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Research article

VALIDITY OF THE EATING ATTITUDE TEST AMONG EXERCISERS

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ABSTRACT
Theory testing and construct measurement are inextricably linked. To date, no published research has looked at the factorial validity of an existing eating attitude inventory for use with exercisers. The Eating Attitude Test (EAT) is a 26-item measure that yields a single index of disordered eating attitudes. The original factor analysis showed three interrelated factors: Dieting behavior (13-items), oral control (7-items), and bulimia nervosa-food preoccupation (6-items). The primary purpose of the study was to examine the factorial validity of the EAT among a sample of exercisers. The second purpose was to investigate relationships between eating attitudes scores and selected psychological constructs. In stage one, 598 regular exercisers completed the EAT. Confirmatory factor analysis (CFA) was used to test the single-factor, a three-factor model, and a four-factor model, which distinguished bulimia from food pre-occupation. CFA of the single-factor model (RCFI = 0.66, RMSEA = 0.10), the three-factor-model (RCFI = 0.74; RMSEA = 0.09) showed poor model fit. There was marginal fit for the 4-factor model (RCFI = 0.91, RMSEA = 0.06). Results indicated five-items showed poor factor loadings. After these 5-items were discarded, the three models were re-analyzed. CFA results indicated that the single-factor model (RCFI = 0.76, RMSEA = 0.10) and three-factor model (RCFI = 0.82, RMSEA = 0.08) showed poor fit. CFA results for the four-factor model showed acceptable fit indices (RCFI = 0.98, RMSEA = 0.06). Stage two explored relationships between EAT scores, mood, self-esteem, and motivational indices toward exercise in terms of self-determination, enjoyment and competence. Correlation results indicated that depressed mood scores positively correlated with bulimia and dieting scores. Further, dieting was inversely related with self-determination toward exercising. Collectively, findings suggest that a 21-item four-factor model shows promising validity coefficients among exercise participants, and that future research is needed to investigate eating attitudes among samples of exercisers.

KEY WORDS: Eating attitudes, model testing, external validity, exercise and health.

INTRODUCTION

Although exercise is associated with numerous health related benefits such as weight management, recent research suggests that it also can be linked with dysfunctional attitudes and behaviors (Szabo, 2000). Obsessive attitudes toward diet and exercise could be associated with binging on food and then engaging in vigorous exercise as a strategy to rid the body of calories. Few studies have investigated eating attitudes among exercise participants with the majority of research focusing on female athletes from sports where a disordered eating attitude is suspected (Hausenblaus and Carron, 1999). Research among samples of athletes indicates sports that emphasize leanness are associated with disordered eating attitudes (see Hausenblaus and Carron, 1999 for a review). Given findings in sport and the value that exercisers place in losing weight, research is needed to examine the nature of eating attitudes among samples of exercise participants.

When extending a line of investigation to a

new population, the researcher is faced with a number of different options regarding how to measure key constructs. One option is to use a previously validated inventory on the new population and assume validity. A second option is cross-validation. A third option is to develop a new measure from principles. Previous research has tended to use the first option (Schutz, 1994). If researchers are to use self-report measures to test theoretical links, the first step in this process should be to demonstrate the validity of measures used, therefore, it is argued that the second option should be conducted as a minimum requirement.

Of the number of measures of eating attitudes, the Eating Attitude Test (EAT: Garfinkel and Garner, 1979; Garner et al., 1982) is possibly the most appropriate measure to cross-validate. The EAT-26 (Garner et al., 1982) has been used extensively in clinical psychology (Boyadjieva and Steinhausen, 1996), general psychology (Rosen et al., Gross, 1998) and more recently, sport psychology (Terry et al., 1999a; Hasse and Prapavessis, 2001; Lane, 2003).

In the original validation study, Garner et al. (1982) reported three highly correlated factors: (1) Dieting, (2) bulimia and food pre-occupation, and (3) oral control. However, the sum of responses to all items tends to be the approach used by researchers and practitioners. Participants that score over 20 on the EAT are suggested to be at risk of having a clinical disorder (Garner et al., 1982).

