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Original Research

Eating Disorder Risk and Pathogenic Behaviors Among Collegiate Student-Athletes

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Context: Eating disorders (EDs) are a cluster of behavioral conditions characterized by uneasy thoughts and behaviors that grow into severe or persistent eating disturbances. The demands on student-athletes may create mental and physical stressors that increase the likelihood of EDs and disordered eating.

Objective: To examine the ED risk through eating attitudes and behaviors in male and female student-athletes and across various sport types (endurance, aesthetic, power, ball or team, or technical sports).

Design: Cross-sectional study.

Setting: Collegiate athletics.

Patients or Other Participants: National Collegiate Athletic Association Division I and II student-athletes (n = 2054; males = 631; females = 1423) from 40 institutions.

Main Outcome Measure(s): Participants completed a web-based demographic survey and the Eating Attitudes Test-26 (EAT-26). Multiple χ^2 analyses examined participants classified as at risk for EDs. Independent-samples *t* tests and a 1-way analyses of variance compared sex and sport type across EAT-26 totals and subscale (Dieting, Bulimia, and Oral Control) scores.

Results: Overall, 25.3% (n = 520/2054) of student-athletes were classified as at risk for EDs. Differences were found between sex and ED risk ($\chi^2_{1,2054} = 32.9$, $P \leq .01$; 17.3% [n = 109/631] males, 28.9% [n = 411/1423] females) and across ED risk and sport type ($\chi^2_{4,2054} = 13.4$, $P = .01$). When examining females only, we observed differences across ED risk and sport type ($\chi^2_{4,1423} = 13.4$, $P \leq .01$). No differences were evident across ED risk and sport type for males. Differences were seen between sex and binge eating ($\chi^2_{1,2054} = 6.8$, $P = .009$), sex and diet pill use ($\chi^2_{1,2054} = 19.6$, $P \leq .01$), and sport type and diet pill use ($\chi^2_{4,2054} = 12.2$, $P = .016$), excessive exercise ($\chi^2_{4,2054} = 32.1$, $P \leq .01$), and losing more than 20 lb (9 kg) in the last 6 months ($\chi^2_{4,2054} = 10.2$, $P \leq .037$).

Conclusions: Student-athletes in the collegiate setting are at risk for EDs. Medical professionals, such as athletic trainers, need to be educated on the potential risk factors that may lead to EDs. Protocols for prevention, screening and recognition, and referral should be developed for student-athletes at risk for EDs.

Key Words: disordered eating, binge eating, sex differences

Key Points

- Collegiate student-athletes are at risk for eating disorders, with females at greater risk than males.
- Although their eating disorder risk was not as prevalent as in female student-athletes, male student-athletes displayed a 17.3% risk, which was higher than previously reported in the literature.
- The eating disorder risk was observed across sport type (endurance, aesthetic, power, ball, and technical sports) for all athletes, but the highest risk was seen in endurance (ie, cross-country, swimming, track) and ball or team (ie, baseball, basketball, soccer, softball, volleyball, beach volleyball) sports.
- Athletics departments should consider integrating universal guidelines or policies and best practices to guide prevention (via education), recognition, evaluation, rehabilitation, treatment measures, and return-to-play guidelines for student-athletes with disordered eating and eating disorders.

Student-athletes are a specialized population typically viewed as having favorable well-being because their roles tend to be associated with physical fitness, increased confidence, enhanced mood, and improved cardiorespiratory health. Sport participation also provides other important positive factors for student-athletes, which may include goal setting, collaboration, and stress reduction. In addition, student-athletes are generally stereotyped as eating in a healthy manner; however, they have an increased risk for developing eating disorders (EDs).[1,2] *Eating disorders* are mental disorders that may affect people of all genders, ages, ethnicities, sexual orientations, and body shapes or weights and are often underestimated across athletic populations. However, EDs have one of the highest mortality rates among mental health conditions for the general population.[3] Patients with EDs are more likely to acquire other comorbidities (eg, depression, anxiety, substance use) and many health and performance consequences (eg, premature death, infertility, cardiac concerns, constant fatigue).[1] More specifically, *disordered eating* describes a range of improper eating behaviors and may or may not have a precise clinical ED diagnosis. The

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substantial difference between EDs and disordered eating is that EDs have strict criteria defined by the American Psychiatric Association,[3] whereas disordered eating refers to a a cluster of maladaptive eating behaviors. Neither condition should be taken lightly because student-athletes may purposely try to lose or gain weight and may not be aware of proper weight management practices.

