Exploring Health Demographics of Female Collegiate Rowers

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Context: Limited information exists about health patterns among female rowers at the collegiate level. Furthermore, the element of weight class (lightweights classified as <130 lb [59 kg]) as a factor in the physical and mental health of female collegiate athletes has not been investigated, despite weight requirements in sport being a risk factor for the female athlete triad.

Objective: To test the hypotheses that (1) components of the female athlete triad were more prevalent in lightweight than in openweight rowers; (2) perceived stress levels were greater in lightweight than in openweight rowers; and (3) rowers who were unable to row due to injury had greater perceived stress levels than uninjured athletes.

Design: Cross-sectional study.

Setting: Twelve collegiate women's rowing programs consisting of 6 National Collegiate Athletic Association Division I openweight and 6 Intercollegiate Rowing Association–level lightweight teams.

Patients or Other Participants: A total of 158 female collegiate rowers (78 lightweight, 80 openweight).

Main Outcome Measure(s): An electronic survey addressing injury history, diet and eating habits and body image (according to the triad screening questionnaire), stress levels (Perceived Stress Scale), and athlete identity (Athlete Identity Measurement Scale) was administered.

Results: Lightweight rowers reported limiting or carefully controlling foods more frequently than openweight rowers (41.9% to 29.9%, P = .013). A history of an eating disorder was more prevalent among lightweight than openweight rowers (25.7% to 13.0%, P = .048). Prevalences of stress fractures and menstrual irregularities did not differ between weight classes. Lightweight and openweight rowers' scores on the Perceived Stress Scale (16.0 \pm 9.9 and 17.3 \pm 6.4, respectively) were not different. Injured rowers scored higher on the Perceived Stress Scale (19.4 \pm 7.2) than did uninjured rowers (16.6 \pm 5.72).

Conclusions: Weight class did not contribute to differences in the prevalence of female athlete triad components or perceived stress, although lightweight rowers were more likely to have a history of eating disorder. Injury may be a risk factor for increased stress in this population.

Key Words: female athlete triad, disordered eating, stress, sports injuries

Key Points

- The prevalences of stress fractures and menstrual irregularities did not differ between lightweight and openweight rowers, whereas a history of an eating disorder was more prevalent among the former (25.7%) than the latter (13%).
- Perceived stress levels did not differ between weight classes.
- Injured rowers scored higher on the Perceived Stress Scale than did uninjured rowers; athletic identity and perceived stress were moderately correlated among those who were currently injured.

t both the collegiate and Olympic levels, female rowers have 2 weight categories: openweight (no weight requirements) and lightweight. To compete in a women's collegiate lightweight event, each rower in the boat must weigh <130 lb (59 kg) the day before the race. Lightweight rowing was introduced to increase accessibility to the sport by giving smaller rowers the opportunity to compete against others of similar height and muscle mass. Openweight rowers tend to have the advantage of height, which facilitates a longer stroke, and muscle mass, which allows more power to be generated through the stroke. To maximize strength, power, and endurance, lightweight rowers are often naturally heavier than the maximum weight and use acute weight-loss methods, primarily hypohydration and nutrient restriction, before competition.^{1,2} Of the 126 National Collegiate Athletic Association (NCAA) women's rowing teams (Divisions I, II, and III), only 7 are lightweight women's

rowing teams. Limited information exists about health patterns among female rowers at the collegiate level. Furthermore, the element of weight class (lightweights classified as <130 lb) as a factor in the physical and mental health of female collegiate rowers has not been studied, despite weight requirements in sport being a risk factor for the female athlete triad.

