The Development of the Brief Eating Disorder in Athletes Questionnaire

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ABSTRACT

MARTINSEN, M., I. HOLME, A. M. PENSGAARD, M. K. TORSTVEIT, and J. SUNDGOT-BORGEN. The Development of the Brief Eating Disorder in Athletes Questionnaire. *Med. Sci. Sports Exerc.*, Vol. 46, No. 8, pp. 1666–1675, 2014. **Purpose**: The objective of this study is to design and validate a brief questionnaire able to discriminate between female elite athletes with and without an eating disorder (ED). **Methods**: In phase I, 221 (89.5%) adolescent athletes participated in a screening including the Eating Disorder Inventory-2 (EDI-2) and questions related to ED. All athletes reporting symptoms associated with ED (n = 96, 94.1%) and a random sample without symptoms (n = 88, 86.3%) attended the ED Examination Interview. On the basis of the screening, we extracted items with good predictive abilities for an ED diagnosis to the Brief ED in Athletes Questionnaire (BEDA-Q) versions 1 and 2. Version 1 consisted of seven items from the EDI-Body dissatisfaction, EDI-Drive for thinness, and questions regarding dieting. In version 2, two items from the EDI-Perfectionism subscale were added. In phase II, external predictive validity of version 1 was tested involving 54 age-matched elite athletes from an external data set. In phase III, predictive ability of posttest assessments was determined among athletes with no ED at pretest (n = 53, 100%). Logistic regression analyses were performed to identify predictors of ED. **Results**: Version 2 showed higher discriminative accuracy than version 1 in distinguishing athletes with and without an ED with a receiver operating characteristics area of 0.86 (95% confidence interval (CI), 0.78–0.93) compared with 0.83 (95% CI, 0.74–0.92). In phase II, the accuracy of version 1 was 0.77 (95% CI, 0.63–0.91). In predicting new cases, version 2 showed higher diagnostic accuracy than version 1 with a receiver operating characteristic area of 0.73 (98% CI, 0.52–0.93) compared with 0.70 (95% CI, 0.48–0.92). **Conclusion**: The BEDA-Q containing nine items reveals good ability to distinguish between female elite athletes with and without an ED. The BEDA-Q's predictive ability should be tested in larger samples. **Key Words:** SCREENING, VALIDATION, INSTRUMENT, SPORTS, DISORDERED EATING

Many female athletes struggle with disordered eating (DE) and eating disorders (ED) as they attempt to conform to demands or competition regulations that might be ill-suited to their physique (36). In this situation, participation in sports may lead to an array of health concerns that may adversely affect the female athlete's short- and long-term health at a variety of performance levels and sports. The peak onset of ED is during adolescence, when females experience a rapid change in body composition and shape (6). It is also during adolescence and young adulthood that most elite athletic participation and competition take place (6), and female adult elite athletes diagnosed with ED report having started dieting and developing ED during puberty or adolescence (35). Recent research shows that the prevalence of ED is higher among adolescent female elite athletes than among nonathletic peers (28).

The importance of early detection of ED behavior has been stressed by the International Olympic Committee, the American College of Sports Medicine, the National Collegiate Athletic Association, the Society for Adolescent Medicine, the American Psychiatric Association, and the National Athletic Trainers' Association (5). Development and modification of instruments for identification of clinically significant ED have been a major research interest for years (16), and instruments designed for screening and diagnostic purposes have been used in the general population (16) as well as among athletes (2,5). Unfortunately, an important limitation among the instruments being used when screening athletes for ED (such as the Eating Disorder Inventory (EDI), the Eating Disorder Examination questionnaire (EDE-Q), and the Eating Attitudes Test) is that they have not been adequately validated in the athletic population and, thus, may not be appropriate screening instruments for athletes (2,5). Moreover, screening questionnaires developed specifically for athletes (such as the Athletic Milieu

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Direct Questionnaire, The Female Athlete Screening Tool, and the College Health Related Information Survey) have not been tested or validated sufficiently in large groups of athletes at different competitive levels (2,5). Furthermore, many of the screening instruments are cumbersome and often require psychometric expertise for administration and data interpretation that seldom is available in most athletic settings (2,5). As a result, most studies among elite athletes, including our studies, have used a combination of standardized questionnaire subscales such as the EDI-Body dissatisfaction (EDI-BD), the EDI-Drive for thinness (EDI-DT), and additional self-developed questions (7,28,34,37,39). Results from these studies show that elite athletes are underreporting and nonathletes are overreporting symptoms associated with ED, resulting in a high percentage of athletes classified as false negative when comparing results from "at risk" screening to a clinical interview for the diagnoses of ED (28,34,39). Therefore, the main objective of this study was to design an accurate yet less comprehensive screening questionnaire with the ability to discriminate between adolescent female elite athletes with an ED from those without an ED. The desired criteria were that the questionnaire should be brief, inexpensive, and easy to understand and yield valid results.

METHODS

We conducted this study in three phases. Phases I and III were based on data from a cluster-randomized controlled trial on adolescent elite athletes attending Elite Sport High Schools in Norway. All the Elite Sport High Schools (n = 16) and the total population of first year male and female athletes during the 2008–2009 school year (born in 1992) were invited to enter the trial (26). The current article includes data from the questionnaire and clinical interviews