The prevalence of EDs has been identified across sexes and genders with various demographics; yet the literature has consistently characterized females (typically those who associate with Western culture) as being at higher risk for EDs and disordered eating than males (9:1 ratio).[1,2,4] The increased risk can be linked with preexisting biological and genetic risk factors that may also contribute to the presence and potency of personality risk factors (eg, perfectionistic, fearful, impulsive, biological vulnerability).[5] Furthermore, psychological and environmental factors play roles as individuals mature throughout the lifespan. These influences may stem from rigid beliefs originating in childhood or how current Western culture seemingly venerates social pressure idealizations.[6] More specifically, Western culture has been criticized for its emphasis on negative stereotyping of overweight and obese figures and overemphasis on a slim physique. In turn, Western culture has a history of dissatisfaction with weight and shape, leading to negative attitudes toward eating, a preoccupation with weight and dieting, and the pervasiveness of EDs in Western society.[7] For student-athletes in particular, Western societal pressures along with sociocultural pressures in sport may drive student-athletes to engage in pathogenic behaviors, which may place them at higher risk for EDs.

Sociocultural perspectives may encourage student-athletes to compare the desired body type or shape with their own.[6] Constant exposure to high standards, physical appearance appraisals, and student-athletes' perfectionistic attitudes can result in body shaming and, ultimately, body image dissatisfaction.[8] Body image dissatisfaction is considered a risk factor for disordered eating and EDs. Student-athletes experiencing this type of body image dissatisfaction may adapt unhealthy thoughts or attitudes about eating and engage in pathogenic behaviors (eg, binge eating; self-induced vomiting; use of diet pills, laxatives, or diuretics; excessive exercise), which may develop into disordered eating or EDs. Eating disorders and disordered eating are preventable; therefore, allied health care professionals, such as athletic trainers, should work collaboratively toward preventive measures (eg, patient education, mental health screening). Subsequently, prevention strategies may reduce the risk of mental health disorders and the number of pathogenic behaviors and avoid the harmful physiological effects that can predispose individuals to serious conditions, such as the female and male athlete triads.

Finally, when we differentiate athletes by sport type, those in lean-focused sports seem to be at higher risk for EDs. Sport classifications may include endurance, aesthetic, weight class, power (eg, sprinters), and technical (eg, lean field: high jump, long jump, triple jump) sports.[9,10] These classifications of sport may carry different sociocultural risks for EDs. For example, aesthetic athletes tend to be at a higher risk for EDs because they are evaluated on the execution of their sport-specific techniques or abilities, team coordination, and appeal.[6,11,12] Additionally, in aesthetic sports, a strong physical and training component exists, yet the public experiences a visual presentation that is centered on appearance.[8,12] In endurance athletes, the predominant view is that a low body weight can lead to more optimal performance.[13–15] Overall, athletes in the lean sport types are more inclined to be at risk for EDs and disordered eating because a specific body makeup is considered imperative.[11,16] Early detection of EDs among athletes within each sport classification is necessary to alter ED attitudes, thoughts, and perceptions before these become more severe clinical conditions. Therefore, the overall purpose of our study was to examine the ED risk among collegiate student-athletes (males and females). A secondary objective was to evaluate the ED risk between sexes (males and females), across sport type (endurance, aesthetic, power, ball and team, and technical sports), and between sexes by sport type. A third objective was to assess pathogenic behaviors between sexes and across sport types. We hypothesized that female student-athletes would be at greater risk and engage in more pathogenic behaviors than male student-athletes. We also hypothesized that athletes in endurance and aesthetic sports would present with a higher risk of EDs and pathogenic behaviors.

METHODS

Study Design

This study was part of a larger cross-sectional investigation of multiple mental health variables (ie, depression, anxiety, low self-esteem, exercise dependence, body image, EDs). It is important to note that all data were collected before the 2020 COVID-19 pandemic, and the initial and partial findings were published in 2023.[17,18]

Participants

Participants were National Collegiate Athletic Association (NCAA) Division I and II student-athletes (n = 2054, age = 19.8 ± 1.4 years; males: n = 631, height = 183.6 ± 6.9 cm, weight = 82.7 ± 12.3 kg; females: n = 1423, height = 167.9 ± 8.8 cm, weight = 63.7 ± 10.5 kg) from across 40 of the approximately 650 NCAA Division I and II institutions. During this time, no participants were recruited from Division III institutions. The inclusion criteria were student-athletes 18 to 26 years old and on an active athletics roster. The institutional review board approved the study, and all participants consented before completing the survey.

Measurements and Instruments

Demographic Survey. The demographic information collected included age, sex, self-reported height, weight, highest weight, lowest weight, ideal weight, academic status, and sport. *Ideal weight* was defined as the optimal weight to feel good about themselves (ie, what weight they would like to be). Body mass index (BMI) was calculated using self-reported height and weight (BMI = kg/m^2). *Academic status* was defined as freshman, sophomore, junior, or senior or fifth-year graduate student. *Sport type* was classified as endurance (ie, cross-country, swimming, track), aesthetic (ie, cheerleading, dance, diving, equestrian), power

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(ie, football; nonlean field events such as the discus, hammer throw, shot put), ball (ie, baseball, basketball, soccer, softball, volleyball, and beach volleyball), and technical (ie, golf; tennis; lean field events such as the high jump, long jump, pole vault).[19]