Female Athlete Triad

The *female athlete triad* refers to the relationship among low energy availability (EA), bone health, and menstrual status, which exists on a continuum ranging from healthy to clinical. Disordered eating or eating disorders may or may not be present.³ Chronic low EA leads to decreased leptin, insulinlike growth factor 1, and estrogen production, which triggers menstrual disturbances and impaired bone formation.⁴ In addition to immediate effects on performance, prolonged durations of the triad components can lead to musculoskeletal injuries, low bone mineral density (BMD), and an increased risk of stress fractures. Disordered eating attitudes and behaviors are estimated to affect almost twothirds of young female athletes, with a greater prevalence in sports emphasizing leanness.⁵ In lightweight rowing, between 12% and 16% of athletes reported disordered eating behaviors, with intentional weight loss increasing the likelihood of engaging in disordered eating behaviors.⁴

In rowers, rib stress fractures are common overuse injuries linked to high-force muscular contractions in the rowing stroke involving the serratus anterior and oblique muscles.⁶ Discomfort in the rib indicates a small stress on the bone; without rest and rehabilitation, it can quickly develop into a fracture. In a study⁴ of elite female lightweight rowers, 32% described a history of extended rib pain associated with menstrual irregularities and low BMD. The data also showed that rib pain was 2.7 times more common in female rowers than in male rowers, and low levels of estrogen were proposed to play a role in the occurrence of rib pain in women.

Early detection of triad symptoms in female athletes is crucial to preventing long-term damage. Athletic trainers are essential to screening and identifying symptoms in collegiate athletes; however, an exploration⁷ of athletic trainers' knowledge of the female athlete triad demonstrated that a standard comprehensive approach to screening and early intervention was lacking. Mencias et al⁸ suggested that the preparticipation evaluation forms used at NCAA Division I universities were not effective in screening for the female athlete triad. Of the 257 universities surveyed, only 9% used preparticipation evaluations that included 9 or more of the 12 items recommended by the Female Athlete Triad Coalition (now known as the Female and Male Athlete Triad Coalition) for primary screening, with 44% of universities using 4 or fewer items.

Sources of Stress in Athletes

Weight Class. Several groups have explored the psychological implications of "making weight" in sport. Among elite combat-sport athletes, Pettersson et al⁹ found a problematic balance between the culture of weight making within their sport and both their physiological needs and societal norms at large. The athletes described experiencing anger, fatigue, and confusion. Similarly, studies of boxers¹⁰ and wrestlers¹¹ showed that weight control was considered one of the most stressful aspects of their sport and that anger and low energy accompanied weight-making practices. Reports of weight-making practices benefitting an athlete's mental well-being have also been published. Some athletes viewed the anger associated with weight making as performance enhancing and confidence boosting, whereas others noted feelings of achievement. In addition, athletes in weight-class sports felt a sense of belonging from the weight-making practices fostered among teammates.¹²

Injuries. Injuries can contribute to significant stress in athletes. The integrated model of psychological response to athletic injury conceptualizes injury as a stressor that athletes respond to via the cognitive-appraisal process.¹³ Situational factors and personal factors influence appraisal, which then influences the emotional and behavioral responses to the injury. Furthermore, the model proposes that the relationship between these responses and injury

recovery outcomes is reciprocal. Stress can be induced after injury due to a lack of set timelines for recovery and return to play as well as performance failure, rehabilitation requirements, and physical symptoms. In addition, decreases in self-esteem and self-efficacy have been shown to follow athletic injury, reportedly due to a loss of athletic identity.¹⁴ A high level of athletic identity was associated with high self-esteem, and researchers¹⁵ observed that athletes who identified highly with their athletic role were more likely to have a more negative psychological response to injury.

Study Aims

The aim of our study was to better understand the health status of female rowers at the collegiate level and to examine weight-class differences. We addressed 3 questions: (1) Were the symptoms of the female athlete triad (low EA or disordered eating; low bone density, increased risk of stress fractures, or both; menstrual disturbance) associated with weight class? Athletes in sports with weight requirements, such as lightweight rowing, appeared to be at a higher risk for the female athlete triad due to low EA and disordered eating. We therefore hypothesized that female athlete triad symptoms would be more prevalent in lightweight rowers. (2) Were stress level, according to the Perceived Stress Scale, and weight class associated? We expected that making weight added additional stress to the demands of competing in Division I athletics. (3) Were stress level and rowing-related injuries associated? Injury can be a significant source of stress for student-athletes, especially when athletic identity and self-esteem are diminished. We therefore hypothesized a positive association between stress level and rowing-related injuries, more so for those with a high level of athletic identity.

