori statistical plan for management of models with unacceptable fit was respecification via modification indices and standardized covariance residuals. We intended to examine convergent validity and internal consistency based on the factor structure identified with the process above. Because we were unable to identify a good-fitting model, we used the CET total.

3. Results

Four a priori factorial models were tested and none provided a good fit (see Table 1). Model 1 provided a worse fit than Model 2 ($\Delta\chi^2(10) = 559.48, p < 0.001$), Model 3 ($\Delta\chi^2(63) = 530.13\, p < 0.001$), and Model 4 ($\Delta\chi^2(4) = 478.39, p < 0.001$), and Model 2 provided a better fit than Model 4 ($\Delta\chi^2(6) = 81.09, p < 0.001$).

Insert Table 1 about here

Because Model 2 provided the best fit, the measurement model was inspected. Standardized factor loadings were all high (> 0.40) and significant (ps < 0.05). No modification indices suggested large misspecification, but did suggest adding error covariances among items within factors. However, there were no theoretical or methodological grounds and only freeing a large number of error covariances would achieve model fit. Adding correlated errors on statistical grounds alone is discouraged; it shifts the model away from its theoretical conception and overfits (Brown, 2006).

Within-factor correlated measurement errors may mean a higher-order factor structure, or a close-fitting model with a misspecified number of factors or item path-factor relations (Gerbing & Anderson, 1984). A higher-order factor structure was tested in Model 4 and gave a worse fit. There were no theoretical grounds to specify an alternate higher-order structure and no other rationale based on extant data to test additional factor configurations. The standardized residual covariances showed areas of misspecification. We next removed problematic items one-by-one, mindful that items should be removed sparingly, otherwise the solution becomes unstable. Removal of items 4, 8, 17, and 18 improved model fit (Model 5 in Table 2 and Figure 1), items 3, 5, and 7 were associated with misspecification but were retained to preserve the minimum recommended three items per factor. The respecified model fit better than Model 3 ($\Delta\chi^2(82) = 388.58, p < 0.001$), fit was acceptable according to the CFI and PGFI but x^2/df ratio and RMSEA were unacceptable. Standardized factor loadings were high (ps < 0.05), but standardized residual covariances suggested misspecification; eight were ± 3.29.

Insert Figure 1 about here

CET total was significantly related (Pearson's r: two-tailed) to the global EDE (r = 0.68, p < 0.001), EDI-3 body dissatisfaction (r = 0.62, p < 0.001), drive for thinness, (r = 0.70, p < 0.001), bulimia (r = 0.32, p = 0.01) and perfectionism (r = 0.42, p = 0.001) scales, and exercise frequency (r = 0.46, p < 0.001).

4. Discussion

This is the first known study to examine the psychometric properties of the CET in a clinical adolescent sample. A confirmatory factor approach failed to confirm a factor structure.

Refinements in the conceptualization of compulsive exercise are needed to develop increasingly targeted, potent interventions. This study adds clear evidence that compulsive exercise is not a unitary construct. Previous research has been done in non-clinical samples and a five-factor structure has emerged (Goodwin et al., 2011; Taranis & Meyer, 2011; Taranis et al., 2011). Our inability to find a multidimensional structure with adequate fit suggests a need for further investigation in clinical populations.

Significant correlations with clinical constructs showed the CET total to be capturing a pathological construct of relevance to EDs. Treatment of perfectionism reduces ED symptoms (Steele & Wade, 2008). It may be interesting to examine if treatment of perfectionism reduces compulsive exercise, or if treatment of compulsive exercise improves EDs and perfectionism. The significant correlation between the CET total and frequency of exercise is contrary to previous findings (Goodwin et al., 2011). Our study measured only exercise pathognomonic to EDs, not exercise for leisure or other reasons. Frequent exercise may not be compulsive, but compulsive exercise is more likely to be frequent.

The study setting is a facility dealing with the most severe cases, so findings may not be generalizable to less severe patients with good medical stability, or males, who were underrepresented.

Despite not establishing a factor structure, the study provides clear evidence for the multidimensionality of compulsive exercise. Further research into the construct and treatment of compulsive exercise offers promise as an addition to existing treatments.

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Table 1.