Eating Attitudes Test

The Eating Attitudes Test (EAT-26) is a self-reported tool for detecting the ED risk.[20] This instrument was not used to diagnose an ED but rather as a tool to detect the ED risk. The EAT-26 consists of 3 subscales to assess attitudes toward eating: Dieting, Bulimia and food preoccupation, and Oral Control. To be considered *at risk*, 3 criteria were used: (1) a score >20 on the EAT-26, (2) low BMI compared with sex- and age-matched norms, or (3) meeting the criteria for pathogenic behavior (ie, purging; binge eating; use of diet pills, diuretics, or laxatives; losing >20 lb [9.1 kg] in the past 6 months).[20] The EAT-26 has an internal consistency of 0.90, with a test-retest reliability of $r = 0.84$– to 0.89[20]; $r = 0.903$ for this study.

Procedures

Participants were recruited using a snowball sampling method. Snowball sampling involved reaching out to athletic trainers willing to help us recruit participants in their athletics departments and across all sports. Athletic trainers who worked in NCAA Division I or II institutions (n = 40) were contacted with an invitation letter and a survey link (SurveyMonkey) and asked to forward the email to their student-athletes. The email contained the invitation and consent letter, demographic items, several surveys to assess mental health (eg, EAT-26 for ED risk, depression, anxiety), and links to mental health resources. In this study, we used only the EAT-26 and demographic data. The survey was available for 30 days, and we sent follow-up reminders to the athletic trainers every 10 days. Data were also collected throughout the year; therefore, the time of survey completion varied for participants (eg, preseason, during the season, off-season).

DATA ANALYSES

We used SPSS (version 28; IBM Corp) and $\alpha < .05$ for the statistical analyses. To calculate power, G*Power software (version 3.1.9.4, Heinrich Heine University) was used. To ensure the appropriate statistical power of 0.95 to examine differences between sexes using a χ^2 test, an α of .05, and a moderate effect size (0.3), our power calculation indicated we needed a sample of 220 males and 220 females. To ensure the appropriate statistical power of 0.90 across sport type using a χ^2 test, an α of .05, and a moderate effect size (0.4), our power calculation indicated we needed 103 participants in each sport category. Basic descriptive statistics (mean ± SD, frequency) were calculated to examine the demographic information and EAT-26 total score and subscales. To examine the proportion of participants classified for ED risk between sexes and across sport type, χ^2 tests of independence were computed. All expected cell frequencies were >5; therefore, all assumptions were met. Crosstabulations assessed the distributions of the numbers at risk for EDs and type of ED risk. A 1-way analysis of variance compared the EAT-26 total and subscales (Dieting, Bulimia, and Oral Control) scores across sport type. We applied Tukey-Kramer post hoc analyses to determine differences between the EAT-26 total and subscales scores (Dieting, Bulimia and food preoccupation, and Oral Control) and sport type.

RESULTS

A total of 2543 student-athletes from 40 institutions initiated the survey; 405 student-athletes completed only the demographics and not the EAT-26, and 84 partially completed the demographic questions and EAT-26, yielding a total of 2054 completed surveys (males = 631, females = 1423) for an 81% completion rate among those who initiated the survey. We were unable to track how many student-athletes opened the survey but did not start it. Our estimated power was exceeded by meeting the requirements of ≥220 participants of each sex (males versus females) and ≥103 in each sport category. All expected cell frequencies were >5; thus, all assumptions were met, which indicated that we had sufficient power to conduct the additional breakdown for ED risk and sex by sport type. The distribution of participants by ethnicity, academic status, and sport type is presented in Table 1. Sports were categorized as endurance (n = 765), aesthetic (n = 357), power (n = 184), ball or team (n = 565), and technical (n = 183). Detailed demographic information (eg, height, weight, BMI) is provided in Table 2.

Prevalence of ED Risk

The distribution of the ED risk data can be found in Table 3. Overall, 25.3% (n = 520/2054) of student-athletes were classified as at risk for an ED. Differences were observed for ED risk and sex ($\chi^2_{1,2054} = 32.9$, $P \leq .01$), with 17.3% (n = 109/631) being male and 28.9% (n = 411/1423) being female. We also noted differences across the ED risk and sport type ($\chi^2_{4,2054} = 13.4$, $P = .01$) for all student-athletes (males and females). For females only, differences were demonstrated across the ED risk and sport type ($\chi^2_{4,1423} = 13.4$, $P \leq .01$). No differences were evident across the ED risk and sport type for males only ($\chi^2_{4,631} = 3.4$, $P = .499$).

Number of ED Risk Factors and Type of ED Risk

Risk factors were (1) a score of >20 on the EAT-26, (2) a low BMI compared with sex- and age-matched norms, and (3) meeting the criteria for pathogenic behavior (ie, purging; binge eating; use of diet pills, diuretics, or laxatives; losing >20 lb in the past 6 months). Among those participants identified as having an ED risk, 20.2% (n = 414) reported 1 risk factor; 5.1% (n = 105), 2 risk factors; and only 0.001% (n = 1), 3 risk factors. Most of the ED risk was associated with the risk for pathogenic behavior, with 22.2% (n = 455) of student-athletes meeting the criteria for pathogenic behaviors, followed by 6% (n = 123) who scored >20 on the EAT-26 and 1.3% (n = 47) having low BMI. The ED risk, number of risk factors, and type of risk factors for student-athletes by sex and sport type are shown in Table 3.

