Utility of Mood Profiles in Identifying Risk of Eating Disorders among Adolescent Rowers

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Abstract

The study assessed the utility of the Brunel Mood Scale (BRUMS) in discriminating between adolescent rowers who were at risk of developing eating disorders and those who were not. Adolescent rowers (N = 111) participating in scholastic rowing competitions completed the BRUMS, the Eating Attitudes Test (EAT) and the Body Shape Questionnaire (BSQ). Risk was indicated by scores above 20 on the EAT or BSQ. Participants were grouped by gender (female = 48, male = 63) and risk status (at risk = 18, not at risk = 93). A 2 x 2 MANOVA of mood responses showed no interaction effect but significant main effects for gender and risk status. Scores for depression, confusion, tension and anger were significantly higher among those at risk. Discriminant function analysis showed that in 75.6% of cases, the risk status of participants was correctly classified from these four mood dimensions. Mood responses could better identify lack of risk than risk. Risk was associated with body shape perceptions rather than eating attitudes. Results were consistent with previous findings among elite rowers, suggesting that mood profiles may provide non-transparent indicators of risk of eating disorders at both junior and senior levels of the sport.

Introduction

The issue of eating disorders (EDs) among athletes represents a serious potential threat to physical and mental health, and to performance (Sundgot-Borgen, 1994a, 1994b; Thompson & Sherman, 1993). Reported prevalence rates of EDs such as bulimia nervosa (BN) and anorexia nervosa (AN) in sport populations have ranged from as low as 1% to as high as 39.2%. (Burckes-Miller & Black, 1988; Warren, Stanton, & Blessing, 1990). Reasons for such a wide spread of estimates include the secretive nature of EDs and the potentially serious repercussions of discovery for an athlete, such as being dropped from the team, that may contribute to a general underestimate of their prevalence in sport (Thornton, 1990). In addition, prevalence rates also depend upon the diagnostic methods of identification, which vary greatly across investigations (Brownell & Rodin, 1992). Provided they are answered honestly, self-report inventories such as the Eating Attitudes Test (EAT: Garner & Garfinkel, 1979) are capable of identifying potential for serious eating-related problems, although they are properly regarded as screening tools for "at risk" status of EDs rather than as clinical diagnostic measures.

There is clear evidence that athletes in sports which emphasise leanness and/or require weight regulation are at greater risk of developing EDs than other athletic groups and the general population (e.g., Byrne & McLean, 2002; Sundgot-Borgen, 1994a). Increased risk may arise either because individuals with a predisposition to EDs are drawn toward certain sports (Sacks, 1990) or because the demands of particular sports push athletes towards undesirable weight loss strategies (Rosen, McKeag, Hough, & Curley, 1986). Rowing is among the sports associated with increased risk of EDs particularly for athletes in the lightweight category and especially for females (Terry, Lane, & Warren, 1999; Terry & Waite, 1996). Given the potentially serious health consequences of EDs, regular screening of athletes to identify those at risk is germane. EDs run a chronic relapsing course and age appears to mediate their onset, with the 15-23 age group being at greater risk than others (Leon, 1991; Thompson, 1987). Screening junior athletic populations is particularly important given that preventive interventions in adolescents appear to be more effective than curative measures aimed at clinical EDs (Killen, 1996).

There is evidence that up to 89% of those identified as "at risk" using traditional eating disorder inventories eventually contract either AN, BN, or anorexia athletica (Sundgot-Borgen, 1994b). Moreover, the proportion of individuals scoring below the "at risk" criterion on the EAT who are subsequently diagnosed as having some clinical form of EDs may be as high as 18% (Wilmore, 1991). These data are consistent with repeated suggestions that the negative predictive utility of the EAT and other similar self-report instruments is limited by intentional underreporting of symptoms when faced with transparent questions about eating behaviours and body shape concerns, calling for alternative non-transparent identification strategies (Lane, 2003; Terry, Lane, & Warren, 1999; Thornton, 1990).