METHODS

Participants

Participants were female undergraduate student-athletes from 12 collegiate women's rowing programs. Programs were selected from among NCAA Division I institutions with both openweight and lightweight women's rowing teams (lightweight teams defined as consistently fielding lightweight women's boats at the Intercollegiate Rowing Association level): Boston University, Georgetown University, Harvard-Radcliffe, Massachusetts Institute of Technology, Princeton University, Stanford University, and University of Wisconsin. The anonymous survey link was distributed to 1 member of each of these 14 teams via e-mail to be distributed among their teammates. The Harvard-Radcliffe openweight team and the Stanford University lightweight team declined participation. A total of 158 student-athletes responded, comprising 78 lightweights and 80 openweights. Participants provided informed consent by completing the survey, and the study was approved by the Georgetown University Institutional Review Board.

Instrument

To address the hypotheses of this study, we developed a 15-minute survey consisting of 4 parts (Appendix 1). The

survey was administered via Qualtrics (Provo, UT) as an anonymous link, with no identifying information collected.

Part A addressed the general demographics of the participants, including age, height, weight, and number of years rowing. It also asked respondents about their injury history, use of birth control, and menstrual dysfunction (among nonusers of oral contraceptives).

Part B related to the energy-deficiency component of the female athlete triad, using screening guidelines from the Female Athlete Triad Coalition.¹⁶ Participants were asked about dietary habits, weight, and body image on a scale of *never*, *almost never*, *sometimes*, *fairly often*, and *very often*. They were also asked to indicate whether they currently or had ever suffered from an eating disorder. An additional question specific to rowers asked about the degree of weight fluctuation per week during the competition season.

Part C was the Perceived Stress Scale (PSS), a validated instrument for evaluating the chronic stress level and the degree to which an individual appraises situations as stressful. Participants were instructed to answer 10 questions on a scale from *never* (0) to *very often* (4) for a 0 to 40 range of possible scores, with higher scores indicating greater perceived stress. A score of 0 to 13 was classified as a *low perceived stress level*, 14 to 26 was a *moderate perceived stress level*, and 27 to 40 was a *high perceived stress level*.¹⁷

Part D was the Athlete Identity Measurement Scale (AIMS), which is a frequently used, validated measure of the degree to which one identifies as an athlete. Participants were instructed to answer 10 questions on a scale from *strongly disagree* (0) to *strongly agree* (6) for a total range of scores from 0 to 60, with higher scores indicating greater athletic identity.¹⁵

Statistical Analysis

We used SPSS (version 26; IBM Corp, Armonk, NY) for data analysis. Means and standard deviations were reported for respondent demographics, and a t test for equality of means (P < .05) was performed for height and weight. To assess differences in the prevalence of stress fractures, low bone density, and menstrual dysfunction (with oral contraceptive users being excluded) between weight classes, we calculated χ^2 tests and defined differences as P values < .05. For Part B of the survey, response categories were combined to reduce 5 categories to 3: never or almost never, sometimes, and fairly or very often. Again, χ^2 tests were used to determine differences (P < .05) between lightweight and openweight rowers. Perceived Stress Scale scores between weight classes were compared using a t test for equality of means. Means for PSS scores were also compared between athletes who answered yes to being currently unable to row due to injury and those who answered *no*, using a *t* test for equality of means. Pearson correlations between PSS and AIMS scores among those who were unable to row due to injury were calculated.