The first reason for examining the factorial validity of the EAT stems from the question of whether the EAT comprised one factor, as is commonly used in research, or three correlated factors as found in the original validation study. Garner et al. (1982) acknowledged that factor analysis results should be treated cautiously. It could be argued that the factor 'bulimia and food pre-occupation' assesses two highly related constructs. Bulimics are likely to have pre-occupation with food, and thus the two constructs could correlate. However, a pre-occupation with food is not necessarily an indicator of bulimia. The possibility that bulimia and food pre-occupation represent independent factors warrants further investigation.

The argument for reinvestigating the factorial validity of the EAT among exercisers is strengthened when examining the participant-group used in the original validation study. Validation studies comprised 300 participants of whom 160 were female anorexia nervosa patients and 140 were university psychology students (Garner and Garfinkel, 1979; Garner et al., 1982). Combining clinical and non-clinical samples is justifiable given the primary purpose of the original study was to develop a measure that could identify individuals at risk. Therefore, it is clearly desirable to use a sample that included participants who have been clinically diagnosed with an eating disorder and contrast their data with individuals who are not clinically diagnosed.

It could be argued that psychology students are sufficiently similar to exercisers, and it is likely that some participants in the sample engaged in regular exercise. However, we suggest that individuals with an eating disorder might conceptualize items differently to individuals not clinically diagnosed. For example, items such as *'I am aware of the calorie content of food I eat'* and *'I avoid foods with sugar in them'* on the EAT are proposed to assess an avoidance of fattening foods and a pre-occupation with being thinner. These items could assess behaviors that are consequences of a disordered attitude toward food, rather than being part of the eating disorder itself. Among exercisers, knowledge of calorie content of food might be a reflection of potentially good dietary practices, where the intention is to eat a relatively low fat and high carbohydrate diet. Awareness of the caloric content is desirable when instigating an education-based intervention to promote a healthy lifestyle. Hence, a score of *'Always'*, rated as 3 on the EAT, might reflect a disordered attitude, or it could reflect increased knowledge of diet. If it does reflect increased knowledge, it clearly should not be included as an indicator of an eating disorder.

A second reason for suggesting further validation work on the EAT is needed is based on arguments that suggest confirmatory factor analysis is needed to establish factorial validity. Garner et al. (1982) used exploratory factor analysis. Thompson and Daniel (1996) argued that exploratory factor analysis tends to produce factors that are unique to the sample under investigation. This method can also produce spurious factors rather than theoretically relevant constructs. Examination of the reproducibility of a factor structure has become increasingly important since confirmatory factor analysis was recommended as the test of choice for investigating factorial validity (Schutz and Gessaroli, 1993; Tabachnick and Fidell, 1996; Biddle et al., 2001). Confirmatory factor analysis tests whether a model is supported, whereas exploratory factor analysis produces a factor solution based on the inter-correlations within the dataset. Thompson and Daniel (1996) argued that statistical tests should be used to test theory. Exploratory factor analysis is therefore criticized because it generates theory. Thompson and Daniel (1996) are critical of cross-validation research that has used exploratory factor analysis. It is common for such research to yield a different factor structure to the one expected. In such studies, Thompson and

Daniel (1996) argued that researchers tend to propose that exploratory factor analysis results produce new constructs rather than emphasizing that the expected constructs did not emerge. Whilst it is possible for exploratory factor analysis to produce new constructs, it is arguably more important for researchers to provide a clear theoretical explanation for the nature of such constructs. Mathematically driven constructs that lack a solid theoretical are likely to lead research in circles rather than moving forwards.

Collectively, the nature of eating disorders prioritizes research to identify possible sufferers. If research and practitioners use self-report measures to gain early insight into disordered eating attitudes, such measures should show validity in the population there are being used. The purpose of the study was to investigate the validity of the EAT for use among exercise participants. We investigated three related models. First, we tested the hypothesis proposing all items load onto a single factor. Second, we tested an interrelated three-factor model proposed by Garner et al. (1982). As it is possible to argue that Garner et al. (1982) identified, four-factors (dieting, oral control, bulimia, and food pre-occupation), we also tested a four-factor model.

After identifying a good fitting model (if a good fitting model was not found, the second purpose would not be explored), a second purpose of the study was to investigate relationships between EAT scores and selected psychological constructs. To this end, we investigated relationships between EAT scores, mood, self-esteem, and motivational indices toward exercise in terms of self-determination, enjoyment and competence (see Markland, 1999).