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Table 1. Participants' Descriptive Data and Sport Type, % (Sample Size)

	All	Females	Males
Ethnicity			
Asian American	1.3 (27)	0.8 (16)	0.5 (11)
Black or African American	10.8 (222)	7.4 (153)	3.4 (69)
Caucasian	80.4 (1651)	55.8 (1147)	24.5 (504)
Hispanic	2.7 (56)	1.4 (28)	1.4 (28)
Indian or Native American	0.5 (11)	0.3 (7)	0.2 (4)
Other	4.2 (87)	3.5 (72)	0.7 (15)
Academic status			
Freshman	28.3 (581)	19.7 (405)	8.6 (176)
Sophomore	26.5 (544)	18.2 (373)	8.3 (171)
Junior	23.5 (483)	15.9 (326)	7.6 (157)
Senior or fifth year	21.7 (446)	15.5 (319)	6.2 (127)
Sport type			
Endurance	37.2 (765)	23.4 (480)	13.9 (285)
Cross-country	12.1 (93)	11.5 (88)	0.6 (5)
Swimming	61.2 (468)	29.2 (223)	32.0 (245)
Track	26.7 (204)	22.1 (169)	4.6 (35)
Aesthetic	17.4 (357)	14.6 (300)	2.8 (57)
Cheerleading	38.4 (137)	30.8 (110)	7.5 (27)
Dance	2.8 (10)	2.8 (10)	0.0 (0)
Diving	17.4 (62)	9.0 (32)	8.4 (30)
Equestrian	41.4 (148)	41.4 (148)	0.0 (0)
Power	9.0 (184)	5.6 (114)	3.4 (70)
Football	20.1 (37)	0.0 (0)	20.1 (37)
Nonlean field events	79.9 (147)	61.9 (114)	18.0 (33)
Ball or team sport	27.5 (565)	19.3 (397)	8.2 (168)
Baseball	16.1 (91)	0.0 (0)	16.1 (91)
Basketball	9.4 (53)	7.1 (40)	2.3 (13)
Field hockey	0.53 (3)	0.53 (3)	0.0 (0)
Lacrosse	0.17 (1)	0.17 (1)	0.0 (0)
Soccer	39.7 (224)	28.4 (160)	11.3 (64)
Softball	15.2 (86)	15.2 (86)	0.0 (0)
Volleyball	13.6 (77)	13.6 (77)	0.0 (0)
Beach volleyball	5.3 (30)	5.3 (30)	0.0 (0)
Technical	8.9 (183)	6.4 (132)	2.5 (51)
Golf	20.2 (37)	15.3 (28)	4.9 (9)
Tennis	24.6 (45)	14.2 (26)	10.4 (19)
Lean field events	55.2 (101)	42.6 (78)	12.6 (23)

The EAT-26 Raw Scores

All EAT-26 total scores and subscales scores appear in Table 4. Differences were found between sex and the total score on the EAT-26 ($F_{1,2053} = 42.8$; $P \leq .01$), Dieting subscale ($F_{1,2052} = 72.8$; $P \leq .01$), and Bulimia subscale ($F_{1,2053} = 53.8$; $P \leq .01$). No differences were seen for sex and the Oral Control subscale score or for sport type and total EAT-26 score, Dieting subscale score, or Oral Control subscale score. However, we identified differences between sport type and the Bulimia subscale score ($F_{4,2053} = 2.8$; $P = .025$, Table 3). Tukey post hoc analyses revealed differences between athletes in power and aesthetic sports (1.81 ± 2.59 versus 1.23 ± 1.96, respectively; $P = .026$) and power and ball or team sports (1.81 ± 2.59 versus 1.30 ± 1.87, respectively; $P = .047$).

Pathogenic Behaviors

All pathogenic behaviors are described in Table 5. Females reported more binge eating ($\chi^2_{1,2054} = 6.8$, $P = .009$) and laxative, diet pill, or diuretic use ($\chi^2_{1,2054} = 19.6$, $P \leq .01$) than males. No differences were present for sex and vomiting, excessive exercise, and losing >20 lb in the last 6 months. We noted differences for sport type and the use of laxatives, diet pills, or diuretics ($\chi^2_{4,2054} = 12.2$, $P = .016$), with the highest usage by athletes in aesthetic sports at 13.4% and technical sports at 12.6%. Differences were also present for sport type and excessive exercise ($\chi^2_{4,2054} = 32.1$, $P \leq .01$), with the most among those in endurance sports at 8.5% (n = 65/765). Finally, differences were demonstrated for sport type and losing >20 lb in the last 6 months ($\chi^2_{4,2054} = 10.2$, $P \leq .037$), with the highest percentage in power sports at 4.9%. No differences were evident for sport type and binge-eating and vomiting.