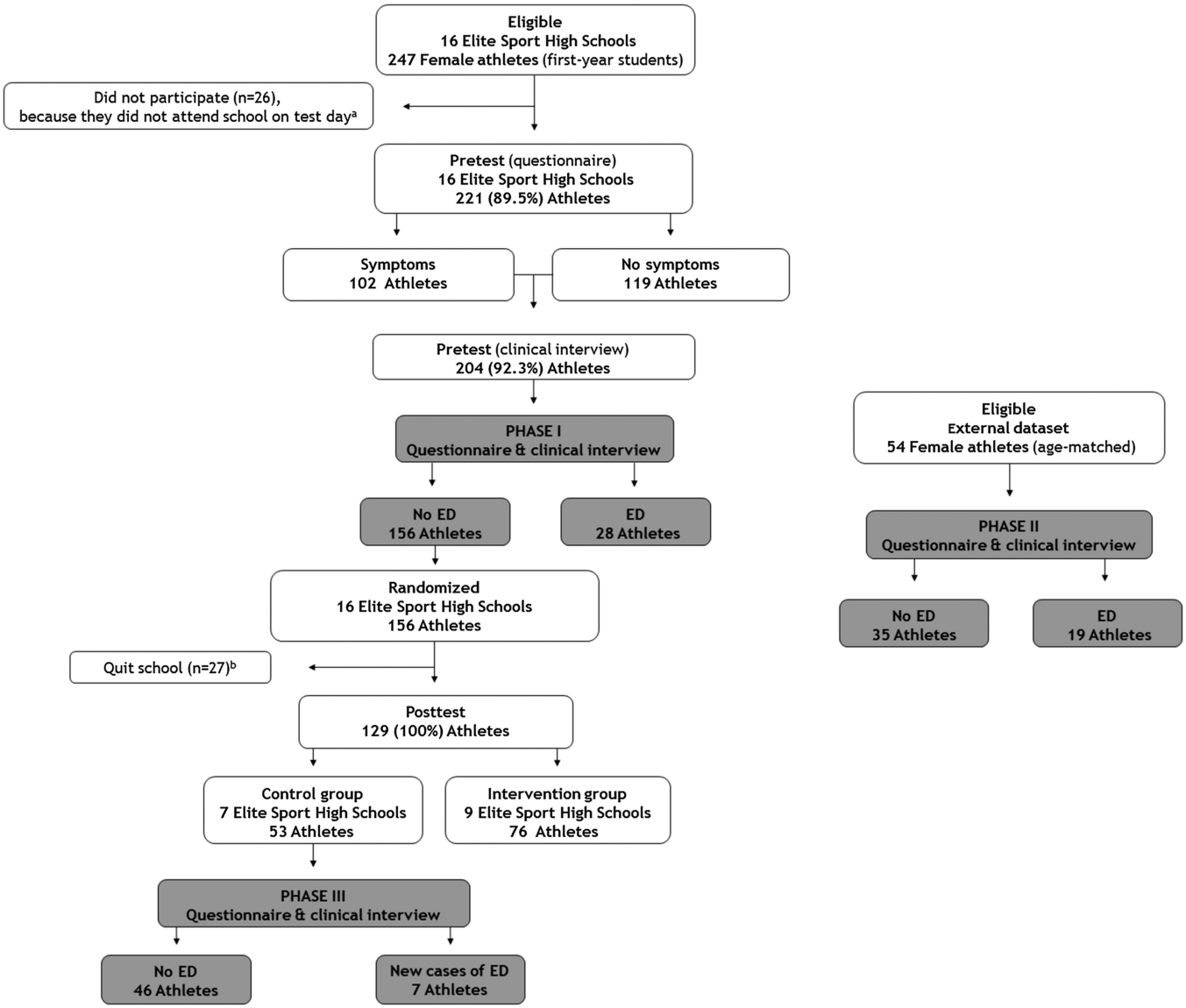

FIGURE 1—Flow chart of the study and participants in phases I, II, and III. [a]Reasons reported were training camps, competition, and illness. [b]Changed to regular school.

conducted at pretest (phase I) and posttest 2 (phase III) (approximately 2 yr after pretest and in the following called posttest) among the female participants only. In phase II, adolescent Norwegian female elite athletes from one of our earlier studies were included as an external validation sample (40). The flow of participants in phases I, II, and III are presented in Figure 1.

In phase I, we extracted items from the comprehensive questionnaire screening at baseline, which revealed good predictive abilities for a diagnosis of ED in female athletes from the Elite Sport High Schools. In phase II, regression coefficients from the derivation samples version 1 were used to estimate logistic scores and estimated probabilities of ED with levels of the predictors found in the external validation data set. Finally, in phase III, we applied the new screening version's (1 and 2) ability to predict new cases of ED among the high school athletes in the control schools (Elite Sport High Schools not given any intervention) classified with no ED diagnosis at pretest (phase I).

Participants

Phase I—the tryout sample. All female first year students (n = 257) were invited to participate. Of these, 10 were excluded (due to age: n = 8; did not obtain parental consent: n = 2). Among the remaining 247 athletes, 26 did not attend school on the test day. Reasons reported were training camps, competition, and illness. This resulted in a sample size of 221 female athletes (89.5%) representing 37 different sport disciplines attending the questionnaire screening at pretest. After the screening, all athletes reporting symptoms associated with ED were classified as "at risk" (attended: n = 96, 94.1%), and a random sample without reported symptoms (attended: n = 88, 86.3%) were invited to attend the clinical interview to determine whether they met the diagnostic criteria for an ED or not. All the 184 athletes (90.2%) attending the clinical interview are included in phase I of this study, and 28 (15.2%) were diagnosed with an ED (Fig. 1).

Phase II—external predictive validity in a different data set. To validate the new ED screening questionnaire, we included 54 gender- and age-matched adolescent elite athletes from one of our previous studies (40). This was the total number of eligible athletes who matched the current sample on age. In this study, an elite athlete was defined as one who qualified for the national team at the junior or senior level or who was a member of a recruiting squad for that team. The 54 athletes included represented 23 different sport disciplines.

Phase III—predictive ability of posttest assessments. In phase III, we wanted to test the new screening questionnaires' ability to predict new cases of ED at posttest among the athletes representing the control schools classified with no ED diagnosis at pretest. Among the 156 athletes attending the clinical interview at pretest without fulfilling the criteria for an ED, 27 left the Elite Sport High School program during the study. Furthermore, 76 of the remaining 129 athletes represented intervention schools. Accordingly, 53 athletes (100%) attending the control schools were included in phase III (Fig. 1).

The Regional Committee for Medical and Health Sciences Research Ethics in Southern Norway and the Norwegian Social Science Data Services approved both studies. The respondents and their parents provided written consent to participate. We also obtained permission to collect data from each Elite Sport High School principal (phases I and III) (26). In addition, the athletes included from the external data set (phase II) had to complete a written consent to participate, and a written parental consent was required for responders younger than 16 yr (40).

Assessment Procedures

Phases I and III (athletes attending the Elite Sport High Schools)

Screening. At pretest and posttest, the athletes were asked to complete a questionnaire including questions regarding training history, nutritional patterns, menstrual history, oral contraceptive use, dieting and weight fluctuation history, use of pathogenic weight-control methods (PWCM), injuries, self-report of previous and/or current ED, and the EDI-2. The questionnaire has been described in detail elsewhere (27).

The athletes completed the questionnaire at school during school hours in the presence of members of the research group.

Symptoms associated with ED were assessed at pretest and posttest based on the self-reported questionnaire. To be classified as "at risk" for ED, the athletes had to meet at least one of the following criteria: (a) EDI-DT score ≥15; (b) EDI-BD score ≥14; (c) body mass index (BMI) corresponding to the underweight value (8); (d) trying to lose weight now; (e) tried to lose weight before ≥3 times; (f) current and/or previous use of PWCM: use of diet pills, laxatives, diuretics, or vomiting to reduce weight; or (g) self-reported menstrual dysfunction: primary amenorrhea or secondary amenorrhea (the previous 6 months). These criteria were chosen and used in our previous studies involving adolescent elite athletes (27,28) and are based on studies of elite athletes (37,39), the *Diagnostic and Statistical Manual of Mental Disorders* (*DSM-IV*) diagnostic criteria for an ED (1), as well as on the assumption that DE occurs on a continuum of severity (11).