RESULTS

Sample Characteristics

Lightweight rowers were shorter in stature and weighed less than openweight rowers (Table 1). Of the 158 participants, 20.9% reported being unable to row due to

Table 1. Characteristics of Study Sample

	Rowers (N $=$ 158)			
	Lightweight (n = 78)	Openweight $(n = 80)$	Total	
Characteristic		$\text{Mean}\pm\text{SD}$		
Age, y Height, cm Weight, kg No. of years rowing	$\begin{array}{c} 20\ \pm\ 2.8\\ 167.9\ \pm\ 5.3\\ 59.0\ \pm\ 3.8\\ 4\ \pm\ 1.4\end{array}$	$\begin{array}{c} 21.5 \pm .7 \\ 176.3 \pm 6.6^{a} \\ 72.8 \pm 8.6^{a} \\ 7 \pm 1.4 \end{array}$	$\begin{array}{c} 21.5 \pm .7 \\ 172.2 \pm 7.4 \\ 66.0 \pm 9.6 \\ 4.5 \pm 2.1 \end{array}$	
		No. (%) ^b		

Since you	started	rowing,	have	you	ever	suffered	an	injury t	that
preve	nted vo	u from r	owina	?					

p						
Yes	48 (61.5)	58 (72.5)	106 (67.1)			
No	30 (38.5)	22 (27.5)	52 (32.9)			
Are you currently unable to row due to injury?						
Yes	13 (16.7)	20 (25.0)	33 (20.9)			
No	65 (83.3)	60 (75.0)	125 (79.1)			
Do you take birth contro	l?					
Yes	36 (46.2)	44 (55.0)	80 (50.6)			
No	42 (53.8)	36 (45.0)	78 (49.4)			
Do you work with a nutritionist?						
Never/almost never	50 (67.6)	57 (74.0)	107 (70.9)			
Sometimes	16 (21.6)	16 (20.8)	32 (21.2)			
Fairly/very often	8 (10.8)	4 (5.2)	12 (7.9)			

^a Indicates difference between lightweight and openweight rowers (P < .05).

^b Items are presented in their original format.

current injuries, with no difference between weight classes. Most respondents (70.9%) stated they never or almost never worked with a nutritionist, and there was no difference between weight classes.

Female Athlete Triad Components

Stress fractures, current or recovered, affected 24.6% of the 158 participants, with no difference between lightweight and openweight rowers. A diagnosis of low BMD was reported in 6 lightweight rowers (7.9%) and 1 openweight rower (1.3%). Almost half of all participants noted worrying about weight or body composition fairly or very often. Lightweight rowers described limiting their foods fairly or very often more than openweight rowers (41.9% versus 29.9%, P = .013). Pathogenic weight-control practices and the degree of weight fluctuation did not differ between weight classes. Among all participants, 19.2% had a history of an eating disorder, more commonly in lightweight rowers than in openweight rowers (25.7% versus 13.0%, P = .048). Menstrual irregularity did not differ among nonusers of oral contraceptives between weight classes (Table 2).

Perceived Stress

Weight Class. The average PSS score (mean \pm SD) overall was 17.0 \pm 6.3, which was classified as a moderate level of perceived stress (range = 14–26). Perceived stress did not differ between lightweight (16.0 \pm 9.9) and openweight (17.9 \pm 6.4) rowers.

Injured and Uninjured Rowers. The average PSS score (mean \pm SD) was 19.4 \pm 7.2 among athletes currently

 Table 2.
 Prevalence of Female Athlete Triad Components Among

 Lightweight and Openweight Rowers
 Prevalence of Female Athlete Triad Components Among