In the sport context, athletes are more likely to respond candidly to a mood inventory whereas they may conceal the truth about undesirable eating behaviours when presented with one of the conventional but transparent indices of EDs (Thornton, 1990). The link between EDs and mood disturbance is well established in the clinical literature (e.g., DiNicola, Roberts, & Oke, 1989). Indeed, affective instability and negative mood characteristics are seen as psychological effects of clinical and subclinical EDs (Thompson & Sherman, 1993). Further, previous research has shown that the process of dieting on it own is also associated with negative cognitive states such as confusion, depression and tension (Butow, Beaumont, & Touyz, 1993).

Terry, Lane and Warren (1999) have previously demonstrated that the link between negative moods and risk of eating disorders shown in clinical environments is

also evident in the athletic environment. Negative mood constructs also correlate with other concerns in the sporting world, such as poor performance (see Beedie, Terry, & Lane, 2000), injury (Heil, 1993) and overtraining syndrome (Budgett, 1990). The mood of athletes in the period leading up to competition is also linked to athletic performance, particularly at the elite level (Terry, 1995). This mood-performance link has been demonstrated in the sport of rowing (e.g., Hall & Terry, 1995). Since mood profiling can be justified from a number of perspectives in the sport context it might represent an inconspicuous, non-specific screening method for at-risk status of EDs.

To date, only two published studies have empirically investigated the link between mood and abnormal eating attitudes and/or body shape perceptions among sport populations. Utilising a sample of 103 elite rowers, Terry, Lane, and Warren (1999) examined the relationship between scores on the EAT and the Body Shape Questionnaire (BSQ: Cooper, Taylor, Cooper, & Fairburn, 1987; Garner, 1985) and scores on the Profile of Mood States – Adolescents (POMS-A: Terry, Lane, Lane, & Keohane, 1999). POMS-A depression scores explained 9% of the variance in EAT scores; 24% of the variance in BSQ scores; and, confusion and tension scores collectively explained a further 13% of the variance in BSQ scores, all in a positive linear manner. Similar results were obtained by Lane (2003) with respect to the utility of mood scores in predicting risk of eating disorders as measured by the EAT. The latter study reported that mood accounted for 38% of the variance of EAT in males, and for 29% of the variance in female athletes among 165 university student athletes drawn from 20 different sports.

The present study quantitatively assessed the predictive utility of mood profiles in identifying the risk of EDs in adolescent rowers. As such, it extended and complemented previous investigations among elite adult rowers. It was hypothesised that the mood dimensions of anger, confusion, depression and tension would discriminate between at-risk and not at-risk status as measured by the EAT and BSQ.

Method

Participants

Participants were 111 adolescent rowers (M = 15.6 yr., SD = 1.4 yr.) comprising 48 females (M = 15.1 yr., SD = 1.5 yr.) and 63 males (M = 15.9 yr., SD = 1.2 yr.). All participants were volunteers, recruited from schools in the Brisbane and Gold Coast areas, who had competed in scholastic rowing during 2002. Rowing experience ranged from 0.2 to 5.8 years (M = 2.1 yr., SD = 1.2 yr.). Mean number of training sessions per week was 5.7 (SD = 3.1) with a mean of 9.0 hours (SD = 5.6 hrs.) of training time. At the time of data collection, the female participants had completed their competition season and had a reduced training regimen, whilst males were still in training for their last competitive events. It was anticipated that this gender difference would influence scores for fatigue and vigour but that this was of no theoretical or practical interest in the current study.

Measures

Eating Attitudes Test (EAT) The EAT is a 26-item scale to identify abnormal eating habits and concerns about weight, derived from a 40-item original (Garner & Garfinkel, 1979). Respondents rate their agreement with statements about weight and food, such as "I am terrified about being overweight," "I find myself preoccupied with food," etc. A score of $\geq$20 is proposed to identify those with abnormal eating concerns who may be at risk of EDs. Garner and Garfinkel reported an alpha coefficient of .94 to demonstrate internal consistency. A test-retest reliability coefficient for the EAT was reported at .81 for a children's version (Allison, 1995). The alpha coefficient in the present study was .83.

Body Shape Questionnaire (BSQ) The BSQ is a 34-item scale to assess self-perceptions of body shape (Cooper et al., 1987; Garner, 1985). Respondents rate their agreement with statements about body shape, such as "Have you felt so badly about your shape that you have cried?" A score of $\geq$20 is proposed to indicate a level of negative body image associated with risk of EDs (Garner, 1985). The psychometric integrity of the BSQ was supported by Cooper et al. (1987) to the extent that scores correlated significantly with both the EAT and the Eating Disorder Inventory (Garner, Olmsted, & Polivy, 1985). The alpha coefficient in the present study was .95.