The EDI-2 is a validated and commonly used self-report instrument to assess the symptoms and psychological features of ED (17). It consists of 91 items and 11 clinically and theoretically subscales measuring 1) EDI-DT, 2) bulimia (EDI-B), 3) EDI-BD, 4) ineffectiveness, 5) perfectionism (EDI-P), 6) interpersonal distrust, 7) interceptive awareness, 8) maturity fears, 9) asceticism, 10) impulse regulation, and 11) social insecurity (17). The items are presented in a six-point format requiring respondents to answer whether each item applies "always," "usually," "often," "sometimes,"

"rarely," or "never." The responses for each item are weighted from 0 to 3, and the subscale scores are computed by summing item scores. Positive scores are weighted as follows: 3 = always, 2 = usually, 1 = often, 0 = sometimes, 0 = rarely, 0 = never. Reverse-scored items are weighted in the opposite manner (17). Three of the subscales measure central ED symptoms: EDI-DT, EDI-B, and EDI-BD. High scores on EDI-DT and EDI-BD, as well as use of PWCM, have been reported to be symptoms of DE and/or ED (3,33). High total scores on EDI-DT and EDI-BD have also been used as selection criteria when screening for athletes "at risk" for ED (34).

Among the additional subscales measuring more psychological correlates associated with ED, the EDI-P subscale has been widely used (25). Besides that perfectionism has been implicated in the development and maintenance of all forms of ED [anorexia nervosa (AN), bulimia nervosa (BN), and ED not otherwise specified (EDNOS)], there is emerging evidence that perfectionism may interact with other risk factors to predict eating disturbances in nonathletes (31). Some have highlighted that perfectionism is an adaptive quality that helps athletes reach their potential (18), whereas others argue its maladaptive nature for achievement pursuit (13). Interestingly, Hopkinson and Lock (23) found by comparing division I collegiate athletes to recreational athletes that perfectionism rather than the level of intensity at which the athletes participated in their sport was the most important factor in predicting DE. Given the high prevalence of ED among adolescent elite athletes (28) and perfectionism's perceived role in the etiology of ED (15), we found it interesting to test two versions of the screening questionnaire: one version with items from the traditionally used EDI-DT and EDI-BD and one where items from the EDI-P were also included.

The EDI-DT reflects an ardent wish to lose weight and fear of weight gain. Items from this subscale assess excessive concern with dieting, preoccupation with weight, and fear of weight gain. In addition, the EDI-BD subscale is related to body image distortions. It measures dissatisfaction with the overall shape and with the size of those regions of the body that are of greatest concern to those with ED (i.e., stomach, hips, thighs, and buttocks) (17). Moreover, the EDI-P subscale measures the extent to which one believes that personal achievements should be superior. Items from this subscale measure the belief that only the highest standards of personal performance are acceptable and the belief that outstanding achievement is expected by others (e.g., parents, teachers) (17).The scale was originally constructed as a one-dimensional measure of perfectionism, but it has been observed that the subscale measures intrapersonal and interpersonal domains corresponding to the "self-oriented" and "socially prescribed" perfectionism dimensions (30). Particularly, three items appear to assess self-oriented perfectionism (the belief that perfectionism is required in personal performance) and three items that appear to measure socially prescribed perfectionism (the belief that perfectionism in personal performance is expected by others) (24). During adolescence, the socially prescribed perfectionism is thought to be of particular importance due to developmental concerns during this phase (14).

Clinical ED was determined by using the ED Examination Interview 16:0 (EDE) (12), also including sport-specific questions regarding suggested predisposing, precipitating, and perpetuating factors related to ED risk. The criteria for AN, BN, or EDNOS from the *DSM-IV* had to be met for being diagnosed with an ED (1). The EDE is an investigator-based interview that assesses ED psychopathology and key ED behaviors. It is generally considered the best established instrument for assessing ED and is used for diagnostic purposes (7,11).

The clinical interview was conducted after questionnaire screening at pretest and at posttest. Furthermore, a random sample of 20 athletes (12 who fulfilled and 8 who did not fulfill the ED criteria after the first clinical interview) was reinterviewed for reliability assessments. We also reinterviewed 10 athletes (four who fulfilled and six who did not fulfill the ED criteria) after the second clinical interview (26). Complete agreement between the two interviewers concerning the diagnostic classification was found in all cases.

Statistical Methods

Statistical analyses were carried out using SPSS Statistics 21 for Windows (IBM Corporation, Route, Somers, NY). Results are expressed as absolute numbers (*N*) and percentages (%) for categorical data and mean values with their SD for continuous data. Logistic regression models were used with symptoms of ED, or ED as dependent variables and risk factors, such as EDI-DT and trying to lose weight now as a predictor per unit change, in the predictors were calculated with 95% confidence limits.

Receiver operating characteristics (ROC) calculations were used to illustrate the ability of the tests to distinguish athletes with and without an ED, where no discriminatory ability corresponds to an area under the ROC curve of 0.5 and perfect discriminatory ability to an area of 1.0. It is considered acceptable if the area under the curve (AUC) is fair if >0.70, good if >0.80, whereas excellent if >0.90. The predicted probabilities from each regression model were used as the independent variable, and ED (yes/no) was used as the dependent variable for the ROC curve analysis. Optimal cutoff score for versions 1 and 2 defined as the value that maximized product of sensitivity and specificity, the corresponding sensitivity and specificity, and the positive likelihood ratio and negative likelihood ratio for a positive and negative test result was reported. The likelihood ratios were calculated by the following formulas:

$$\text{positive likelihood} = \text{sensitivity}/(1 - \text{specificity})$$

$$\text{negative likelihood} = (1 - \text{sensitivity})/\text{specificity}$$

In phase II, regression coefficients from the tryout sample was used to estimate logistic scores and estimated probabilities

TABLE 1. Baseline characteristics of athletes participating in phases I and II of the study.

	Phase I Pretest			Phase II External Data			Total		
	ED $n = 28$	Non-ED $n = 156$	P	ED $n = 19$	Non-ED $n = 35$	P	Phase I $n = 184$	Phase II $n = 54$	P
Age (yr)	16.4 ± 0.4	16.5 ± 0.3	0.057	16.5 ± 1.0	16.9 ± 0.8	0.145	16.5 ± 0.3	16.7 ± 0.9	0.058
BMI ($kg \cdot m^{-2}$)	21.5 ± 2.5	21.2 ± 2.1	0.425	20.5 ± 1.6	20.8 ± 2.0	0.534	21.2 ± 2.1	20.7 ± 1.9	0.130
Weight-sensitive sports	11 (39.3)	41 (26.3)	0.159	16 (84.2)	9 (25.7)	<0.001	52 (28.3)	25 (46.3)	0.013
Selected for national teams (recruit, junior, or senior level)	11 (39.3)	49 (31.4)	0.413	15 (78.9)	30 (85.7)	0.704	60 (32.6)	45 (83.3)	<0.001

Results are given as means with SD for continuous variables or numbers with percentages for categorical variables. Only cases without missing values are considered.

of ED with levels of the predictors found in the external validation data set. These were then used to calculate ROC areas in the validation data. To correct for overoptimism in the regression model fit in phase I, we adjusted the coefficients according to a method by Van Houwelingen and Le Cessie (equation 77) in the external data set (41).

