

Exploratory Factor Analyses of the Female and Male Body Checking Questionnaires in Collegiate Athletes

Original Research

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Abstract

Introduction: Collegiate athletes have demonstrated heightened risk for disordered eating and body image concerns, yet many body checking questionnaires have been developed and validated in clinical and non-clinical adult populations which reflects a gap in measures for the athlete population.

Methods: Collegiate athletes (n = 174; 86 females, 84 males, and 4 non-binary) completed both the Body Checking Questionnaire (BCQ) and the Male Body Checking Questionnaire (MBCQ) using online survey software. Exploratory factor analyses (EFAs) were performed on each questionnaire to assess their psychometric properties in our mixed-gender sample. An item-reduction technique was then performed on each questionnaire to explore more manageable and relevant sets of items in our sample.

Results: A reduced-item BCQ (12 items) yielded a two-factor structure, comparison and checking behaviors, while maintaining high internal consistency (Cronbach's $\alpha = 0.918$ and McDonald's $\omega = 0.921$). For the MBCQ, an 11-item measure (removed 8 items) yielded three factors, comparison, flexing, and asking/seeking behaviors, while maintaining high internal consistency ($\alpha = 0.903$ and $\omega = 0.913$).

Conclusions: The original and reduced-item questionnaires maintained their psychometric integrity when administered to college athletes regardless of gender, potentially reflecting an evolving consciousness of cultural and societal norms around athlete body image.

Key Words: Body image, disordered eating, psychometrics

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Introduction

Disordered eating (DE) in athletes is characterized by an intense preoccupation with food, exercise, and body image, as well as engagement in pathogenic behaviors that lead to impaired health, well-being, and sport performance.^{1,2} DE risk is a concern in the athletic population, especially for female athletes, who are more likely to report an eating disorder (e.g., anorexia nervosa, bulimia nervosa, binge eating disorder, and eating disorder not otherwise specified) compared to their non-athlete counterparts.³ Furthermore, studies show that female athletes have a higher prevalence of DE, regardless of sport type and competition level (e.g., recreational, elite, professional), compared to male athletes.⁴⁻⁸ It is important to note that athletes who participate in weight-class (e.g., wrestling, rowing) and aesthetic (e.g., gymnastics) sports have historically reported greater DE risk compared to other sport

types.⁹ Sport-specific pressures, such as an overemphasis on body composition for sport performance, may further increase risk for DE and body image disturbance (BID) in athletes.^{10,11}

Body image is a multidimensional construct encompassing self-perceptions and attitudes regarding one's physical appearance, and BID is associated with increased risk of DE and more frequent body checking behaviors.^{12–16} Studies have reported mixed findings on the prevalence of BID in athlete and non-athlete samples; however, BID prevalence in the athletic population has been shown to be greater in females compared to males as well as in sports that emphasize leanness (e.g., gymnastics) compared to non-leanness (e.g., soccer) sports.¹⁷

Research has consistently shown that individuals experiencing BID are more likely to engage in body checking behaviors, with those who have clinical DE reporting significantly greater engagement in checking behaviors compared to non-clinical populations.^{18–21} Body checking refers to an individual's tendency to internally and/or externally examine their body weight and shape through repetitive or ritualistic behaviors (e.g., habitual weighing, compulsive mirror checking, use of clothing fit to judge their body weight and shape).²² Sporting culture tends to emphasize finite body ideals that are believed to be associated with optimal sports performance, likely leading athletes to internalize body-focused messages.²³ As such, body checking is likely to contribute to DE behaviors in athletic populations, but this has yet to be established as body checking is not well-explored in athletic populations.

Well-established measures of body checking, such as the Body Checking Questionnaire (BCQ) and Male Body Checking Questionnaire (MBCQ), have been used to assess body checking in clinical and non-clinical adult populations.^{24–26} The BCQ and MBCQ measure constructs related to body checking through idiosyncratic behaviors such as touching and pinching, using reflective surfaces such as mirrors and windows to assess body shape, comparing physique to celebrities, athletes, and other prominent social figures, and verbal reassurance seeking of body shape from friends, peers, and family.^{24,25} Despite this, it is important to consider that sporting culture imposes unique social, emotional, and performance factors that could relate to body checking, which may not be accounted for in measures' original development.^{27–30} While the prevalence and psychological underpinnings related to DE in athletes are well-stated in the literature; little is known about the role of body checking behaviors or the utility of the BCQ and MBCQ in athletic populations.