EAT scores were correlated with mood states assessed in the Profile of Mood States (POMS: McNair et al., 1971). The POMS assesses six mood states: Anger, confusion, depression, fatigue, tension, and vigor. Terry et al. (1999a) found that depressed mood scores were associated with EAT scores. Research has suggested a relationship between low self-esteem and eating disorder symptoms (e.g. Wood et al., 1994; Button et al., 1996), although such research has used a longitudinal approach.

Relationships between eating attitudes and participation motives towards exercise were also investigated. On principle interest was the relationships between EAT subscale scores and self-determination. Self-determination to exercise participation is primarily concerned with whether an individual decides to exercise for intrinsic reasons such as enjoyment, or extrinsic reasons, because they feel they ought to, usually for an externally regulated reason (Deci and Ryan, 1985). If low scores of self-determination were associated with high scores on the dieting subscale, it might suggest that individuals use exercise as a form of calorie removal.

METHODS

Participants

Volunteer participants were 598 exercisers (Age: M = 29.38, SD = 10.22 years; Male: N = 270, Female: N = 325, with 3 participants not reporting gender). Participants reported to have taking regular exercise for an average of 4.23 years (SD = 3.38, completing an average of 3 exercise sessions (SD = 4.34) each week. Participants reported to take part in a number of different types of exercise sessions as part of their regular program. The majority of participants reported taking part in more than one type of exercise each week. Combinations of exercise included one or more of the following activities: running, cycling, various forms of cardio-vascular training equipment (cross-trainer, stepper, rowing machine, cycling, and treadmill walking or running), aerobics, fitness classes (yoga, circuit training, and boxercise), dance, swimming and weight-lifting. It should be emphasized that none of the participants used in the present study reported to be training to take part in competitive sport. In addition, none of the participants reported being currently or previously diagnosed with a clinical eating disorder.

Two subsections of participants and one additional group of participants completed the EAT and a second questionnaire. Fifty-seven participants completed the EAT and Rosenberg self-esteem scale (Rosenberg, 1965). Seventy-three participants completed the EAT and the Brunel Mood Scale (Terry et al., 1999b; Terry et al., 2003). There were no significant differences in age, gender ratio, and exercise preferences between these subsections of participants and the remaining participants.

Forty-three participants (Age: M = 24.58 yrs, SD = 12.45; Male N = 12, Female N = 31) completed the EAT and the 10-item motivation scale used by Markland (1999). Participants were regular exercisers engaging in an average of 11 hours (SD = 5.14) of exercise per week. This subsection of participants engaged in significantly more hours of exercise than participants in the main dataset.

Measures

Eating Attitudes Test

The EAT-26 (Garner et al., 1982) is a 26-item questionnaire designed to identify abnormal eating habits and concerns about weight derived from a 40-item original inventory (Garner and Garfinkel, 1979). To complete the EAT-26, participants rate

their agreement with statements about weight and food. The factor dieting describes avoiding high calorie food and a pre-occupation with being thinner. Examples include *'I enjoy trying new rich foods'* and *'I am terrified about being overweight'*. The factor bulimia and food pre-occupation includes items that reflect thoughts about food. Examples include *'I find myself preoccupied by food'* and *'I feel that food controls my life'*. The bulimia aspect of the factor includes items such as *'I have the impulse to vomit after meals'* and *'I have gone on eating binges where I feel that I may not be able to stop'*. Items on the third factor, *'oral control'* are related to the control of eating and the perceived pressure from others to gain weight. Examples include *'I avoid eating when I am hungry'* and *'I cut my food into small pieces'*.

Garner and Garfinkel (1979) reported an Alpha coefficient (Cronbach, 1951) of 0.94 to demonstrate internal consistency. A test-retest reliability coefficient for the EAT was not reported by Garner and Garfinkel but has subsequently been identified at 0.81 for a children's version (Allison, 1995). Research among students athletes has suggested that the EAT is an internally consistent scale with an alpha coefficient of 0.79 (Lane, 2003). However, it should be noted that alpha coefficients tend to be inflated when examining large number of items simultaneously (Schutz and Gessaroli, 1993).

Participants rate the intensity of attitudes from six possible options *Never, Rarely, Sometimes* (0), *Often* (1), *Very Often* (2), and *Always* (3). The first three responses are scored zero, with the other three responses being scored 1, 2, and 3 accordingly. A score greater than 20 is considered to be an indicator of a possible eating disorder problem, and individuals who score 20 or more should seek clinical support.