Internal reliability was assessed with Cronbach α coefficient. The significance level was set to 0.05.

RESULTS

Participant Characteristics

All participants from the Elite Sport High Schools were born in 1992, and there were no differences in age, training background, or BMI between those with and without an ED at pretest (phase I) (Table 1). Among the athletes from the external data set (phase II), a higher percentage of athletes with an ED compared with non-ED athletes competed in weight-sensitive sports (Table 1). Moreover, a higher percentage of the athletes from the external data set compared with the Elite Sport High School athletes at pretest (phase I) competed in weight-sensitive sports and were selected for national teams (Table 1). There were no differences in age or BMI between the athletes from the external data set compared with the athletes attending the Elite Sport High Schools.

Phase I

Developing a new screening questionnaire. Our starting point in developing a new and briefer screening questionnaire was to examine how well our questions previously used (symptoms associated with ED) discriminated between the Elite Sport High School athletes with and without an ED at pretest (Table 2).

In our search for potential predictors among the symptoms associated with ED, we included the three at-risk criteria with the highest sensitivity and specificity that significantly differed between athletes with and without an ED ("trying to lose weight now", "tried to lose weight before ≥3 times", and EDI-BD ≥14) in a logistic regression model as the independent variables and clinical ED (yes or no) as the dependent variable. The significant predictors proved to be "trying to lose weight now" [odds ratio (OR) = 4.0; 95% confidence interval (CI), 1.47–11.2; $P = 0.007$] and "tried to lose weight before ≥3 times" (OR = 3.1; 95% CI, 1.05–8.9; $P = 0.041$), whereas EDI-BD score ≥14 was borderline significant (OR = 2.8; 95% CI, 0.97–8.3; $P = 0.056$). Because frequent weight fluctuations have been suggested as an important trigger factor for the development of an ED in athletes (35), a natural next step in our search for the strongest potential predictors was to combine the variables "trying to lose weight now" and/or "tried to lose weight before ≥3 times" into one variable (dieting) (Table 2). With logistic regression analysis, dieting proved to be a strong significant predictor for ED (OR = 17.4; 95% CI, 5.7–53.2; $P < 0.001$).

Furthermore, because neither the EDI-DT nor the EDI-BD is sport specific or developed for the purpose of screening athletes, we decided to also examine the different items in the subscales independently. In addition, given perfectionism's perceived role in the etiology of ED (15), we also examined the items from the EDI-P. Based on a review

TABLE 2. The different symptoms associated with ED among athletes with and without an ED at pretest (phase I).

	ED $n = 28$	Non-ED[a] $n = 156$	P	Sensitivity	Specificity
Body dissatisfaction ≥14	15 (53.6)	19 (12.2)	<0.001	0.54	0.88
Drive for thinness ≥15	1 (3.6)	4 (2.6)	0.566	0.57	0.92
BMI underweight[b]	1 (4.3)	10 (6.8)	1.000	0.04	0.94
PWCM[c]	12 (42.9)	12 (7.7)	<0.001	0.43	0.92
Vomiting	10 (35.7)	8 (5.1)	<0.001	0.36	0.95
Diet pills	3 (10.7)	3 (1.9)	0.046	0.11	0.98
Diuretics	1 (3.6)	2 (1.3)	0.392	0.04	0.99
Laxatives	1 (3.6)	2 (1.3)	0.392	0.04	0.99
Amenorrhea[d]	4 (14.3)	17 (10.9)	0.533	0.14	0.89
Trying to lose weight now	19 (67.9)	29 (18.6)	<0.001	0.68	0.81
Tried to lose weight before ≥3 times	18 (64.3)	26 (16.8)	<0.001	0.64	0.83
Dieting[e]	24 (85.7)	40 (25.6)	<0.001	0.85	0.74

Results are given as numbers with percentage.
[a]Non-ED (athletes without an ED at the clinical interview at pretest).
[b]BMI underweight [corresponding to the underweight value by Cole et al. (8)].
[c]Total PWCM (vomiting, diet pills, laxatives, and/or diuretics) to lose weight.
[d]Amenorrhea (primary or secondary).
[e]Dieting (trying to lose weight now and/or tried to lose weight before ≥3 times).

TABLE 3. The different items included in the EDI-2 subscales body dissatisfaction, drive for thinness, and perfectionism among athletes with and without an ED at pretest.

Subscale/Item No.	ED $n = 28$	Non-ED $n = 156$	P	Included
EDI-Body dissatisfaction				
2. I think that my stomach is too big[a]	1.9 ± 1.2	0.6 ± 1.1	<0.001	X
9. I think that my thighs are too large	1.3 ± 1.2	0.6 ± 1.0	0.006	
12. I think that my stomach is just the right size[b]	1.5 ± 1.1	0.9 ± 1.0	0.006	
19. I feel satisfied with the shape of my body[a,b]	1.8 ± 0.9	0.8 ± 0.9	<0.001	X
31. I like the shape of my buttocks[b]	1.4 ± 1.2	0.8 ± 1.0	0.040	
45. I think my hips are too big	1.3 ± 1.2	0.4 ± 0.9	0.001	
55. I think that my thighs are just the right size[b]	1.7 ± 1.0	0.9 ± 1.0	<0.001	
59. I think my buttocks are too large	0.9 ± 1.2	0.3 ± 0.9	0.027	
62. I think that my hips are just the right size[b]	1.9 ± 0.9	1.0 ± 1.1	<0.001	
EDI-Drive for thinness				
1. I eat sweets and carbohydrates without feeling nervous[b]	1.3 ± 1.0	0.5 ± 0.8	<0.001	
7. I think about dieting	1.0 ± 1.0	0.3 ± 0.7	0.001	
11. I feel extremely guilty after overeating[a]	1.1 ± 1.3	0.4 ± 0.9	0.008	X
16. I am terrified of gaining weight	1.1 ± 1.2	0.4 ± 0.9	0.006	
25. I exaggerate or magnify the importance of weight	0.3 ± 0.6	0.2 ± 0.6	0.554	
32. I am preoccupied with the desire to be thinner[a]	1.1 ± 1.1	0.3 ± 0.7	0.001	X
49. If I gain a pound, I worry that I will keep gaining	0.8 ± 1.2	0.2 ± 0.7	0.033	
EDI-Perfectionism				
13. Only outstanding performance is good enough in my family	0.6 ± 1.0	0.2 ± 0.6	0.015	
29. As a child, I tried very hard to avoid disappointing my parents and teachers[c]	1.1 ± 1.3	0.4 ± 0.8	<0.001	X
36. I hate being less than best at things	0.9 ± 1.3	0.8 ± 1.1	0.701	
43. My parents have expected excellence of me[c]	0.9 ± 1.1	0.2 ± 0.6	<0.001	X
52. I feel that I must do things perfectly or not do them at all	0.1 ± 0.4	0.05 ± 0.3	0.037	
63. I have extremely high goals	1.8 ± 1.1	1.7 ± 1.2	0.730	