Therefore, the primary aim of this study was to conduct exploratory factor analyses (EFA) on the BCQ and MBCQ to assess the psychometric properties of each questionnaire for use in the collegiate athlete population. The secondary aim of this study was to apply an item-reduction technique to both the BCQ and MBCQ to propose reduced-item measures with the goal of enhancing questionnaire utility by decreasing administration time while maintaining sufficient internal reliability.

Scientific Methods

Participants

The final sample included 174 collegiate athletes (86 females, 84 males, and 4 non-binary), aged 18 years or older, from 12 National Collegiate Athletic Association (NCAA) colleges or universities' athletic training departments, varsity sport coaching staff, and compliance offices in the northeast region of the United States. The participants were recruited through email which outlined the informed consent process and provided contact information for participant questions prior to engaging in the online survey via Qualtrics. The University of Rhode Island's Institutional Review Board approved this study (IRB:1794769-1), and online informed consent was obtained from all participants.

Protocol

Participants were asked to complete a one-time online questionnaire (Qualtrics XM, Provo, UT) consisting of the BCQ²⁴ and the MBCQ,²⁵ as well as self-reported demographic information (e.g., biological sex, gender identity, ethnicity/race, academic year, sport type, NCAA competition level). The BCQ and MBCQ were selected because they are widely used, dedicated measures that more directly assess body checking-related behaviors, compared with questionnaires related to DE. Both questionnaires were administered to all participants, regardless of gender identity, to capture a broader understanding of body checking behaviors within an athlete-specific sample, as sporting contexts impose unique social and performance-related body ideals that may influence body checking behaviors in athletes, irrespective of gender.

The Body Checking Questionnaire (BCQ)

The BCQ is a validated 23-item questionnaire that measures three factors of overall appearance, checking of specific body parts, and idiosyncratic checking rituals in female adults which are believed to contribute to thin idealization.²⁴ Individual items examine compulsive behaviors associated with body image and perception including, but not limited to, grabbing, pinching, jiggling, mirror reflection, and other evaluative behaviors of specific body parts with participants being asked to rate their frequency of behaviors based on a 5-point Likert scale. The BCQ achieved high internal consistency (Cronbach's $\alpha = 0.94$) in the original population of non-clinical adult females.²⁴

The Male Body Checking Questionnaire (MBCQ)

The MBCQ was modified from the original BCQ to account for muscularity-related checking behaviors in males.²⁵ The MBCQ is a validated 19-item questionnaire that consists of four factors with items inquiring about behaviors related to global muscle checking, chest and shoulder checking, other-comparative checking, and body testing, with participants being asked to report their frequency of engagement with each item based on a 5-point Likert scale.²⁵ Original validation of the MBCQ assessed convergent properties of the four subscales with subscale scores on the Eating Disorder Examination Questionnaire (EDE-Q), Eating Disorder Inventory (EDI), and Muscle Dysmorphic Disorder Inventory (MDDI). Further, the MBCQ total score demonstrated good test-retest reliability, $r = 0.841$, across two time points.²⁵

Statistical Analysis

Data from Qualtrics was downloaded and transferred to Microsoft Excel for scoring and coding. IBM SPSS Statistics for Macintosh V.28 (IBM Corp. Armonk, NY) was used for statistical analyses. EFAs were conducted using principal components analysis (PCA) on the BCQ and MBCQ to explore how items loaded on factors based on shared variance. Methodologically, a sufficient sample of at least 100 collegiate athlete responses were needed to conduct an EFA on the BCQ and MBCQ to maintain criteria for determining complex and insufficient factor loadings.^{31,32} To conduct the EFA, a direct Oblimin (i.e., oblique) rotation was applied to examine the factor loadings in the current athlete population compared to previous validation efforts. Sufficient factor loadings were determined as being $> |0.3|$.³³ Scree plots were used to help determine the number of factors extracted, based on the plot's inflection point for both measures.