Correlates of Eating Attitude Test scores

Mood

Mood was assessed using the 24-item BRUMS (Terry et al., 1999b, 2003) which is a shortened version of the POMS (McNair et al., 1971). Validation of the BRUMS involved 3,361 participants ranging in age from 12-39 years (Terry et al., 1999b, 2003). Confirmatory factor analysis supported the factorial validity of a 24-item six-factor model using both independent and multisample analyses. Items are rated on a 5-point scale anchored by *"not at all"* (0) to *"extremely"* (4).

Self-esteem. Rosenberg's Self-esteem Scale (Rosenberg, 1965) was used to assess self-esteem. Respondents completed the scale by indicating their agreement with each of the 10 items (e.g. *"On the whole I am satisfied with myself"*, *"I certainly feel useless at times"*) on a 4-point scale (4 = *'strongly agree'*, 1 = *'strongly disagree')*. After reversing the scoring for 5 negatively worded items, a total Self-esteem score was obtained by summing the 10 responses. The range of scores using this procedure was 10-40 with higher scores indicating higher self-esteem. In the present study, the alpha coefficient was .82, hence indicating an internally reliable scale.

Motivation was assessed using the 10-item scale used by Markland (1999). Intrinsic motivation was assessed using 4-items from the Intrinsic Motivation Inventory (IMI: McAuley et al., 1989, 1991). Examples of items include 'I enjoy participating in exercise very much' and 'I think taking part in exercise is fun'. Perceived Competence was assessed through three-items ('think I do pretty well in completing exercise sessions, compared to other people' and 'I am pretty skilled at the level of exercise performed in this leisure center') (see McAuley et al., 1991). Self-determination was assessed using three-items ('Having to exercise is a bit of a bind, but it has to be done' and 'Exercising is not necessarily something I would chose to do; rather something that I feel I ought to do') (see Markland and Hardy, 1997).

Procedure

The research project was granted ethical approval from the university ethics committee of the second author. Leisure centers in the Midlands area of the United Kingdom were contacted via letter and a follow-up telephone call regarding the study. Six leisure centers agreed to participate in the study. Informed consent was obtained before data collection. Participants were informed that the purpose of the study was to explore attitudes towards eating among exercise participants, that there were no right or wrong answers, and that data would be treated confidentially. Participants completed the EAT-26 (Garner et al., 1982) before or after exercising with a subsection of participants also completing the BRUMS, Rosenberg self-esteem scale, or motivation scale.

Data analysis

Confirmatory factor analysis (CFA) using EQS V5 (Bentler and Wu, 1995) was used to test the three hypothesized models. As there was evidence of multivariate non-normality in the data (Mardia = 42.23), the Robust Maximum Likelihood estimation method was used. This has been found to effectively control for overestimation of X^2, under-estimation of adjunct fit indexes, and under-identification of errors (Hu and Bentler, 1995).

Table 1. Standardized factor loadings for the 26-item Eating Attitude Test.