DISCUSSION

Overall Risk of Student-Athletes

We examined student-athletes' ED risk and pathogenic behavior between sexes and across sport type. The overall risk for ED was 25.3%, which is similar to results from other student-athlete or performer population studies, in which prevalence ranged from ~11% to 45%.[2,21–23] Our findings may reflect heightened sociocultural factors, including perceived pressure from support groups, high-standard lean idealizations, sport-specific demands, weight-consciousness environments, and preoccupation with body weight observed in sports.[2,24–26] Additionally, student-athletes are more likely to display psychological elements associated with an increased ED risk, such as competitiveness, low self-esteem, perfectionism, obsessive-compulsive tendencies, or risk-taking behaviors.[24–26] Further, student-athletes have increased sociocultural and sport-specific risk factors compared with the general population.[1,4,26] Overall, the literature supports the notion that student-athletes are at a heightened ED risk, aligning with our outcomes.[11,12,27,28]

Differences by Sex

Sex is arguably the most predominant risk factor for EDs. To date, females continue to have a higher risk for EDs than males.[2,21–23] Our sample consisted of more females (n = 1423, 69%) than males (n = 631), which may have inflated the overall prevalence. Females in our study displayed a higher risk than males; this may also be explained by females' predisposition to psychological traits such as heightened body image dissatisfaction, lower self-esteem, and perfectionism.[11,25,26] Sociocultural risk factors that females may be exposed to typically pertain to strong contemporary media influences enforcing thin idealizations and social pressures.[6] Lastly, females may face sport-specific demands involving pressure to lose weight (particularly from coaches), sport-specific intense training, and even revealing uniform styles, particularly in lean sports.[6,25]

Although the ED risk continues to be higher in females, approximately 17% of the males in our investigation were at risk for EDs. The 2016 update[1] on EDs across athletes showed that at least 10% of all ED cases occurred in males. The authors[21,22,29] of research conducted within the last 6 years focused on physically active men have provided varying results. Baldó Vela et al[29] reported similar findings, with 18.5% of male athletes at risk for EDs; their sample ranged from 18 to 55 years of age and completed 4 validated questionnaires. Moreover, nearly 20% of male track and cross-country runners disclosed being dissatisfied with

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Table 2. Demographic Information, Mean ± SD[a]

Characteristic	Student-Athletes					
	All (n = 2054)	Endurance (n = 765)	Aesthetic (n = 357)	Power (n = 184)	Ball or Team (n = 565)	Technical (n = 183)
Females, No.	1423	480	300	114	397	132
Age, y	19.8 ± 1.4	20 ± 1.4	19.8 ± 1.4	20.5 ± 1.4	19.4 ± 1.3	20.1 ± 1.4
Height, cm	167.9 ± 8.8	168.2 ± 8.6	163.9 ± 13.3	167.3 ± 13.3	170.7 ± 8.5	167.8 ± 8.8
Weight, kg						
Current	63.7 ± 10.5	62.1 ± 9.0	59.2 ± 8.1	69.8 ± 16.6	67.6 ± 10.1	62.5 ± 7.9
Highest	66.5 ± 11.3	64.7 ± 9.9	61.8 ± 8.6	72.9 ± 17.9	70.4 ± 10.9	65.8 ± 9.1
Lowest	59.1 ± 9.9	57.7 ± 8.3	54.9 ± 7.8	63.8 ± 16.3	62.8 ± 9.8	58.6 ± 7.3
Ideal	61.1 ± 9.0	59.9 ± 7.8	56.5 ± 6.6	66.2 ± 13.8	65.0 ± 8.8	60.0 ± 6.5
Current ideal	2.5 ± 3.7	2.3 ± 2.9	2.7 ± 3.2	3.7 ± 5.6	2.6 ± 4.5	2.5 ± 2.8
Body mass index, kg/m^2	22.6 ± 4.0	22.0 ± 4.1	22.0 ± 2.4	25.3 ± 8.4	23.2 ± 2.7	22.1 ± 2.2
Males, No.	631	285	57	70	168	51
Age, y	19.7 ± 1.4	19.5 ± 1.4	19.9 ± 1.7	19.8 ± 1.6	19.8 ± 1.3	20.1 ± 1.2
Height, cm	183.6 ± 6.9	184.3 ± 6.4	179.6 ± 7.3	184.7 ± 6.2	183.4 ± 7.6	183.2 ± 6.4
Weight, kg						
Current	82.7 ± 12.3	79.5 ± 8.3	82.5 ± 19.2	96.4 ± 16.8	83.6 ± 10.1	79.3 ± 6.4
Highest	86.5 ± 30.4	84.7 ± 40.7	82.9 ± 23.1	100.1 ± 19.0	86.9 ± 13.0	80.8 ± 14.3
Lowest	76.9 ± 12.9	74.7 ± 8.0	73.5 ± 22.7	87.5 ± 18.2	78.4 ± 10.1	74.1 ± 12.3
Ideal	84.6 ± 12.9	81.2 ± 8.3	82.1 ± 17.6	97.6 ± 17.0	86.9 ± 13.4	80.4 ± 5.5
Current ideal	–1.8 ± 6.05	–1.7 ± 3.77	0.4 ± 5.1	–1.2 ± 5.5	–3.3 ± 9.3	–1.1 ± 2.3
Body mass index, kg/m^2	24.5 ± 3.0	23.4 ± 1.8	25.4 ± 4.9	28.2 ± 4.0	24.8 ± 2.1	23.7 ± 2.1