Following the factor extraction process, factor loadings were examined to ensure that items were reasonably related to their respective factor. Item loadings $> |0.3|$ within a factor were retained when conducting the item-reduction process, whereas items with complex loadings of at least $|0.3|$ on two or more dimensions and items loading $< |0.3|$ were considered for removal. Internal consistency of the BCQ and MBCQ in the current sample was assessed via Cronbach's alpha (α) and McDonald's omega (ω) prior to and after engaging in the item-reduction process. When appropriate, $p \leq 0.05$ was considered statistically significant a priori.

Results

Participants

Participant data was taken from a larger study previously published that examined athletes and non-athletes.³⁴ The current sample included 174 collegiate athletes ($n = 86$ females, 84 males, and four who identified as "other gender identity"). Participant demographics are presented in Table 1.

Initial Assessment of Internal Consistency

Both questionnaires had high internal consistency for our sample (BCQ: Cronbach's $\alpha = 0.961$, McDonald's $\omega = 0.962$; MBCQ: Cronbach's $\alpha = 0.930$, McDonald's $\omega = 0.935$).

EFA and Item-Reduction of the BCQ

Based on the EFA of the BCQ, three factors were delineated in the sample of collegiate athletes, which reflected a similar factor structure in the BCQ parent study with a non-clinical adult female sample.²⁶ However, when factors were extracted based on data from the scree plot, the factor structure was reduced from three factors to two, which permitted the items to load more robustly (see Tables 2 and 3). The EFA revealed six items that were considered complex based on our criteria of loading on more than one factor and were thus removed from the BCQ and not considered for the reduced-item questionnaire. Additionally, five items loaded characteristically lower than other BCQ items for respective factors based on our criteria and were also subsequently dropped.

Table 1. Participant demographics.

Characteristic	<i>n</i> (% of total <i>N</i>)
Gender Identity	
Female	86 (49.4)
Male	84 (48.3)
^a Other gender identity	4 (2.3)
Academic Year	
Freshman	47 (27.0)
Sophomore	45 (25.9)
Junior	39 (22.4)
Senior	26 (14.9)
Fifth-year undergraduate	3 (1.7)
Graduate student	14 (8.1)
Athlete Status	
Team sport athlete	99 (56.9)
Individual sport athlete	75 (43.1)
^bNCAA Sport	
Basketball	7 (2.7)
Baseball	49 (18.9)
Cross Country	8 (3.1)
Fencing	1 (0.4)
Football	2 (0.8)
Gymnastics	1 (0.4)
Indoor/Outdoor T&F	63 (24.3)
Lacrosse	1 (0.4)
Rowing	8 (3.1)
Soccer	6 (2.3)
Softball	12 (4.6)
Swimming & Diving	21 (8.1)
Tennis	1 (0.4)
Volleyball	15 (5.8)
NCAA Division	
Division I	75 (43.1)
Division III	97 (55.8)
Unaccounted for	2 (1.1)
^cRace/Ethnicity	
Black or African American	13 (7.2)
Hispanic or Latino	5 (2.8)
Asian	2 (1.1)
Native Hawaiian or Pacific Islander	0 (0.0)
American Indian or Alaskan Native	1 (0.6)
White or Caucasian	160 (88.4)

^aindividuals who identified as a transgender man, transgender woman, or a non-binary person were collectively coded as "other gender identity" given the small sample size for each gender identity alone

^bNCAA Sport total counts > 174 since there was multi-select option

^crace/ethnicity total counts > 174 since there was multi-select option

Following the item-reduction procedure, the reduced-item BCQ consisted of 12 items that were retained from the original 23-item questionnaire. The shortened BCQ had two factors emerge: (1) items assessing comparison/internalizing behaviors and (2) items assessing checking/externalizing behaviors. The first factor (comparison/internalizing behaviors) included items related to self-evaluation or comparison (e.g., I look at others to see how my body size compares to their body size). The second factor (checking/externalizing behaviors) included

items related to physical or active body checking (e.g., I check the diameter of my wrist to make sure it's the same size as before). Following the factor delineation and item-reduction procedure, internal consistency coefficients of the reduced-item BCQ were excellent as evidenced by having a Cronbach's $\alpha = 0.918$ and McDonald's $\omega = 0.921$.