	Rowers No. (%)				
Component ^a	Lightweight	Openweight	Total		
Low bone mineral density					
Diagnosed with low bone					
mineral density	6 (7.9)	1 (1.3)	7 (4.5)		
History of stress fracture ^b	17 (21.8)	22 (27.5)	39 (24.6)		
Energy deficiency					
Worry about weight/body composition					
Never/almost never	12 (16.4)	14 (18.2)	26 (17.3)		
Sometimes	25 (33.8)	25 (32.5)	50 (33.3)		
Fairly/very often	36 (48.6)	38 (49.4)	74 (49.3)		
Limit or carefully control foods					
Never/almost never	8 (10.8)	23 (29.9) ^d	31 (20.5)		
Sometimes	35 (47.3)	31 (40.3)	66 (43.7)		
Fairly/very often	31 (41.9)	23 (29.9) ^d	54 (35.8)		
Induce vomiting or use diuretics/laxatives after eating					
Never/almost never	70 (94.6)	74 (96.1)	144 (95.4)		
Sometimes	4 (5.4)	2 (2.6)	6 (4.0)		
Fairly/very often	0 (0)	1 (1.3)	1 (0.7)		
Degree of weight fluctuation per week (in competition season)					
0–2 lb (0–0.9 kg)	28 (38.4)	27 (35.1)	55 (36.7)		
3–6 lb (1.3–2.7 kg)	36 (49.3)	42 (54.6)	78 (52.0)		
7+ lb (3.1+ kg)	9 (12.3)	8 (10.4)	17 (11.3)		
History of eating disorder ^b	19 (25.7)	10 (13.0) ^d	29 (19.2)		
Menstrual dysfunction					
Lack monthly menstrual cycles ^c	14 (35.0)	8 (22.9)	22 (29.3)		

^a Items are presented in their original format.

^b Question asked if participant currently suffered from or had ever suffered from condition.

^c Excludes participants using oral contraceptives.

^d Indicates difference between lightweight and openweight rowers (P < .05).

unable to row due to injury and 16.6 ± 5.7 among the uninjured (P = .023). In those who were unable to row due to injury, higher PSS scores were moderately correlated with higher AIMS scores. The Pearson correlation coefficient was 0.356 (P = .053).

DISCUSSION

Our data add to the literature regarding signs and symptoms of the female athlete triad and perceived stress in female collegiate rowers. We found no difference in the prevalence of risk factors for the triad between lightweight and openweight rowers, although restricting food intake and a history of eating disorders were more common in lightweight rowers. Our hypothesis that stress levels would be higher in lightweight rowers was not supported. The results endorsed our suggestion that athletes unable to row due to injury would have greater perceived stress levels, and among the injured, stress level and athletic identity were moderately correlated.

Female Athlete Triad Components

The female athlete triad, consisting of low EA, low BMD, and menstrual disturbances, is a concern among collegiate athletes.¹⁸ Furthermore, sport intensity has been positively correlated with components of the female athlete triad and, thus, athletes in high–training-volume sports are at greater risk.¹⁹ Rowing at the collegiate level is a physically demanding sport that requires high training

volumes for much of the year. To the best of our knowledge, we are the first to explore risk factors and symptoms of the female athlete triad in collegiate rowers.

Energy Deficiency. A negative energy balance, such that nutritional intake is insufficient to meet both the demands resulting from physical training and normal physiological functions, drives the pathophysiology of the female athlete triad.²⁰ Although an eating disorder is not always diagnosed clinically, disordered eating behaviors are often present. Female athletes face numerous pressures to be thin, ranging from performance-related to social factors. Among our participants, roughly half indicated they worried about their weight or body composition fairly or very often, and more than a third stated they limited or carefully controlled their foods fairly or very often. These numbers are similar to those found in NCAA Division I female athletes across numerous sports.²¹ The majority of respondents never or almost never worked with a nutritionist, and previous researchers⁴ demonstrated that a lack of nutritional knowledge contributed to inadequate energy intake in athletes. Increasing access to nutritional support may be beneficial, given the relatively high number who reported worrying about their weight and body composition and limiting their food intake. A lower percentage of participants recounted pathogenic weight-control behaviors (such as vomiting or use of laxatives) than identified in largescale studies^{21,22} of female collegiate athletes.

Numerous researchers^{5,21} have observed associations between disordered eating behaviors and sports emphasizing leanness (including those with aesthetic components), endurance sports, and those with weight requirements (such as lightweight rowing). Furthermore, lightweight rowers were at a greater risk of eating disorders than heavyweight rowers.²³ Our results are consistent with these findings because lightweight rowers reported past or current eating disorders more often than openweights. Given that lightweight rowers must weigh <130 lb, we expected to learn that they were more likely to limit and control their foods. It is interesting to note, however, that participants in both weight classes frequently worried about their weight and body composition, and the degree of weight fluctuation between lightweights and openweights did not differ. The influence of education on safe weight loss and maintenance practices was not considered, although the majority of participants rarely or never worked with a nutritionist.