[a] Unless otherwise indicated.

their eating patterns, 6.3% stated they were currently or had previously suffered with an ED, and nearly 30% commented that their weight affected how they felt about themselves.[30]

Our results indicated an association between sex and the total EAT-26 score and the Dieting and Bulimia subscale scores but not the Oral Control subscale score. A possible explanation is that the EAT-26 Oral Control subscale largely consists of items reflecting self-control about food and acknowledgment of social pressure to gain weight.[20] High scores in this section are proposed to possibly reach a positive relationship, in addition to being associated with lower weight and the absence of bulimia, ensuring high social responsiveness to their environment.[20] This suggests that either our participants expressed similar

Table 3. Proportions of Participants by ED Risk and No. and Type of ED Risks by Sport Type, % (Size)[a,b]

Participants	ED Risk	*P* Value	No. of ED Risks			Type of ED Risk		
			1	2	3	Eating Attitudes Test-26 Score	Pathogenic Behavior	Body Mass Index
All participants (N = 2054)	25.3 (520)[c]	.01	20.2 (414)	5.1 (105)	0.001 (1)	6.0 (123)	22.2 (455)	2.3 (47)
Endurance (n = 765)	10.1 (208)		7.9 (163)	2.1 (44)	0.001 (1)	2.4 (49)	8.9 (182)	1.1 (23)
Aesthetic (n = 357)	4.8 (98)		4.0 (82)	0.8 (16)	0 (0)	0.9 (19)	3.9 (81)	0.6 (13)
Power (n = 184)	2.5 (52)		1.9 (38)	0.7 (14)	0 (0)	0.7 (14)	2.1 (44)	0.3 (7)
Ball or team (n = 565)	5.4 (111)		4.3 (89)	1.1 (22)	0 (0)	1.3 (27)	5.1 (104)	0.1 (2)
Technical (n = 183)	2.5 (51)		2.0 (42)	0.4 (9)	0 (0)	0.7 (14)	2.1 (44)	0.1 (2)
Females (n = 1423)	28.9 (411)	≤.01	21.9 (312)	6.9 (98)	0.1 (1)	7.9 (112)	24.7 (352)	3.2 (45)
Endurance (n = 480)	11.2 (159)		8.2 (117)	2.9 (41)	0.1 (1)	3.1 (44)	9.6 (136)	1.5 (22)
Aesthetic (n = 300)	5.9 (84)		4.8 (68)	1.1 (16)	0 (0)	1.3 (19)	4.8 (68)	0.8 (12)
Power (n = 114)	2.8 (40)		1.9 (27)	0.9 (13)	0 (0)	0.8 (12)	2.3 (33)	0.5 (7)
Ball or team (n = 397)	6.1 (87)		4.8 (68)	1.3 (19)	0 (0)	1.7 (24)	5.6 (80)	0.1 (2)
Technical (n = 132)	2.9 (41)		2.2 (32)	0.6 (9)	0 (0)	0.9 (13)	2.5 (35)	0.1 (2)
Males (631)	17.3 (109)	.499	16.2 (102)	1.1 (7)	0 (0)	1.7 (11)	16.3 (103)	0.3 (2)
Endurance (n = 285)	7.8 (49)		7.3 (46)	0.5 (3)	0 (0)	0.8 (5)	7.3 (46)	0.2 (1)
Aesthetic (n = 57)	2.2 (14)		2.2 (14)	0 (0)	0 (0)	0 (0)	2.1 (13)	0.2 (1)
Power (n = 70)	1.9 (12)		1.7 (11)	0.2 (1)	0 (0)	0.3 (2)	1.7 (11)	0 (0)
Ball or team (n = 168)	3.8 (24)		3.3 (21)	0.5 (3)	0 (0)	0.5 (3)	3.8 (24)	0 (0)
Technical (n = 51)	1.6 (10)		1.6 (10)	0 (0)	0 (0)	0.2 (1)	1.4 (9)	0 (0)

Abbreviation: ED, eating disorder.

[a] Unless indicated otherwise.