Table 2. Exploratory factor analysis on the Body Checking Questionnaire.

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			
	Total	% of Variance	Cumulative %	Total	Rotation Sums of Squared Loadings ^a		Total
					% of Variance	Cumulative%	
1	11.95	51.96	51.96	11.95	51.96	51.96	10.08
2	1.64	7.14	59.10	1.64	7.14	59.10	9.55
3	1.20	5.23	64.34				
4	0.99	4.31	68.65				
5	0.91	3.96	72.61				
6	0.82	3.57	76.17				
7	0.67	2.93	79.10				
8	0.59	2.58	81.68				
9	0.51	2.23	83.91				
10	0.45	1.95	85.85				
11	0.41	1.78	87.63				
12	0.38	1.64	89.27				
13	0.34	1.48	90.75				
14	0.32	1.38	92.13				
15	0.30	1.32	93.45				
16	0.29	1.26	94.71				
17	0.26	1.14	95.85				
18	0.22	0.97	96.82				
19	0.19	0.83	97.64				
20	0.16	0.70	98.43				
21	0.15	0.67	99.01				
22	0.12	0.52	99.53				
23	0.11	0.47	100.00				

Extraction Method: Principal Component Analysis (PCA)

^aWhen components are correlated, sums of squared loadings cannot be added to obtain a total variance Student-athlete sample with total variance explained (% of Variance) with extraction

EFA and Item-Reduction of the MBCQ

Based on the EFA of the MBCQ in the original non-clinical study, four factors were delineated in the current sample of collegiate athletes.²⁵ Following the initial EFA, the scree plot of the MBCQ suggested that the pattern of item loadings may reflect a three-factor structure (see Tables 4 and 5). The three-factor extraction loaded more robustly, leading to greater insight on identifying complex and weak factor loadings for item-removal. Seven items exhibited complex factor loadings, with an additional item being removed to accommodate retaining another item to maintain factor structure integrity (i.e., having at least three items to compose a factor), resulting in a total of eight items being removed from the original questionnaire.

Following the item-reduction process, the reduced-item MBCQ consisted of 11 items loading onto three factors that included items assessing (1) comparison behaviors, (2) external checking behaviors, and (3) asking/seeking behaviors. The first factor (comparison behaviors) included items related to self-evaluation or self-comparison (e.g., I compare my overall leanness mass to athletes or celebrities). The second factor (external checking behaviors) included items related to physical or active body checking (e.g., I flex my chest muscles in the mirror to find lines or striations in the muscle). Lastly, the third factor (asking/seeking) included items related to elicitation of feedback from others about their body (e.g., I ask others to comment on my muscle definition or size). Following the factor delineation and item-

reduction procedure, internal consistency coefficients of the reduced-item MBCQ were excellent with a Cronbach's $\alpha = 0.903$ and McDonald's $\omega = 0.913$.

Table 3. Pattern matrix of the Body Checking Questionnaire with extraction.

	Component ^a	
	1	2
1. I check to see how my bottom looks in the mirror	0.895	-0.121
2. I look at others to see how my body size compares to their body size	0.868	-0.014
3. I compare myself to models on TV or in magazines	0.812	0.022
4. I check my reflection in glass doors or car windows to see how I look	0.810	-0.071
5. I suck in my gut to see what it is like when stomach is completely flat	0.731	0.186
6. I practice sitting and standing in various positions to see how I look in each position	0.651	0.197
7. I ask others about their weight or clothing size so I can compare my own weight/size	0.600	-0.097
8. I check to see if my fat jiggles	0.552	0.312
9. I check to see if my thighs rub together	0.540	0.340
10. I touch underneath my chin to make sure I don't have a "double chin"	0.510	0.317
11. I rub (or touch) my thighs while sitting to check for fatness	0.500	0.427
12. I try to elicit comments from others about how fat I am	0.373	0.358
13. I lie on the floor to see if I can feel my bones touch the floor	-0.203	0.891
14. I check the diameter of my wrist to make sure it's the same size as before	-0.085	0.772
15. I have special clothes which I try on to make sure they'll fit	0.151	0.743
16. I check to make sure my rings fit the same way as before	-0.076	0.740
17. I check the diameter of my legs to make sure they're the same size as before	0.140	0.671
18. I pinch my upper arms to measure fatness	0.280	0.609
19. I pull my clothes as tightly as possible around myself to see how I look	0.251	0.590
20. I pinch my cheeks to measure fatness	0.076	0.513
21. I pinch my stomach to measure fatness	0.400	0.495
22. I look to see if I have cellulite on my thighs when I am sitting	0.362	0.489
23. I check to see if my thighs spread when I am sitting down	0.449	0.472