Scoring of the EAT and BSQ Items are scored "always" = 3, "very often" = 2, "often" = 1 and "sometimes", "rarely" or "never" = 0. The EAT-26 and BSQ were used to maintain comparability with the Terry, Lane, and Warren (1999) study.

Brunel Mood Scale (BRUMS) The BRUMS, formerly known as the POMS – A, is a 24-item version of the Profile of Mood States (POMS: McNair, Lorr, & Droppleman, 1971), which assesses six mood dimensions: anger, confusion, depression, fatigue, tension, and vigour. Respondents rate "How are you feeling right now?" on a 5-point scale anchored by 0 ("not at all") to 4 ("extremely"). The scale was validated with athletes aged 12 to 36 using confirmatory factor analysis (see Terry, Lane, & Fogarty, 2003; Terry, Lane, Lane, & Keohane, 1999). In the present study, alpha coefficients were > .70 for all subscales, with the exception of tension (α = .58).

Procedures

The second author collected data with the help of rowing coaches and school officials. Participants received packs containing all questionnaires and instructions that outlined the general nature of the investigation but made no mention of eating disorders. Participants and a parent/guardian signed informed consent forms and confidentiality was assured. Completed questionnaires were returned to the researchers in a sealed envelope.

Results

Cross-tabulation of the data for 111 rowers yielded the grouping shown in Table 1. Eighteen participants (16.2%) were flagged as at-risk by the BSQ and/or the EAT,

comprising nine males (14.3%) and nine females (18.8%). No females and only three males (4.8%) scored above the risk threshold on the EAT. All three also had above-threshold BSQ scores; thus the at-risk category could entirely be defined by body shape concerns alone. Descriptive statistics for the sample as a whole and grouped by gender and risk status are shown in Table 2. For ease of comparison, BRUMS scores are presented in T-score format. Results were consistent with expectations. In general terms, anger, confusion, depression and tension scores were higher for the at-risk groups regardless of gender.

Table 1: Group sizes for risk of eating disorders by gender of adolescent rowers (N = 111).

	Risk of eating disorder					
	At risk		Not at risk		All participants	
Group	*n*	%	*n*	%	*n*	%
Gender						
Male	9	8.1	54	48.7	63	56.8
Female	9	8.1	39	35.1	48	43.2
All participants	18	16.2	93	83.8	111	100.0

Standard data screening procedures were applied prior to conducting a 2 x 2 (gender x status) MANOVA. Non-normal distributions were noted for anger, confusion, depression and tension. Skewness and kurtosis were successfully normalised by inverse transformations, following which there were no univariate or multivariate outliers. Cell requirements for MANOVA were met; the largest-to-smallest cell size ratio of 1:7 and the 9:1 split for the not at-risk and at-risk groups were acceptable although not ideal. A Bonferroni adjustment was made to control for family-wise error in follow-up tests.

MANOVA showed main effects on mood scores for both risk status [*Wilk's lambda*$_{6,102}$ = .82, p = .002, η^2 = .19] and gender [*Wilk's lambda*$_{6,102}$ = .76, p < .001, η^2 = .24] but no interaction effect. Follow-up tests for risk status showed effects for anger [$F_{1,107}$ = 16.58, p < .001, d = .91], confusion [$F_{1,107}$ = 10.28, p = .002, d = .79], depression [$F_{1,107}$ = 8.19, p = .005, d = .66] and tension [$F_{1,107}$ = 9.69, p = .002, d = .80]. Consistent with previous research and theoretical considerations, scores were higher for the at-risk group. Effect sizes were moderate to large in each case. For gender, effects were shown for fatigue [$F_{1,107}$ = 6.80, p = .01, d = .73] and vigour [$F_{1,107}$ = 6.19, p = .01, d = -.43]. Males reported more fatigue and less vigour; effects that were explainable by the different training regimes of the male and female rowers. Since none of the other mood dimensions differed significantly by gender and there was no interaction effect, only the scales discriminating between at-risk and not at-risk groups were investigated further.