[b] Overall, 25.3% (n = 520/2054) of all student-athletes were classified as at risk for EDs. Differences were found across ED risk and sex ($\chi^2_{1,2054} = 32.9$, $P \leq .01$) of 17.0% (n = 107/631) for men and 28.9% (n = 411/1423) for women. Differences were also identified across ED risk and sport type ($\chi^2_{4,2054} = 13.4$, $P = .01$). When examining women only, we noted differences across ED risk and sport type ($\chi^2_{4,1423} = 13.4$, $P \leq .01$); no differences were present across ED risk and sport type for men ($\chi^2_{4,631} = 3.4$, $P = .499$).

[c] *P* value for ED risk and sex ($\chi^2_{1,2054} = 32.9$, $P \leq .01$).

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Table 4. EAT-26 Total and Subscale Scores by Sex and Sport Category (Mean ± SD)[a]

Variable	Student-Athletes					
	All (n = 2054)	Endurance (n = 765)	Aesthetic (n = 357)	Power (n = 184)	Ball or Team (n = 565)	Technical (n = 183)
Sex						
Females						
Total EAT-26 score	6.7 ± 8.3	7.1 ± 9.1	6.6 ± 8.0	7.9 ± 8.6	6.2 ± 7.5	6.6 ± 8.2
Diet subscale score	3.8 ± 5.7	4.0 ± 6.2	3.9 ± 5.4	4.3 ± 5.8	3.3 ± 5.4	3.9 ± 5.7
Bulimia subscale score	1.5 ± 2.3	1.7 ± 2.5	1.3 ± 2.1	2.0 ± 2.8	1.4 ± 2.0	1.5 ± 2.4
Oral Control subscale score	1.4 ± 2.0	1.4 ± 2.1	1.5 ± 2.2	1.6 ± 2.0	1.4 ± 1.9	1.2 ± 1.8
Males						
Total EAT-26 score	4.3 ± 6.5	4.3 ± 6.3	3.5 ± 2.8	5.0 ± 9.3	4.3 ± 6.7	4.2 ± 4.2
Diet subscale score	1.7 ± 3.8	1.7 ± 3.7	1.6 ± 2.3	2.0 ± 5.9	1.7 ± 4.0	1.2 ± 1.9
Bulimia subscale score	1.2 ± 1.7	1.1 ± 1.8	0.9 ± 1.0	1.5 ± 2.1	1.1 ± 1.6	1.5 ± 2.1
Oral Control subscale score	1.5 ± 2.1	1.5 ± 2.2	1.0 ± 1.1	1.5 ± 2.5	1.5 ± 2.3	1.5 ± 1.5

Abbreviation: EAT, Eating Attitudes Test.

[a] *P* values: Sex: Total score on EAT-26 ($F_{1,2053} = 42.8$; $P \leq .01$), Dieting subscale ($F_{1,2052} = 72.8$; $P \leq .01$), Bulimia subscale ($F_{1,2053} = 53.8$; $P \leq .01$), and Oral Control subscale ($F_{1,2053} = 0.299$; $P = .585$). Sport type: Total EAT-26 score ($F_{4,2053} = 0.859$; $P = .488$), Dieting subscale ($F_{4,2052} = 0.986$; $P = .414$), Bulimia subscale ($F_{4,2053} = 2.8$; $P = .025$), and Oral Control subscale ($F_{4,2053} = 0.495$; $P = .739$).

levels of self-control toward eating or that males perceived pressure to gain weight.[20,31] The male student-athletes in our sample probably perceived pressure to gain weight. Furthermore, the theory of the drive for muscularity and stereotypical male gender roles in society are more likely to cause males to perceive pressure to gain weight than to lose weight compared with females, who relate more to the drive for thinness.[27,28,32] Muscularity has a positive relationship with weight lifting, dieting to gain weight, and nutritional supplements.[33] The drive for muscularity in college-aged males has been significantly associated with the internalization of media ideals rather than the objectification theory, body shame, body surveillance, and BMI awareness seen in women.[34] We insinuate that males desire to build muscle mass for performance-based goals (eg, improved strength and fitness level) and to reach the sociocultural influenced ideal physique.[32,34] Nevertheless, females and males have distinctive predisposing factors that may increase their risk for EDs.

Differences in Sport Type

We aimed to expand upon the work of previous investigators[2,9,13] who identified at-risk individuals within athletic populations, specifically focusing on student-athletes by sport type. Sport type has been established as a predictor for body image dissatisfaction and, consequently, the risk

Table 5. Pathogenic Behaviors by Sex and Sport Category (Percentage and Sample Size)