Higher scores indicate greater manifestation of the trait. Results are given as means with SD.
[a]Included in versions 1 and 2.
[b]Reversed scored.
[c]Included in version 2.

of the current evidence and the collective expertise of the authors, items that were not able to discriminate between athletes with ED and no ED at pretest, and items focusing on concerns most likely not being relevant for athletes, were eliminated (Table 3).

The next step was to determine the key items that may predict possible ED among athletes. Through group discussions, we ended up with nine items: two items from each of the EDI-DT, EDI-BD, and EDI-P subscales from the EDI-2, and the questions "Have you tried to lose weight?", "If yes, how many times have you tried to lose weight?", and "Are you trying to lose weight now?" from the symptoms associated with ED at risk criteria. This resulted in the Brief ED in Athletes Questionnaire (BEDA-Q) that we wanted to test further (from version 1 with seven items and version 2 with nine items) (Table 4).

As seen in Table 4, items from the EDI-DT and EDI-BD completed the variable EDI_4 in BEDA-Q version 1, whereas items from the EDI-DT, EDI-BD, and EDI-P completed the variable EDI_6 included in BEDA-Q version 2.

Predictive Ability of Versions 1 and 2 for a Diagnosis of ED

BEDA-Q versions 1 and 2 showed good ability in distinguishing between the female elite athletes with and without an ED at phase I with ROC areas of 0.83 (95% CI, 0.74–0.92) and 0.86 (95% CI, 0.78–0.93), respectively (Table 5). Version 2 improved with approximately 0.03 area units compared with version 1.

For version 1, we calculated the optimal cutoff point by using the probability score from the variables dieting and subscale 1, which maximized the product of sensitivity and specificity. The cutoff was 0.26 with a sensitivity of 85.7% (95% CI, 80.6–90.8) and specificity of 78.8% (95% CI, 73.0–84.7). This gave a positive likelihood ratio of 4.0 and a negative likelihood ratio of 0.2.

The optimal cutoff point for version II was 0.27 with a sensitivity of 82.1% (95% CI, 76.6–87.6) and specificity of 84.6% (95% CI, 79.4–89.8). For version 2, this gave a positive likelihood ratio of 5.3 and a negative likelihood ratio of 0.2.

Finally, we constructed individual predictive scores using the coefficients from the logistic models for versions 1 and 2 to classify athletes at risk for an ED if the score was greater than the optimal cutoff value and not at risk otherwise. The estimated probabilities of ED for versions 1 and 2 were calculated by the following formulas:

$$\text{prob (ED)} = \exp(\text{score})/[1 + \exp(\text{score})],$$
where the score =
Version 1: $-3.562 + ((0.135\ \text{EDI}_4) + (2.322 \times \text{variable dieting}))$
Version 2: $-3.712 + ((0.152\ \text{EDI}_6) + (2.142 \times \text{variable dieting}))$
Adjusted for over optimism =
Version 1: $-3.488 + ((0.132\ \text{EDI}_4) + (2.276 \times \text{variable dieting}))$
Version 2: $-3.634 + ((0.149\ \text{EDI}_6) + (2.099 \times \text{variable dieting}))$

Phase II

Validating BEDA-Q version 1 versus the external data set. Because no previous studies examining the prevalence of ED among adolescent female elite athletes have included items from the EDI-P subscale, we were only able to carry out an external validation for version 1. We used the regression coefficients from the derivation data set adjusted for overoptimism to estimate logistic scores and estimated probabilities of ED in the validation data by using the adjusted

TABLE 4. The different items included in BEDA-Q versions 1 and 2.

Items	ED $n = 28$	Non-ED $n = 156$	P	Version 1	Version 2
1 I feel extremely guilty after overeating (EDI-DT11)[a,c] □always □usually □ often □ sometimes □ rarely □never	1.1 ± 1.3	0.4 ± 0.9	<0.001	X	X
2 I am preoccupied with the desire to be thinner (EDI-DT32)[a,c] □always □usually □ often □ sometimes □ rarely □never	1.1 ± 1.1	0.3 ± 0.7	<0.001	X	X
3 I think that my stomach is too big (EDI-BD2)[a,c] □always □usually □ often □ sometimes □ rarely □never	1.9 ± 1.2	0.6 ± 1.0	<0.001	X	X
4 I feel satisfied with the shape of my body (EDI-BD19)[a,b] □always □usually □ often □ sometimes □ rarely □never	1.8 ± 0.9	0.8 ± 0.9	<0.001	X	X
5 My parents have expected excellence of me (EDI-P43)[c] □always □usually □ often □ sometimes □ rarely □never	0.9 ± 1.1	0.2 ± 0.6	<0.001		X
6 As a child, I tried very hard to avoid disappointing my parents and teachers (EDI-P29)[c] □always □usually □ often □ sometimes □ rarely □never	1.1 ± 1.3	0.4 ± 0.8	<0.001		X
7 Are you trying to lose weight now? □ Yes □No	19 (67.9)	29 (18.6)	<0.001	X	X
8 Have you tried to lose weight? □ Yes □No				X	X
9 If yes, how many times have you tried to lose weight? □ 1–2 □ 3–5 □ >5 times				X	X
Dieting (trying to lose weight now and/or tried before ≥3 times)	24 (85.7)	40 (25.6)	<0.001		

Results are given as means with SD or numbers with percentages, as appropriate. The responses on the EDI items six-point format are weighted from 0 to 3, and the scores are computed by summing the item scores. Positive scores are weighted as follows: 3 = always, 2 = usually, 1 = often, 0 = sometimes, 0 = rarely, 0 = never, and reverse-scored items are weighted in the opposite manner (17).
[a]Included as EDI_4 in BEDA-Q version 1.
[b]Reversed scored.
[c]Included as EDI_6 in BEDA-Q version 2. Highest possible score for EDI_4 was 12 and 18 for EDI_6.

formula above for version 1. The estimated probabilities were then used in the ROC analysis calculation for ED in version 1. The accuracy of version 1 was measured by the area under the ROC curve of 0.77 (95% CI, 0.63–0.91).