Bone Mineral Density and Stress Fractures. The prevalence of stress fractures in young female athletes has been reported²⁴ to be as high as 20%. Female collegiate athletes were more likely than male collegiate athletes to sustain stress fractures,²⁵ and recurring stress fractures were associated with the female athlete triad.²⁶ Although the mechanism is still unclear, the hypoestrogenic state of the female athlete triad likely shifts the set point for bone to repair damage and undergo remodeling.²⁷ Of our 158 participants, one-quarter described currently experiencing or having ever experienced a stress fracture, which is similar to the 27% prevalence of rib stress fractures in NCAA female collegiate rowers.²⁸ Rib stress fractures among both male and female rowers at the elite level were estimated⁶ at 10% to 25%, whereas rib pain was almost 3 times more common in female rowers than in male rowers.⁴

The lack of a difference in the prevalence of stress fractures between lightweight and openweight rowers was

surprising. As part of the female athlete triad, stress great fractures have been described as more common in endurance and aesthetic sports and associated with disordered eating behaviors.²¹ Furthermore, long-term rib inju pain has been identified as more prevalent among elite female lightweight rowers than among female rowers at large,⁴ which was not the case in our study. Participants were also asked if they had ever been diagnosed with low BMD. Although more lightweights than openweights had been diagnosed with low BMD, the number of participants who responded *yes* was too small for statistical analysis. **Menstrual Dysfunction.** Amenorrhea is reportedly²⁹ more prevalent in athletes than in the general population, were

more prevalent in athletes than in the general population, resulting from a variety of factors that influence the hypothalamus-pituitary-ovaries axis. Energy deficit and low leptin levels resulting from caloric insufficiency lead to decreases in luteinizing hormone pulse frequency and the hypothalamic release of gonadotropin-releasing hormone, resulting in a hypoestrogenic state.²⁰ We found that 29.3% of the 78 participants not using oral contraceptives lacked monthly menstrual cycles. This is consistent with the 31% prevalence of menstrual irregularity in a sample of 425 female collegiate athletes²¹ and considerably higher than the 14% prevalence in female college students in general.³⁰

We expected more lightweight rowers than openweight rowers to lack monthly menstrual cycles due to the influence of weight restriction on estrogen levels. The prevalence of oligomenorrhea or amenorrhea in elite female lightweight rowers has been demonstrated⁴ to be as high as 76%. Menstrual irregularities were more prevalent in lightweights than openweights in nonusers of oral contraceptives, but this difference was not significant. Similarly, in a study of collegiate female athletes,²¹ more of those in aesthetic and endurance sports reported irregular menstrual cycles than those in team or anaerobic sports, yet this difference was not significant.

Perceived Stress

Among the 158 rowers, the average PSS score was classified as a moderate level of perceived stress (range = 14–26). Moderate perceived stress has also been observed³¹ in collegiate athletes on a larger scale. Among male and female rowers, perceived stress was higher in rowers during peak training months (April and May) than early in the season (February), although it still was categorized as moderate.³²

Role of Weight Class. Our hypothesis that perceived stress would be greater among lightweight rowers than openweight rowers was not supported. The PSS scores did not differ between weight classes, and in fact, openweight rowers had slightly higher perceived stress than lightweights. These results conflict with those of athletes in weight-class sports who experienced stress and other negative psychological effects of sport-related weight control.^{9–11} However, investigators¹² have also pointed to the positive psychological effects of sport-related weight control, including feelings of achievement at making weight and the sense of belonging that weight-making practices foster, which might mediate the stressful aspects.