A direct discriminant function analysis was performed using anger, confusion, depression and tension scores to predict risk status. Since classification was the purpose, violation of assumptions about the shape of the distributions was of no particular concern and untransformed variables were used to facilitate interpretation (see Tabachnick & Fidell, 2001). Results are shown in Table 3.

Since only one discriminant function was possible, it accounted for 100% of the between-group variability and, as expected, indicated a significant association between groups and predictors, χ^2 (4) = 22.62, p < .001. The standardised discriminant function values evaluated at group means for the at-risk and not at-risk groups were 1.2 and –.2, respectively.

Table 2: Descriptive statistics for EAT, BSQ and BRUMS scores for adolescent rowers (N = 111) grouped by risk status and gender.

	All participants				Female				Male			
	At-risk		Not at-risk		At-risk		Not at-risk		At-risk		Not-at risk	
Measure	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
EAT	16.3	8.1	4.6	3.7	13.0	4.2	4.1	3.0	19.6	10.0	4.8	4.1
BSQ	34.2	15.0	4.9	5.8	32.7	13.6	7.9	6.2	35.7	17.0	2.7	4.5
BRUMS												
Anger	62.3	12.9	52.5	8.0	58.1	13.5	52.0	6.6	66.4	11.4	52.8	9.0
Confusion	62.3	12.5	53.8	8.7	62.6	9.3	57.3	8.8	62.1	15.7	51.3	7.5
Depression	59.4	11.8	52.4	9.1	57.1	11.4	56.2	10.9	61.8	12.4	49.7	6.3
Fatigue	62.3	10.7	58.5	11.0	60.1	11.3	53.6	9.4	64.6	9.9	62.1	10.9
Tension	50.7	6.4	45.7	6.1	50.6	8.0	46.8	5.9	50.8	4.9	44.9	6.2
Vigour	46.3	8.3	49.0	7.1	48.9	7.6	49.6	6.9	43.7	8.5	46.8	7.1

Table 3: Discriminant function analysis for classifying at-risk status from mood scores.

	Function			Correlations		
Subscale	Loading	Std. Coeff.	$F_{1,109}$	Con	Dep	Ten
Anger	.84	.82	18.10*	.38	.62	.36
Confusion	.72	.59	13.18*		.67	.54
Depression	.56	-.47	8.12*			.52
Tension	.62	.23	9.77*			
Canonical R	.44					
Eigenvalue	.24					

*p < .01

Essentially, the discriminant function analysis confirmed the results of the MANOVA and indicated no remarkable differential patterning among predictors. The overall predictive power of the discriminant function was 75.6% as it correctly classified 84 of the 111 adolescent rowers. Specificity was 78.5% as 73 of the 93 members of

the not at-risk group were correctly classified. Sensitivity was 61.1% as 11 of the 18 members of the at-risk group were correctly classified. Due to the relatively small sample size, classification was validated using the leave-one-out method provided by SPSS that yielded essentially the same results. There was only one less incorrect classification in the at-risk group, 10 (55.6%) upon validation. Table 4 summarises the classification results.

The remaining customary operating characteristics of the discriminant function were evaluated as follows: positive predictive power = 35.5%, negative predictive power = 91%. The positive predictive power suggests that mood scores are weak indicators of the risk of eating disorders, which is not surprising given the large number of forces unrelated to eating behaviour that could elevate scores on negative mood indicators. However, the negative predictive power indicates that scoring in the range not foreshadowing risk is a strong indicator of lack of such risk.

Table 4: Summary of classification of risk status from mood scores among adolescent rowers (N = 111).