Phase III

The ability of BEDA-Q versions 1 and 2 to predict new cases of ED (posttest assessments). In this phase, we wanted to test the ability of BEDA-Q versions 1 and 2 to predict new cases of ED among the 53 athletes (100%) attending the posttest classified with no ED diagnosis at pretest attending the control schools. Seven of the 53 athletes (13.2%) had developed an ED during these 2 yr and were classified as new cases of ED at posttest. As shown in Table 5, version 2 showed slightly better diagnostic accuracy than version 1 with an area under the ROC curve of 0.73 (95% CI, 0.52–0.93) compared with 0.70 (95% CI, 0.48–0.92), respectively.

DISCUSSION

The main finding in this study was the ability of BEDA-Q versions 1 and 2 to distinguish between adolescent female elite athletes with and without an ED. Even though both versions appear well suited for screening purposes in this population with ROC areas above 80%, it is worth noticing that by adding the two items measuring the socially prescribed perfectionism from the EDI-P, the discriminative accuracy increased with approximately 0.03 area units for version 2 compared with version 1. It is difficult to interpret absolute differences in ROC area, but an improvement above 0.02 area units (more than 4%–5%) is regarded to be clinically important (22). Thus, version 2 consisting of nine items seems to be an even better suited version than version 1 in distinguishing between adolescent female elite athletes with and without an ED. However, both versions are inexpensive, are easy to understand, and showed valid results.

TABLE 5. Results of the logistic regression models of ED presented with OR per unit change of predictor variable, 95% CI, significance level (P), and AUC with 95% CI for BEDA-Q versions 1 and 2 at phases I and III among the athletes attending the Elite Sport High Schools.

Phase I ($n = 184$)	Odds Ratio (95% CI)	P	AUC (95% CI)
Version 1[a]			
Dieting	10.2 (2.9–35.9)	<0.001	
EDI_4	1.14 (0.99–1.33)	0.076	0.83 (0.74–0.92)
Version 2[b]			
Dieting	8.5 (2.5–29.3)	0.001	
EDI_6	1.2 (1.04–1.31)	0.011	0.86 (0.78–0.93)
Phase III ($n = 53$)	**Odds Ratio (95% CI)**	**P**	**AUC (95% CI)**
Version 1			
Dieting	3.8 (0.61–23.2)	0.152	
EDI_4	0.96 (0.67–1.36)	0.800	0.70 (0.48–0.92)
Version 2			
Dieting	4.6 (0.77–27.2)	0.094	
EDI_6	0.87 (0.62–1.24)	0.453	0.73 (0.52–0.93)

[a]Cronbach $\alpha = 0.83$.
[b]Cronbach $\alpha = 0.81$.

The relation between ED and perfectionism has been well established, and it may influence in an indirect manner (24). Among athletes, it is suggested that perfectionism as a personality trait combined with environmental and other factors may increase the risk of developing an ED (15). Both self-oriented perfectionism and socially prescribed perfectionism have been independently and positively related to ED among nonathletes (30), and it has been suggested that women high on socially prescribed and self-oriented perfectionism are especially vulnerable (30). However, few studies have explored this proposed relation in depth (15), and traditionally, EDI-DT and EDI-BD have been included in relation to self-developed questions when screening for symptoms associated with ED among elite athletes (28,37,39).

The increased accuracy found when including the socially prescribed perfectionism items measuring parent's expectations and avoiding disappointing parents and teachers are in line with previous research. Stoeber and Otto (32) reviewed the consequences of perfectionism among athletes and found that dimensions assessing evaluative concerns (e.g., concern over mistakes, perceived parental and coach pressure) are associated with negative consequences, whereas dimensions assessing a commitment to exceptionally high standards are associated with positive consequences. Furthermore, a recent longitudinal study following a large sample of adolescents age 15–19 yr over a period of 7–9 months showed that perceived parental expectations predicted longitudinal increases in socially prescribed perfectionism. In contrast, no such effect was found for self-oriented perfectionism or for parental criticism (9).

On the basis of the importance athletes tend to ascribe to coaches (29), and that the athletes in our study are at the early stages of their athletic career, it seems liable to suggest that those perceiving parental expectations may transfer these perceptions that also coaches have high expectations of them. If this is the case, these athletes will believe that other people's (in this case, coaches) acceptance will be contingent upon meeting these expectations being key characteristics of socially prescribed perfectionism (9).

Furthermore, in our study, most of the first year students attending the Elite Sport High Schools with an ED were diagnosed with EDNOS (n = 20, 71.4%) (28). Additionally, Hewitt et al. (20) found that social dimensions of perfectionism were broadly related to ED as well as self-esteem, whereas self-oriented perfectionism was related only to anorexic tendencies among female university students. In addition to the association between perfectionism and ED, a high level of socially prescribed perfectionism has shown strong and consistent positive correlations with negative affect, anxiety, suicidal ideation (10), and athlete burnout among adolescent elite athletes (21). Thus, the socially prescribed perfectionisms association to negative psychological outcomes (13) and its particular importance during adolescence (14) may explain version 2's higher discriminative accuracy than version 1 in distinguishing athletes with and without an ED. However, due to the cross-sectional nature of this part of the study, it is not possible to interpret causality. Whether the athletes with an ED diagnosis compared with the athletes without an ED diagnosis were more socially prescribed perfectionistic before they developed an ED, or whether this is a consequence or antecedent to the athletic participation itself, needs further investigation.

Concerning the external validity, an important next step in our study was to determine the BEDA-Q efficacy in discriminating between age-matched female elite athletes with and without an ED in the external data set. Unfortunately, there are no previous studies available including items from the EDI-P with a two-tiered approach (questionnaire screening and clinical interview) among female elite athletes. Therefore, we were only able to measure the external validity by using the estimated probabilities from the derivation data set in the ROC analysis calculations for ED in version 1. Version 1 showed high discriminating accuracy with an area under the ROC curve of 77%. Even though we were not able to test the external validity of version 2, there is reason to believe that it would have shown an even better discriminating ability than version 1 as shown in the derivation data set (phase I). This is further supported in phase III where the ability to predict new cases of ED (posttest assessments) increased with 0.03 area units by using version 2 instead of version 1.