Role of Injuries. We believe this is the first study of perceived stress levels among injured and uninjured female collegiate rowers. As we anticipated, perceived stress was

greater in athletes who were currently unable to row due to injury. This finding adds to the numerous papers on stress and other negative psychological implications after athletic injury in collegiate athletes, resulting from physical limitations and pain, rehabilitation setbacks, fear of performance loss, and loss of confidence and self-esteem.^{14,33,34}

Furthermore, athletic identity is a factor in the psychological response to athletic injury. Perceived stress and athletic identity were moderately correlated among the 30 injured participants. This result supported prior studies^{14,15} indicating that athletes who had a greater athletic identity had a stronger negative emotional response to injury and were less able to cope. Rowers who identify strongly with their athletic role may perceive a loss of identity when unable to perform due to injury. Therefore, they will experience greater perceived stress than injured rowers who do not feel as tightly bound to their athletic role.

Limitations and Future Directions

The major limitation of this study was the time of year during which the survey was administered. Responses were collected in mid-February, which is considered winter training for most collegiate rowing teams. Racing does not begin until late March, and many teams use indoor rowing machines for training due to winter weather. This timing may have affected reports of injuries because indoor rowing places slightly different stresses on the body than does on-the-water rowing. For lightweight rowers, official weigh-ins do not begin until racing season. As a result, lightweight participants' eating behaviors may have been different than if they had been assessed later in the season. However, we did not expect this factor to affect the results as the majority of lightweight rowers tend to practice weight management throughout the year and especially in the month leading up to racing season. In addition, perceived stress levels may have been lower than if we had conducted this study during peak training and racing season. Reporting bias may have also been a factor.

Because this was an electronically administered survey, we were limited in our investigation of low BMD as a component of the female athlete triad. Dual-energy x-ray absorptiometry (DXA) is frequently used to evaluate BMD. The Female Athlete Triad Coalition recommended DXA scan for BMD testing in athletes with 1 or more triad highrisk factors, which include a history of a Diagnostic and Statistical Manual of Mental Disorders (Fifth Edition)³⁵diagnosed eating disorder, body mass index $< 17.5 \text{ kg/m}^2$ or recent weight loss of >10% in 1 month, menarche at 16 years or older, <6 menses over the past 12 months, 2 prior stress reactions or fractures, or a prior Z score $<-2.0.^3$ A DXA scan is also recommended for athletes with 2 or more triad moderate-risk factors. It would be worthwhile to investigate low BMD in lightweight and openweight collegiate rowers on a clinical level. Furthermore, we did not assess body mass index and fat-free mass via body composition analysis in this study.

It would be interesting to explore other factors contributing to the psychological effects of injury in this population. Social support and positive affect, for example, have been found to be important in an athlete's recovery. Other measures of psychological well-being in injured rowers, including coping strategies and engagement in nonsport-related activities, would also be worthwhile topics.

CONCLUSIONS

Some, but not all, components of the female athlete triad were more prevalent in lightweight than in openweight rowers. Lightweight rowers were more likely to report a history of an eating disorder and dietary-restriction practices, but the weight classes did not differ in pathogenic weight-control practices, weight fluctuations, or menstrual irregularities. Athletic trainers should be aware of the risk factors for the female athlete triad and eating disorders in both lightweight and openweight rowers. These results reinforce the National Athletic Trainers' Association recommendations³⁶ for athletic trainers to closely monitor female athletes (particularly those presenting with amenorrhea) and to collaborate in an interdisciplinary manner with coaches, physicians, and nutritionists in managing athletes at risk of the triad.

Based on our findings, lightweight rowers were not more likely to have sustained a stress fracture than were openweight rowers. However, among the 158 participants, this was a fairly common injury (24.6%); athletic trainers should therefore be aware of the stress-fracture prevalence in female rowers. Coaches and athletic trainers should pay extra attention to the mental health of injured athletes because they experience greater perceived stress than uninjured athletes. Coping strategies to alleviate some of the negative psychological effects of injury should be explored, especially for those with a high level of athletic identity.

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Appendix 1. Survey Instrument^a

Exploring Health Demographics of Female Collegiate Rowers

Part A.