	Standardized factor loading (error variances in parentheses)					
	1-factor model		3-factor model		4-factor model	
Dieting						
I enjoy trying new rich foods	.02	(1.00)	.04	(1.00)	.04	(1.00)
I am terrified about being overweight	.61	(.79)	.64	(.77)	.64	(.77)
I am aware of the calorie content of foods I eat	.45	(.89)	.46	(.89)	.46	(.89)
I particularly avoid foods with a high carbohydrate content	.35	(.94(	.36	(.94)	.36	(.93)
I feel extremely guilty after eating	.62	(.78)	.62	(.80)	.62	(.79)
I am preoccupied with a desire to be thinner	.77	(.64)	.79	(.61)	.79	(.61)
I think about burning up calories when I exercise	.55	(.84)	.57	(.82)	.57	(.82)
I am preoccupied with the thought of having fat on my body	.67	(.74)	.69	(.73)	.69	(.73)
I avoid foods with sugar in them	.29	(.96)	.29	(.96)	.30	(.96)
I eat diet foods	.52	(.86)	.52	(.85)	.52	(.85)
I feel uncomfortable after eating sweets	.57	(.82)	.57	(.82)	.57	(.82)
I engage in dieting behavior	.72	(.69)	.72	(.69)	.73	(.69)
I like my stomach to be empty	.56	(.83)	.55	(.83)	.56	(.83)
Oral control						
I avoid eating when I am hungry	.35	(.94)	.18	(.98)	.36	(.94)
I cut my food into small pieces	.10	(.99)	.26	(.97)	.26	(.97)
I feel that others would prefer I ate more	.27	(.96)	.80	(.59)	.79	(.62)
Other people think I am too thin	.11	(.99)	.56	(.83)	.58	(.82)
I take longer than others to eat my meals	.07	(.99)	.13	(.99)	.13	(.99)
I display self-control around food	.12	(.99)	.21	(.98)	.20	(.98)
I feel that others pressure me to eat	.20	(.98)	.60	(.80)	.61	(.79)
Food preoccupation						
I find myself preoccupied by food	.58	(.81)	.70	(.72)	.70	(.71)
I feel that food controls my life	.62	(.78)	.72	(.69)	.72	(.69)
I give too much time and thought to food	.65	(.76)	.73	(.69)	.74	(.67)
Bulimia						
I have the impulse to vomit after meals	.36	(.93)	.40	(.92)	.88	(.48)
I have gone on eating binges where I feel that I may not be able to stop	.46	(.89)	.50	(.87)	.50	(.87)
I vomit after I have eaten	.28	(.96)	.31	(.95)	.66	(.76)

Recent research has proposed a two-index criterion for assessing the adequacy of model fit (Hu and Bentler, 1999). The first fit index used was the Robust Comparative Fit Index (RCFI). The RCFI evaluates the adequacy of the hypothesized model in relation to the worst (independent) model. If the hypothesized model is not a significant improvement on the independent model, the fit indices will be close to zero (Bentler, 1995). The criterion value for an acceptable model fit is proposed to .95 or higher (Hu and Bentler, 1999). The second fit index was the Root Mean Square Error of Approximation (RMSEA: Steiger, 1990) where a value of .05 or lower indicates a good fit and values up to .08 indicate an acceptable fit (Browne and Cudeck, 1993). The RMSEA has been described as "one of the most informative criteria in structural equation modeling" (Byrne, 1989, p. 112).

RESULTS

Confirmatory factor analysis results for the single factor model (RCFI = 0.69; RMSEA = 0.11) and 3-factor-model (RCFI = 0.84, RMSEA = 0.10) showed that fit indices for the single factor and three-factor models are poor. CFA results for the four-factor model shows some support for the hypothesized model (RCFI = 0.91, RMSEA = 0.06), although the RCFI was below the 0.95 value required for an acceptable fit (see Hu and Bentler, 1999).

Standardized factor loadings are contained in Table 1. Five items showed weak factor loadings on

Table 2. Descriptive statistics for the 21-item Eating Attitude Test

	Minimum	Maximum	M	SD	Mean Rank
Dieting	.00	2.55	0.33	0.44	3.36
Oral control	.00	2.25	0.09	0.28	2.21
Food pre-occupation	.00	3.00	0.19	0.48	2.39
Bulimia	.00	2.00	0.04	0.16	2.04

all three CFAs. These items accounted for less than 1% of the variance of factor scores: 1) *'I enjoy trying new rich foods'*, 2) *'I take longer than others to eat my meals'*, 3) *'I display self-control around food'*, 4) *'I cut my food into small pieces'* and 5) *'I particularly avoid foods with a high carbohydrate content'*. After these 5-items were discarded, the three models were re-analyzed. CFA results indicated that the single-factor model (RCFI = 0.76, RMSEA = 0.10) and three-factor model (RCFI = 0.82, RMSEA = 0.08) showed poor fit, although RMSEA values were marginal. CFA results for the four-factor model showed acceptable fit indices (RCFI = 0.98, RMSEA = 0.06).

A Total EAT-26 score was calculated yielding a mean score of 6.15 (SD = 6.96, range 0 to 51). As confirmatory factor analysis indicated that participants conceptualized items differently, mean scores were calculated using the revised, 21-item, and four-factor model (see Table 2). Calculated factor scores were compared using Friedman non-parametric Test as data deviated significantly from normality. Friedman results indicated significant differences in EAT factor scores ($X^2 = 693.81$, $p < 0.001$). Post-hoc tests demonstrated that each subscale differed significantly from each other (Dieting and Oral Control, $Z = 13.90$, $p < 0.001$; Food pre-occupation, $Z = 10.62$, $p < 0.001$; Bulimia and Dieting, $Z = 4.36$, $p < 0.001$; Bulimia and Food-preoccupation, $Z = 8.71$, $p < 0.001$).