The most effective way to reduce the incidence of ED among athletes is to prevent them from occurring in the first place. Thus, a valid screening instrument with the ability to predict new cases of ED among young athletes may be an important step in preventing ED, because treatment and recovery may not occur without identification (38). In the third phase of this study, we therefore wanted to determine the BEDA-Q's ability to predict new cases of ED. Because this is the first study among adolescent elite athletes with a prospective design aiming to determine BEDA-Q's ability to predict new cases of ED by posttest assessments, comparisons with other similar studies are not possible. In accordance with what we found in phase I, version 2 revealed a higher diagnostic accuracy than version 1. However, the number of athletes with an ED diagnosis at posttest was low (n = 7, 13.2%); thus, the CI is wide ranging between excellent and poor distinguishing ability. Our finding that version 2 also showed better diagnostic accuracy than version 1 is an important contribution to our understanding of the role social (parental) expectations play in the development of socially prescribed perfectionism as well as ED. Because the only difference between versions 1 and 2 is the two items measuring the athlete's perception that their parents expect them to be perfect, it implies that these items are probably essential to include in screening questionnaires for adolescent elite athletes.

An important question to answer when developing a new screening questionnaire is how accurate the test should be to be clinically useful. This is related to the prevalence of the disease in the subjects being tested, and in our case, the prevalence of ED among adolescent female elite athletes. For screening tests, negative results are not desirable,

whereas a moderate number of false-positive results are usually accepted. However, when it comes to diseases with high morbidity and mortality, the sensitivity of the test (detection of ED) is more important than the specificity (detection of healthy cases). In our study, we calculated the optimal cutoff value for BEDA-Q at which optimal balance between sensitivity and specificity is achieved. In phase I, BEDA-Q showed a high ability in both detecting athletes with an ED as well as athletes without an ED with sensitivity and specificity of 82.1% and 84.6%. In addition, the sensitivity and specificity of the symptoms associated with an ED previously used to classify the athletes in this article "at risk" and not "at risk" for an ED in our previous study (28) were 85.7% and 53.8%. This gave a positive likelihood ratio of 1.9 and a negative likelihood ratio of 0.3. Thus, an athlete with a positive score on the symptoms associated with an ED actually having an ED increases approximately 1.9 times, whereas the likelihood of having an ED with a score at or above the BEDA-Q cutoff is more than fivefold.

Methodological Considerations

The main strengths of this study are (a) recruitment of a large, nationally representative sample of female adolescent elite athletes representing a wide range of sport events, (b) that the clinical interview EDE considered to be the "gold standard" for diagnosing ED was used, and (c) that the tests' external predictive validity was measured to distinguish adolescent female elite athletes with and without an ED. This study does, however, also have some limitations that should be considered when interpreting the results, such as (a) the athletic groups included consist of adolescent female elite athletes exclusively and we do not know if the results can be generalized to male athletes or other age groups, (b) we were not able to carry out an external validation of BEDA-Q version 2, and (c) due to few new cases of athletes diagnosed with an ED, the test's prognostic ability need to be tested in a larger sample. Finally, referring to the purpose of this study (to design an accurate yet less comprehensive screening questionnaire with the ability to discriminate between adolescent female elite athletes with an ED from those without an ED), we carefully evaluated BEDA-Q against the 10 questions suggested by Greenhalgh (19) to evaluate the validation of different diagnostic and screening tests. The BEDA-Q fulfilled a total of nine out of these 10 questions. The only question we were not able to fulfill was the following: "Was the test shown to be reproducible?" Because the aim of our study was to develop and validate BEDA-Q as a possible new screening questionnaire among adolescent elite athletes, its reproducibility has not yet been assessed between observers. However, BEDA-Q had high internal consistency, with a Cronbach α of 0.81.

Implications and Applicability

It is well known that even though coaches are in a prime position to monitor their athletes' behavior and reactions, it may be challenging to determine whether the athletes' DE and dieting behaviors are transient, safely managed behaviors associated with the specific demands of the sport, or if the symptoms are more stable and signify a clinical ED. To facilitate early identification and treatment, we present in this study a brief and easy administrated screening questionnaire appearing well suited as a first step to identify adolescent elite athletes that may have an ED and are in need of further medical and psychological examination. For professionals working with athletes, BEDA-Q may be an important contribution in making it easier to identify those athletes in need for further examination.

In our study, most of the athletes diagnosed with an ED fulfilled the criteria for EDNOS, which is the most common ED encountered among athletes (28,39). This indicates that the athletes included are representative of the athletic population in which BEDA-Q is meant being used. However, it should be noted that the diagnostic criteria used in this study is based on the *DSM-IV* (1). The recent revision of the *DSM-V* has changed the distribution because it entails a lowering of thresholds for AN and BN, making binge eating (BED) a formal ED diagnosis and renaming EDNOS "feeding and eating conditions not elsewhere classified" along with some specifications for subtypes (4). Because we avoided evaluating our screening questionnaire in a sample in which the proportion of cases is artificially high, and the items included from the EDI in our screening questionnaire ask for psychological concepts rather than ED symptoms, we expect BEDA-Q to work equally good in distinguishing athletes with and without an ED in the *DSM-V* as in the *DSM-IV*.

BEDA-Q has revealed very promising psychometric and predictive features when it comes to distinguishing adolescent elite athletes with and without ED. However, more studies are needed including larger samples, athletes with different competitive levels and both gender represented, to further confirm these results and also to test the predictive ability of BEDA-Q.

CONCLUSION

This study shows that BEDA-Q containing nine items is a well-suited screening questionnaire to distinguish between adolescent female elite athletes with and without an ED. This new screening questionnaire (BEDA-Q) may also be a useful instrument for predicting new cases of ED. Socially prescribed perfectionism among athletes and its relation to ED should be further investigated.