Classifications	BSQ and EAT				Totals	
	At risk		Not at risk			
	n	%	*n*	%	*n*	%
At risk	11	9.9	20	18.1	31	28
Not at risk	7	6.3	73	65.7	80	72
Totals	18	16.2	93	83.8	111	100

Discussion

Given the relatively small numbers of participants who qualified in the at-risk group and the exclusive reliance on self-report data in the present study, its findings should be interpreted with some degree of caution. In addition, there was a requirement to obtain parental consent that appeared to have substantially decreased the levels of participation compared to initially indicated levels of interest by adolescent rowers. Consequently, strong volunteer bias was likely to have been present unlike in the previous study with elite rowers (Terry, Lane, & Warren, 1999). It is impossible to comment on how risk-prevalence rates might have been affected by such bias beyond noting the fact that rates in the present sample were in the mid-range of previously published rates for a variety of athletic samples and were not dissimilar from the two studies that have used the same instruments with elite rowers (Terry, Lane, & Warren, 1999; Terry & Waite, 1996). Therefore, the theoretically based mood-risk relationship in the sample is not expected to have been altered substantially by volunteerism.

The finding that risk was generally associated with body shape perceptions rather than with eating attitudes is not surprising since adolescence is the age during which adult body shape and other physical characteristics are attained, and social physique anxiety is most pronounced. Social physique anxiety, exercise addiction, and EDs have been linked together in the literature (Pasman & Thompson, 1988) and such linkage is naturally provided by the age of adolescence when the incidence of these disorders peaks.

Depression, confusion and tension were previously shown to be significant predictors of risk of EDs in the context of body shape concerns among elite rowers and the present findings lend further support to prior suggestions that mood profiles are useful non-transparent indicators of risk of EDs in rowing populations and in other athletic groups (Lane, 2003; Terry, Lane, & Warren, 1999). The present study provides further support for these predictors in the same context. The utility of mood profiles for monitoring the general well-being athletes has been demonstrated. In this context it appears possible to confidently indicate that a range of serious problems, such as the risk of EDs and/or overtraining syndrome, are absent. In the present sample, knowing only the BRUMS scores excluded the risk of EDs with a 91% probability. Consequently, the negative predictive power of the BRUMS with respect to the risk of EDs compares favourably to that of 82% estimated for the EAT.

Dieting, on its own, has been associated with negative cognitive states such as depression, confusion, and tension (Butow et al., 1993) supporting a notion that a predominance of negative mood states develop concurrently with negative physical self-perceptions and unhealthy eating attitudes. Similar negative mood profiles may be associated with other causes of concern in the sporting context such as poor performance, injury and overtraining syndrome. Based on the results of the present study a mood profile that is consistently elevated by 5 to 10 T-score points above the applicable population standard on all negative dimensions (except for fatigue that might be explainable from current training loads) should warrant follow up specifically aiming to exclude the development of negative physical self-perceptions and/or unhealthy eating attitudes as the underlying cause. Conversely, a mood profile without such characteristics would appear to exclude issues of concerns with a substantial degree of confidence.

References

Allison, D. B. (1995). *Handbook of assessment for eating behaviour and weight-related problems*. London: Sage.

Beedie, C. J., Terry, P. C., & Lane, A. M. (2000). The profile of mood states and athletic performance: Two meta-analyses. *Journal of Applied Sport Psychology, 12*, 49-68.

Brownell, K. D., & Rodin, J. (1992). Prevalence of eating disorders in athletes. In K. D. Brownell, J. Rodin & J. H. Wilmore (Eds.), *Eating, body weight and performance in athletes: Disorders of modern society*. Philadelphia: Lea & Febiger.

Budgett, R. (1990). Overtraining syndrome. *British Journal of Sports Medicine, 24*, 231-236.

Burckes-Miller, M., & Black, D. (1988). Male and female college athletes: Prevalence of anorexia nervosa and bulimia nervosa. *Athletic Training, 23*, 137-140.

Butow, P., Beaumont, P., & Touyz, S. W. (1993). Cognitive processes in dieting disorders. *International Journal of Eating Disorders, 12*, 319-329.

Byrne, S., & McLean, M. (2002). Elite athletes: Effects of the pressure to be thin. *Journal of Science and Medicine in Sport, 5*, 80-94.

Cooper, P. J., Taylor, M. J., Cooper, Z., & Fairburn, C. G. (1987). The development and validation of the Body Shape Questionnaire. *International Journal of Eating Disorders, 6*, 485-494.

DiNicola, V. F., Roberts, N., & Oke, L. (1989). Eating and mood disorders in young children. *Psychiatric Clinics of North America, 12*, 873-893.

Garner, D. M. (1985). *Manual for Body Shape Questionnaire*. Odessa, FL: Psychological Assessment Resources.