Extraction Method: Principal Components Analysis (PCA)

Rotation Method: Oblimin with Kaiser Normalization

^aRotation converged in 14 iterations

Table 4. Exploratory factor analysis on the Male Body Checking Questionnaire.

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings				Rotation Sums of Squared Loadings ^a
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative%	Total	
1	8.60	45.25	45.25	8.60	45.25	45.25	7.75	
2	1.66	8.74	53.99	1.66	8.74	53.99	4.48	
3	1.46	7.66	61.65	1.46	7.66	61.65	4.19	
4	1.27	6.67	68.33					
5	1.18	6.19	74.52					
6	0.84	4.42	78.94					
7	0.61	3.21	82.15					
8	0.57	2.30	85.14					
9	0.50	2.65	87.79					
10	0.47	2.46	90.24					
11	0.38	2.02	92.27					
12	0.35	1.81	94.08					

13	0.31	1.64	95.72
14	0.25	1.31	97.03
15	0.23	1.23	98.25
16	0.14	0.75	99.00
17	0.12	0.60	99.61
18	0.04	0.22	99.82
19	0.03	0.18	100.00

Extraction Method: Principal Component Analysis (PCA)

^aWhen components are correlated, sums of squared loadings cannot be added to obtain a total variance Student-athlete sample with total variance explained (% of Variance) with extraction

Table 5. Pattern matrix of the Male Body Checking Questionnaire with extraction.

	Component ^a		
	1	2	3
1. I compare my overall leanness mass to athletes or celebrities	0.907	0.026	-0.007
2. I compare my overall muscle mass to athletes or celebrities	0.896	0.008	0.003
3. I compare my overall leanness and muscle definition to others	0.879	0.056	0.029
4. I compare the size of my muscles to others	0.783	-0.029	0.131
5. I look at my abdominals (6-pack) in the mirror	0.783	-0.034	-0.197
6. I will check the size and shape of my muscles in most reflective surfaces (e.g., car, windows, shopping store windows, mirrors, etc.)	0.713	-0.138	-0.121
7. I pinch the fat around my abdomen and back (e.g., love handles) to determine my leanness	0.566	0.212	0.425
8. I compare the leanness or definition of my chest and muscles with others	0.534	-0.332	0.084
9. I pinch or grab my muscles to check their size and density	0.503	-0.117	0.219
10. I flex my biceps when looking in the mirror to ensure symmetry of my muscles	0.451	-0.404	-0.009
11. I check on the hardness of my biceps to ensure I have not lost any muscle mass	0.378	-0.163	0.332
12. I compare the broadness of my shoulders with others	0.363	-0.277	0.320
13. I flex my muscles when looking in the mirror to find lines or striations in the muscle	0.006	-0.947	0.015
14. I flex my chest muscles in the mirror to find lines or striation in the muscle	0.003	-0.947	0.009
15. I compare the size of my chest muscles with others	0.331	-0.454	0.199
16. I ask others to feel my muscles to ensure their size or density	-0.190	-0.123	0.882
17. I ask others to comment on my muscle definition or size	-0.040	-0.052	0.780
18. I push the fat around or pull my skin back to accentuate the muscles underneath	0.313	0.186	0.542
19. I take measurements of my muscle with a tape measure	0.174	-0.143	0.192

Extraction Method: Principal Components Analysis (PCA)

Rotation Method: Oblimin with Kaiser Normalization

^aRotation converged in 8 iterations

Discussion

The purpose of the study was to explore the efficacy of two well-established body checking measures (BCQ and MBCQ) in a sample of collegiate athletes. Reduced-item questionnaires for the BCQ and MBCQ improved utility and maintained excellent internal consistency. Both the BCQ and MBCQ had excellent internal reliability (α and $\omega > 0.90$) for full-item and reduced-item analyses.