Relationships between EAT scores and a second scale are contained in Table 3. Correlation results show that depressed mood correlated significantly with bulimia and dieting but showed no significant correlation with a pre-occupation with food. Relationships between EAT scores and motivation scores indicated that dieting was associated with motivation to exercise for externally regulated reasons. This finding could suggest that the exercise was being used as a strategy for calorie control. In addition, oral control related significantly with enjoyment of exercise. The direction of relationships indicated that individuals who enjoy exercising reported low scores on oral control.

When correlation results are seen collectively, differential relationships between EAT subscale scores and other constructs emphasize the importance of investigating discrete components of eating attitudes, rather than calculating a global factor score.

DISCUSION

The first purpose of the present study was to investigate the factorial validity of Eating Attitude Test (EAT; Garfinkel and Garner, 1979; Garner et al., 1982) among exercise participants. Although the EAT is a widely used measure in a number of psychology disciplines, researchers should not assume validity holds from one population to another. Confirmatory factor analysis results show that a 21-item four-factor model that assesses dieting, oral control, bulimia, and food pre-occupation provides the best description of eating attitudes among exercisers. Findings demonstrate poor fit for the original 26-item single and three-factor models. The revised scale is included as an Appendix to this paper.

Although previous research has tended to sum EAT scores into a single scale (see Terry et al., 1999a; Hasse and Prapavesssis, 2001; Lane, 2003), findings from the present study lend support to using

Table 3. Correlations between Eating Attitude Test (21-items) scores, mood and self-esteem.

	Bulimia	Dieting	Oral Control	Food Pre-Occupation
Self-esteem ($N = 57$)	.14	.17	.07	.05
Vigor ($N = 73$)	-.18	.20	.12	.14
Tension ($N = 73$)	.03	-.06	.00	-.07
Fatigue ($N = 73$)	.00	-.00	.06	-.11
Depression ($N = 73$)	.26**	.23**	.04	.20
Anger ($N = 73$)	-.02	.05	-.02	.03
Self-determination ($N = 43$)	.14	.41*	.03	.28
Competence ($N = 43$)	.15	-.20	-.13	.22
Enjoyment ($N = 43$)	-.01	-.23	-.33*	.07

* $p < .01$, ** $p < .05$

each subscale independently. It is argued that it is particularly important for researchers and practitioners alike to examine scores on each subscale for two main reasons. First, results indicated that exercisers reported higher scores for dieting behaviors than oral control, food pre-occupation, and bulimia. Scores on dieting behaviors will heavily influence the composite score on the EAT, and therefore could mask relatively small, but possibly important indicators of disorders such bulimia. Second, correlation results show only dieting and bulimia scores were associated with depressed mood. The results also lend support to previous research that has found a link between depression and eating disorder (Hatsukami et al., 1984; DiNicola et al., 1989; Vandereycken, 1987; Terry et al., 1999a). However, findings from the present study suggest that the variance in depression is associated with dieting and bulimia rather than oral control and food-pre-occupation.

The relationship between EAT subscale scores and motivation indicated individuals who engage in exercise because they ought to, rather that wish to, and who do not overly enjoy exercise tended to report high scores for dieting and oral control. Szabo (2000) argued that exercise could be linked with dysfunctional attitudes and behaviors. Findings from the present study lend some support to the notion that obsessive attitudes toward diet are associated with engaging in vigorous exercise as a strategy to rid the body of calories. However, the relatively small sample size (N = 43) used suggests these results should be interpreted with caution and further research is warranted.

The most substantial difference between findings from the present study with those reported by Garner et al. (1982) is the exclusion of five items. It is possible that exercisers have a unique conceptualization of eating behaviors, particularly items that describe the carbohydrate content of food. For example, the meaning of the item: 'I particularly avoid foods with a high carbohydrate content' could be interpreted in a number of different ways. On one hand, it could refer to avoiding eating food that contains simple sugars, and on the other hand, it could refer to avoiding eating food containing complex carbohydrates. It is suggested that exercisers with knowledge of the nutritional value of food are likely to give a low score for eating simple sugars and a high score for eating complex carbohydrates.