Garner, D. M., & Garfinkel, P. E. (1979). The Eating Attitudes Test: An index of the symptoms of anorexia nervosa. *Psychological Medicine, 9*, 273-279.

Garner, D. M., Olmsted, M. P., & Polivy, J. (1985). *Manual for Eating Disorder Inventory (EDI)*. Odessa, FL: Psychological Assessment Resources.

Hall, A., & Terry, P. C. (1995). Trends in mood profiles in the preparation phase and racing phase of the 1993 World Rowing Championships, Roundnice, the Czech Republic. *Journal of Sports Sciences, 13*, 56-57.

Heil, J. (1993). *The psychology of sport injury*. Champaign, IL: Human Kinetics.

Killen, J. D. (1996). Development and evaluation of a school-based eating disorder symptoms prevention program. In L. Smolak, M. O. Levine & R. Striegel-More (Eds.), *The developmental psychopathology of eating disorders: Implications for research, prevention, and treatment*. Mahwah, NJ: Erlbaum.

Lane, A. M. (2003). Relationships between eating attitudes towards eating disorders and mood. *Journal of Science and Medicine in Sport, 6*, 144-154.

Leon, G. R. (1991). Eating disorders in female athletes. *Sports Medicine, 12*, 219-227.

McNair, D. M., Lorr, M., & Droppleman, L. F. (1971). *Profile of Mood States manual*. San Diego, CA: Educational and Industrial Testing Service.

Pasman, L. T., & Thompson, J. K. (1988). Body image and eating disturbance in obligatory runners, obligatory weigth lifters, and sedentary individuals. *International Journal of Eating Disorders, 7*, 759-769.

Rosen, L. W., McKeag, D. B., Hough, D. O., & Curley, V. (1986). Pathogenic weight-control behavior in female athletes. *The Physician and Sportsmedicine, 14*, 79-86.

Sacks, M. H. (1990). Psychiatry and sport. *Annals of Sport Medicine, 5*, 47-52.

Sundgot-Borgen, J. (1994a). Eating disorders in female athletes. *Sports Medicine, 17*, 176-188.

Sundgot-Borgen, J. (1994b). Risks and trigger factors for the development of eating disorders in female elite athletes. *Medicine and Science in Sports and Exercise, 26*, 414-419.

Tabachnick, B. G., & Fidell, L. S. (2001). *Using multivariate statistics* (4th ed.). Needham Heights, MA: Allyn & Bacon.

Terry, P. C. (1995). The efficacy of mood state profiling with elite performers: A review and synthesis. *The Sport Psychologist, 9*, 309-324.

Terry, P. C., Lane, A. M., & Fogarty, G. J. (2003). Construct validity of the Profiles of Mood States - Adolescents for use with adults. *Psychology of Sport and Exercise, 4*, 125-139.

Terry, P. C., Lane, A. M., Lane, H. J., & Keohane, L. (1999). Development and validation of a mood measure for adolescents. *Journal of Spors Sciences, 17*, 861-872.

Terry, P. C., Lane, A. M., & Warren, L. (1999). Eating attitudes, body shape perception and mood of elite rowers. *Journal of Science and Medicine in Sport, 2*, 67-77.

Terry, P. C., & Waite, J. (1996). Eating attitudes and body shape perceptions among elite rowers: Effects of age, gender and weight category. *Australian Journal of Science and Medicine in Sport, 28*, 3-6.

Thompson, R. A. (1987). Management of the athlete with an eating disorder: Implications for the sport management team. *The Sport Psychologist, 1*, 114-126.

Thompson, R. A., & Sherman, R. T. (1993). *Helping athletes with eating disorders*. Champaign, IL: Human Kinetics.

Thornton, R. S. (1990). Feast or famine: Eating disorders in athletes. *The Physician and Sportsmedicine, 18*, 118-122.

Warren, B. J., Stanton, A. L., & Blessing, D. L. (1990). Disordered eating patterns in competitive female athletes. *International Journal of Eating Disorders, 9*, 565-569.

Wilmore, J. H. (1991). Eating and weight disorders in female athletes. *International Journal of Sport Nutrition, 1*, 104-117.