Please respond honestly to each item below.

- 1. Year in school:
- 2. Age:
- 3. For how many years have you been rowing?
- 4. If you started rowing in college, what sport(s) did you participate in prior to rowing?
- 5. On average, how many total hours per week do you spend training for rowing (rowing, ergometer, lifting, cross-training)?
- 6. Are you a lightweight or an openweight rower?
- 7. Height:
- 8. Weight (natural weight):
- 9. Since you started rowing, have you ever suffered a stress fracture?
 - a. No
 - b. Yes, recovered
 - c. Yes, current
- 10. Since you started rowing, have you ever suffered a herniated disc?
 - a. No
 - b. Yes, recovered
 - c. Yes, current
- 11. Since you started rowing, have you ever suffered from tendonitis?
 - a. No
 - b. Yes, recovered
 - c. Yes, current
- 12. Since you started rowing, have you ever suffered an injury that prevented you from rowing?
- 13. If you answered yes to Question 12, for how long did the injury prevent you from rowing?
 - a. Brief (<1 month)
 - b. Half a season
 - c. Full season
 - d. More than one season
- 14. If you answered yes to Question 12, are you currently unable to row due to injury?
- 15. Have you ever been diagnosed with low bone density?
- 16. At what age was your first period?
- 17. Do you take birth control?

^a Items are presented in their original format.

- a. If yes, do you take birth control to regulate your menstrual cycle?
- b. If no, do you have monthly menstrual cycles?

Part B.

For the following 4 questions, please choose the number corresponding most closely to your personal thoughts, feelings, and behaviors. 0 =Never, 1 =Almost Never, 2 =Sometimes, 3 = Fairly Often, 4 = Very Often.

- 1. Do you work with a nutritionist?
- 2. Do you worry about your weight or body composition?
- 3. Do you limit or carefully control the foods that you eat?
- 4. Do you make yourself vomit or use diuretics or laxatives after you eat?

Please respond honestly to each item below.

- 5. Do you currently or have you ever suffered from an eating disorder?
 - a. Yes
 - b. No
- 6. To what degree does your weight fluctuate on a weekly basis in competition season?
 - a. 0–2 lbs
 - b. 3–6 lbs
 - c. 7–9 lbs
 - d. 10+ lbs

Part C.

For the following 10 questions, please choose the number corresponding most closely to your personal thoughts, feelings, and behaviors. 0 = Never, 1 = Almost Never, 2 = Sometimes, 3 = Fairly Often, 4 = Very Often.

- 1. In the last month, how often have you been upset because of something that happened unexpectedly?
- 2. In the last month, how often have you felt that you were unable to control the important things in your life?
- 3. In the last month, how often have you felt nervous and "stressed"?
- 4. In the last month, how often have you felt confident about your ability to handle your personal problems?
- 5. In the last month, how often have you felt that things were going your way?
- 6. In the last month, how often have you found that you could not cope with all the things that you had to do?
- 7. In the last month, how often have you been able to control irritations in your life?

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- 8. In the last month, how often have you felt that you were on top of things?
- 9. In the last month, how often have you been angered because of things that were outside of your control?
- 10. In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?

Part D.

For the following 10 questions, please choose the number corresponding most closely to your personal thoughts, feelings, and behaviors. 1 =Strongly Disagree, 2 =Disagree, 3 =Somewhat Disagree, 4 =Neither Agree nor Disagree, 5 =Somewhat Agree, 6 =Agree, 7 =Strongly Agree.

- 1. I consider myself an athlete.
- 2. I have many goals related to sport.
- 3. Most of my friends are athletes.
- 4. Sport is the most important part of my life.
- 5. I spend more time thinking about sport than anything else.
- 6. I need to participate in sport to feel good about myself.
- 7. Other people see me mainly as an athlete.
- 8. I feel bad about myself when I do poorly in sport.
- 9. Sport is the only important thing in my life.
- 10. I would be very depressed if I were injured and could not compete in sport.