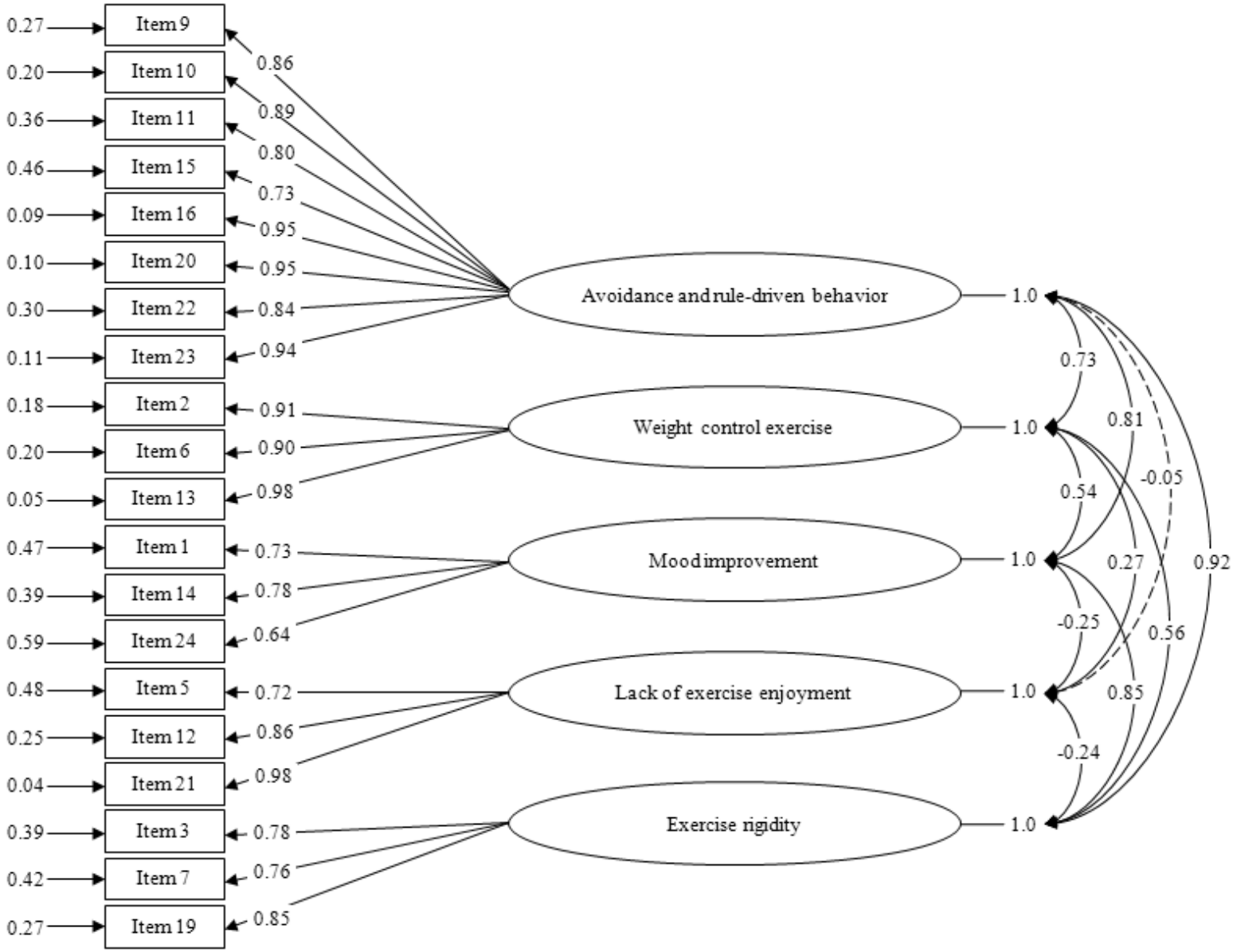
Fit indices for confirmatory models of the CET.

Model	χ^2	*df*	χ^2/df	CFI	PGFI	RMSEA
1. General factor	1569.18***	252	6.23	0.89	0.35	0.18 [0.16,0.19]
2. Five factors, correlated	1009.70***	242	4.17	0.98	0.52	0.08 [0.07,0.09]
3. Five factors, uncorrelated	1039.05***	189	5.50	0.96	0.48	0.12 [0.11,0.14]
4. Higher-order	1090.79***	248	4.40	0.97	0.51	0.09 [0.08,0.11]
5. Five factors, correlated, four items deleted	621.12***	160	3.89	0.98	0.52	0.08 [0.06,0.10]

*$p < 0.05$ **$p < 0.01$ ***$p < 0.001$.

Figure 1.

Best fitting model for the CET. Standardized beta coefficients are shown, unbroken lines represents significant paths ($p < 0.05$).


0.27
Item 9
0.20
Item 10
0.36
Item 11
0.46
Item 15
0.09
Item 16
0.10
Item 20
0.30
Item 22
0.11
Item 23
0.18
Item 2
0.20
Item 6
0.05
Item 13
0.47
Item 1
0.39
Item 14
0.59
Item 24
0.48
Item 5
0.25
Item 12
0.04
Item 21
0.39
Item 3
0.42
Item 7
0.27
Item 19
0.86
0.89
0.80
0.73
0.95
0.95
0.84
0.94
0.91
0.90
0.98
0.73
0.78
0.64
0.72
0.86
0.98
0.78
0.76
0.85
Avoidance and rule-driven behavior
Weight control exercise
Mood improvement
Lack of exercise enjoyment
Exercise rigidity
1.0
1.0
1.0
1.0
1.0
0.73
0.81
-0.05
0.54
0.27
0.92
-0.25
0.56
0.85
-0.24