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REFERENCES

1. American Psychiatric Association. Eating Disorders. *Diagnostic and Statistical Manual of Mental Disorders: DSM-IV*. Washington (DC): American Psychiatric Association; 1994. p. 539–50.
2. Beals KA. *Disordered eating among athletes: a comprehensive guide for health professionals*. Champaign (IL): Human Kinetics; 2004. p. 255.
3. Beals KA, Manore MM. Disorders of the female athlete triad among collegiate athletes. *Int J Sport Nutr Exerc Metab*. 2002;12(3):281–93.
4. Birgegard A, Norring C, Clinton D. DSM-IV versus DSM-5: implementation of proposed DSM-5 criteria in a large naturalistic database. *Int J Eat Disord*. 2012;45(3):353–61.
5. Bonci CM, Bonci LJ, Granger LR, et al. National athletic trainers' association position statement: preventing, detecting, and managing disordered eating in athletes. *J Athl Train*. 2008;43(1):80–108.
6. Byrne S, McLean N. Eating disorders in athletes: a review of the literature. *J Sci Med Sport*. 2001;4(2):145–59.
7. Byrne S, McLean N. Elite athletes: effects of the pressure to be thin. *J Sci Med Sport*. 2002;5(2):80–94.
8. Cole TJ, Flegal KM, Nicholls D, Jackson AA. Body mass index cut offs to define thinness in children and adolescents: international survey. *Br Med J*. 2007;335(7612):194–7.
9. Damian LE, Stoeber J, Negru O, B-âban A. On the development of perfectionism in adolescence: perceived parental expectations predict longitudinal increases in socially prescribed perfectionism. *Pers Individ Dif*. 2013;55(6):688–93.
10. Enns MW, Cox BJ. The nature and assessment of perfectionism: a critical analysis. In: Flett GL, Hewitt PL, editors. *Perfectionism*. Washington (DC): American Psychological Association; 2002. p. 33–62.
11. Fairburn CG, Bohn K. Eating disorder NOS (EDNOS): an example of the troublesome "not otherwise specified" (NOS) category in DSM-IV. *Behav Res Ther*. 2005;43(6):691–701.
12. Fairburn CG, Cooper Z, O'Connor ME. Eating disorder examination (Edition 16.0D). In: Fairburn CG, editors. *Cognitive Behavior Therapy and Eating Disorders*. New York: The Guilford Press; 2008. p. 265–308.
13. Flett GL, Hewitt PL. The perils of perfectionism in sports and exercise. *Curr Dir Psychol Sci*. 2005;14(1):14–8.
14. Flett GL, Hewitt PL, Oliver JM, Macdonald S. Perfectionism in children and their parents: a developmental analysis. In: Flett GL, Hewitt PL, editors. *Perfectionism: Theory, Research, and Treatment*. Washington (DC): American Psychological Association; 2002. p. 88–132.
15. Forsberg S, Lock J. The relationship between perfectionism, eating disorders and athletes: a review. *Minerva Pediatr*. 2006;58(6):525–36.
16. Friborg O, Clausen L, Rosenvinge JH. A five-item screening version of the Eating Disorder Inventory (EDI-3). *Compr Psychiatry*. 2013;54(8):1222–8.
17. Garner DM. *Eating Disorder Inventory-2: Professional Manual*. Odessa (FL): Psychological Assessment Resources; 1991. IV, 70 p.
18. Gould D, Dieffenbach K, Moffett A. Psychological characteristics and their development in Olympic champions. *J Appl Sport Psychol*. 2002;14(3):172–204.
19. Greenhalgh T. How to read a paper—papers that report diagnostic or screening tests. *Br Med J*. 1997;315(7107):540–3.
20. Hewitt PL, Flett GL, Ediger E. Perfectionism traits and perfectionistic self-presentation in eating disorder attitudes, characteristics, and symptoms. *Int J Eat Disord*. 1995;18:317–26.
21. Hill AP, Hall HK, Appleton PR. Perfectionism and athlete burnout in junior elite athletes: the mediating role of coping tendencies. *Anxiety Stress Coping*. 2010;23(4):415–30.
22. Holme I, Pedersen TR, Boman K, et al. A risk score for predicting mortality in patients with asymptomatic mild to moderate aortic stenosis. *Heart*. 2012;98(5):377–83.
23. Hopkinson R, Lock J. Athletics, perfectionism, and disordered eating. *Eat Weight Disord*. 2004;(9):99–106.
24. Keel PK, Forney KJ. Psychosocial risk factors for eating disorders. *Int J Eat Disord*. 2013;46(5):433–9.
25. Lampard AM, Byrne SM, McLean N, Fursland A. The Eating Disorder Inventory-2 Perfectionism scale: factor structure and associations with dietary restraint and weight and shape concern in eating disorders. *Eat Behav*. 2012;13(1):49–53.
26. Martinsen M, Bahr R, Børresen R, Holme I, Pensgaard AM, Sundgot-Borgen J. Preventing eating disorders among young athletes: a randomized controlled trial. *Med Sci Sports Exerc*. 2014; 46(3):435–47.
27. Martinsen M, Bratland-Sanda S, Eriksson AK, Sundgot-Borgen J. Dieting to win or to be thin? A study of dieting and disordered eating among adolescent elite athletes and non-athlete controls. *Br J Sports Med*. 2010;44(1):70–6.
28. Martinsen M, Sundgot-Borgen J. Higher prevalence of eating disorders among adolescent elite athletes than controls. *Med Sci Sports Exerc*. 2013;45(6):1188–97.
29. Pensgaard AM, Roberts GC. Elite athletes' experiences of the motivational climate: the coach matters. *Scand J Med Sci Sports*. 2002;12(1):54–9.
30. Sherry SB, Hewitt PL, Besser A, Mcgee BJ, Flett GL. Self-oriented and socially prescribed perfectionism in the Eating Disorder Inventory Perfectionism Subscale. *Int J Eat Disord*. 2004;35(1):69–79.
31. Stice E. Risk and maintenance factors for eating pathology: a meta-analytic review. *Psychol Bull*. 2002;128(5):825–48.
32. Stoeber J, Otto K. Positive conceptions of perfectionism: approaches, evidence, challenges. *Pers Soc Psychol Rev*. 2006;10(4):295–319.
33. Sundgot-Borgen J, Larsen S. Pathogenic weight-control methods and self-reported eating disorders in female elite athletes and controls. *Scand J Med Sci Sports*. 1993;3:150–5.
34. Sundgot-Borgen J. Prevalence of eating disorders in elite female athletes. *Int J Sport Nutr*. 1993;3(1):29–40.
35. Sundgot-Borgen J. Risk and trigger factors for the development of eating disorders in female elite athletes. *Med Sci Sports Exerc*. 1994;26(4):414–9.
36. Sundgot-Borgen J, Meyer NL, Lohman TG, Ackland TR, Maughan RJ, Muller W. How to minimize the health risks to athletes who compete in weight-sensitive sports. Review and position statement on behalf of the Ad Hoc Research Working Group on Body Composition Health and Performance, under the auspices of the I.O.C. Medical Commission. *Br J Sports Med*. 2013;47:1012–22.
37. Sundgot-Borgen J, Torstveit MK. Prevalence of eating disorders in elite athletes is higher than in the general population. *Clin J Sport Med*. 2004;14(1):25–32.
38. Thompson RA, Trattner Sherman R. *Eating Disorders in Sport*. New York: Routledge; 2010. p. 284.
39. Torstveit MK, Rosenvinge JH, Sundgot-Borgen J. Prevalence of eating disorders and the predictive power of risk models in female elite athletes: a controlled study. *Scand J Med Sci Sports*. 2008; 18(1):108–18.
40. Torstveit MK, Sundgot-Borgen J. The female athlete triad exists in both elite athletes and controls. *Med Sci Sports Exerc*. 2005;37(9): 1449–59.
41. Van Houwelingen JC, Le Cessie S. Predictive value of statistical models. *Stat Med*. 1990;9(11):1303–25.