It is argued that when exercise participants give high scores to the items described above, they are not necessarily indicative of a potential disordered attitude such as an obsession with food or bulimia. Indeed, it is possible that the inclusion of such items in an eating disorder scale could be a result of using a sample that comprised clinically diagnosed individuals. Excessive concerns regarding the content of food is a characteristic of a clinical eating disorder, and therefore it is likely that such items will show stronger correlations with items designed to assess bulimia when completed by clinically diagnosed individuals.

We suggest the comprehensibility and meaning of items should be thoroughly investigated when using a measure on a different population to the one used during validation. If some participants in target population misunderstand items, this makes interpretation of subscales scores problematic. We argue that the first step that researchers should take when extending a line of investigation from one population to another is to thoroughly validate the measures used.

Although the four-factor model shows promising validity, future research is needed to explore the nature of each factor. One way of exploring the nature of these four-factors is to interview exercise participants on the meaning of items. Interview techniques could be used to not only explore the nature of items, but also identify factors not currently identified. We suggest that findings from the present study should be used to start comprehensive validation of a measure of eating attitudes for use in exercise, rather than assume that validation of a 21-item four-factor EAT is complete.

CONCLUSION

In conclusion, confirmatory factor analysis indicated support for a four-factor model, which distinguished bulimia from food pre-occupation. Further, results indicated that five-items showed poor factor loadings and that meaning of such items could be misinterpreted. A limitation of the model of EAT used in the present study is that it was developed for use with a clinical population and thus, it might assess a restricted range of factors. We argue that future research should involve qualitative techniques and interview exercise participants to explore the nature of eating attitudes.

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KEY POINTS

- Validity of psychometric measures should be thoroughly investigated. Researchers should not assume that a scale validation on one sample will show the same validity coefficients in a different population.
- The Eating Attitude Test is a commonly used scale. The present study shows a revised 21-item scale was suitable for exercisers.
- Researchers using the Eating Attitude Test should use subscales of Dieting, Oral control, Food pre-occupation, and Bulimia.
- Future research should involve qualitative techniques and interview exercise participants to explore the nature of eating attitudes.

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APPENDIX

Revised 21-items Eating Attitude Questionnaire

1. I am terrified about being overweight	Never	Rarely	Some-times	Often	Always	Very Often
2. I avoid eating when I am hungry	Never	Rarely	Some-times	Often	Always	Very Often
3. I find myself preoccupied by food	Never	Rarely	Some-times	Often	Always	Very Often
4. I have gone on eating binges where I feel that I may not be able to stop.	Never	Rarely	Some-times	Often	Always	Very Often
5. I am aware of the calorie content of foods I eat	Never	Rarely	Some-times	Often	Always	Very Often
6. I feel that others would prefer I ate more	Never	Rarely	Some-times	Often	Always	Very Often
7. I vomit after I have eaten	Never	Rarely	Some-times	Often	Always	Very Often
8. I feel extremely guilty after eating	Never	Rarely	Some-times	Often	Always	Very Often
9. I am preoccupied with a desire to be thinner	Never	Rarely	Some-times	Often	Always	Very Often
10. I think about burning up calories when I exercise	Never	Rarely	Some-times	Often	Always	Very Often
11. Other people think I am too thin	Never	Rarely	Some-times	Often	Always	Very Often
12. I am preoccupied with the thought of having fat on my body	Never	Rarely	Some-times	Often	Always	Very Often
13. I avoid foods with sugar in them	Never	Rarely	Some-times	Often	Always	Very Often
14. I eat diet foods	Never	Rarely	Some-times	Often	Always	Very Often
15. I feel that food controls my life	Never	Rarely	Some-times	Often	Always	Very Often
16. I feel that others pressure me to eat	Never	Rarely	Some-times	Often	Always	Very Often
17. I give too much time and thought to food	Never	Rarely	Some-times	Often	Always	Very Often
18. I feel uncomfortable after eating sweets	Never	Rarely	Some-times	Often	Always	Very Often
19. I engage in dieting behavior	Never	Rarely	Some-times	Often	Always	Very Often
20. I like my stomach to be empty	Never	Rarely	Some-times	Often	Always	Very Often
21. I have the impulse to vomit after meals	Never	Rarely	Some-times	Often	Always	Very Often