Findings from the current study illustrate an emergence of unique factor structures that differ somewhat from previous validation efforts in clinical and non-clinical adult populations when administering the BCQ and MBCQ to collegiate athletes. The change in item-factor loading and composition may suggest that athletes respond differently to BCQ and MBCQ items than non-athletes or that some items on the questionnaires resonate more with the athlete population. The differences in factors between athletes and non-athletes may be explained, in part, by the unique social, emotional, and performance factors posed by the sporting culture, such as physiological and metabolic demands of sport, sport body image idealization, and messaging from coaches, parents, and other external systems that promote a specific body image.^{12,27–30}

The present study explored foundational psychometric properties of the BCQ and MBCQ in a sample of collegiate athletes which expands upon previous research done in the non-athlete adult population. Continued development and validation of athlete-specific body checking screening questionnaires may help promote early identification of at-risk individuals experiencing BID, and thus, improve primary prevention of DE. Identifying key items, such as those delineated in the reduced-item BCQ and MBCQ that align with athlete-specific risk factors and body checking behaviors, has the potential to increase sensitivity in determining risk for BID and DE.¹³⁻¹⁶

The current study explored the potential in establishing a body checking questionnaire with intentions of validating for use in the collegiate athlete population regardless of gender. The use of two previously validated questionnaires of body checking behavior, albeit validated in non-athlete samples, provided a foundation to explore factor structure in athletes and future development of an athlete body checking questionnaire. Investigation into body checking and eating behaviors in male and female collegiate athletes have revealed emerging cultural and systemic changes in body image idealization across gender, suggesting that body checking constructs may not be as gendered-specific as historically believed.³⁴ However, future research could explore possible considerations related to sex-specific characteristics that may account for differences in body checking and body image within the sporting and broader cultural context.

It is important to note the limitations of using self-report questionnaires to assess individuals' behaviors, including risks of human error in reporting, recall bias, and influence of social desirability in responding to items which may lead to under-reporting of DE and body checking behaviors. The current sample of collegiate athletes reflects a limited number of universities and universities in Northeast, USA. Generalizations should be considered carefully, and future studies should target a broader network of universities at various competition levels, different geographical location, with a more diverse sample of collegiate athletes. Another key limitation is that the BCQ and MBCQ were originally developed and validated in sex-specific, non-athlete samples. Although we administered both measures across gender identities to characterize body checking in collegiate athletes, we did not test measurement invariance or differential item functioning by gender. Therefore, equivalence of item functioning across genders cannot be assumed. Future work should evaluate invariance in larger samples and consider development of gender-inclusive, athlete-specific body-checking measures. Currently, the BCQ and MBCQ lack specific cut-off criteria that could provide insight into the sensitivity and specificity of the questionnaires in identifying individuals at risk for DE. Potential insights in determining the effectiveness of the BCQ, MBCQ, and the reduced-item versions in identifying individuals who are at risk for DE were unable to be determined from the present study, however, the results provide a scaffolding for future endeavors in developing a salient risk identification tool for the athletic population.

Conclusions

Our findings provide support for the use of two well-established questionnaires of body checking (BCQ and MBCQ) in collegiate athlete populations, which were originally validated in clinical and non-clinical adult populations. Future research can verify whether these findings reflect some sort of evolving nature of cultural and societal norms when it comes to athlete body image issues. The EFAs and internal consistency calculations of the BCQ and the MBCQ in our sample of collegiate athletes established a strong foundation for future validation efforts in this population. Continued work in developing a psychometrically robust body checking questionnaire for collegiate athletes has implications for enhanced ability to identify those at risk for DE and BID, potentially enhancing the effectiveness of treatment while reducing risk of relapse and life-threatening physical and psychological consequences.

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