Variable	Pathogenic Behavior				
	Binge Eating	Vomiting	Diet Pills	Excessive Exercise	Lost 20 lb (9.1 kg) in Past 6 mo
All participants (n = 2054)	9.0 (184)	3.7 (75)	9.5 (195)	5.1 (104)	2.2 (46)
Sex					
P values	.009	.073	≤ .01	.819	.819
Female (n = 1423)	10.0 (143)	4.1 (59)	11.4 (162)	5.0 (71)	2.5 (36)
Male (n = 631)	6.5 (41)	2.5 (16)	5.2 (33)	5.2 (33)	1.6 (10)
Sport category					
P values	.054	.801	.016	≤ .01	≤ .037
Endurance (n = 765)	11.2 (86)	4.2 (32)	7.6 (58)	8.5 (65)	2.2 (17)
Female (n = 480)	13.8 (66)	5.6 (27)	10.6 (51)	9.0 (43)	2.9 (14)
Male (n = 285)	7.0 (20)	1.8 (5)	2.5 (7)	7.7 (22)	2.2 (17)
Aesthetic (357)	6.4 (23)	3.1 (11)	13.4 (48)	1.7 (6)	2.0 (7)
Female (n = 300)	6.0 (18)	3.7 (11)	14.0 (42)	1.7 (5)	2.0 (6)
Male (n = 57)	8.8 (5)	0 (0)	10.5 (6)	1.8 (1)	2.0 (7)
Power (n = 184)	8.7 (16)	3.3 (6)	9.2 (17)	3.8 (7)	4.9 (9)
Female (n = 114)	11.4 (13)	3.5 (4)	11.4 (13)	3.5 (4)	6.1 (7)
Male (n = 70)	4.3 (3)	2.9 (2)	5.7 (4)	4.3 (3)	4.9 (9)
Ball or team (n = 565)	2.0 (42)	3.2 (18)	8.7 (49)	3.7 (21)	2.3 (13)
Female (n = 397)	8.1 (32)	2.5 (10)	9.6 (38)	3.5 (14)	2.3 (9)
Male (n = 168)	6.0 (10)	4.8 (8)	6.5 (11)	4.2 (7)	2.4 (4)
Technical (n = 183)	9.3 (17)	4.4 (8)	12.6 (23)	2.7 (5)	0 (0)
Female (n = 132)	10.6 (14)	5.3 (7)	13.6 (18)	3.8 (5)	0 (0)
Male (n = 51)	5.9 (3)	2.0 (1)	9.8 (5)	0 (0)	0 (0)

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of EDs.[9,35] Previous findings reflected sport-specific demands that accentuate thinness, attributes, and appearance features that may benefit performance (eg, aesthetic and endurance sports).[13,16,26,35] Aesthetic- and endurance-based sports could be considered lean sport types because of the misconception that a lower body weight will result in more favorable performance outcomes.[11–13,35] Although no differences were observed between sport type and total EAT-26 scores, differences were demonstrated between sport type and the ED risk, with endurance athletes accounting for 10.1% of the at-risk population. One possible explanation is that our sport-type categories had a disproportionate number of participants in each group, with endurance athletes constituting more than one-third of the sample. Of importance, we note the percentages athletes at risk for EDs in each sport type: endurance, 27.2% (n = 208/765); aesthetic, 27.4% (n = 98/357); power, 28.3% (n = 52/184); ball or team, 19.7% (n = 111/565); and technical, 27.9% (n = 51/183). When comparing the prevalence by sport type to the outcomes of Sundgot-Borgen and Klungland Torstveit,[2] we identified a higher prevalence across all sport types except for aesthetic sports (33.8% [n = 22/65] versus 27.4%, respectively). The increased prevalence across all other sports can be explained by the fact that we examined only the risk for EDs, whereas they conducted further clinical interviews to confirm the subclinical or clinical presence of an ED. We hypothesized that athletes in lean sports would be at greater risk. We did not dichotomize the data into lean versus nonlean sports, yet if we consider endurance and aesthetic sport types as lean, a higher percentage of these athletes were at risk (27.3%) than those in other sport types (22.9%).

Looking specifically at the raw scores for the EAT-26 Bulimia subscale by sport type, differences were seen for (1) aesthetic and power and (2) power and ball and team sports. This could denote that power athletes are an understudied population with body-image concerns. Power sports typically have goals of simultaneously maximizing strength and speed to ultimately improve performance.[9,13] Power sports offer more diverse findings because this category contains both nonlean (eg, football players and nonlean track and field athletes) and lean (eg, track sprinters) athletes.[19] The Bulimia subscale has a strong relationship with individuals whose current and ideal body types are more divergent. To simplify, high scores on the Bulimia subscale are associated with individuals who have greater body-image concerns.[13,20] These athletes are not typically viewed as at risk. However, Rosendahl et al[36] determined that athletes in power sports had a higher prevalence of disordered eating when adjusted for sex (females had the highest prevalence versus endurance, aesthetic, and weight-dependent sports). These outcomes could guide future research aimed at assessing the influence of body image and ED risk exclusively in power sports.

To summarize, relationships existed between sex and the ED risk, sex and the overall EAT-26 score, and sport type and the ED risk but not between sport type and the overall EAT-26 score. These results suggest that sex may be a more influential factor in EDs than specific sport types, but we must acknowledge that athletes in sport types that are considered lean continue to present at an increased risk for EDs. Those in lean sports (running, swimming, etc) have an increased ED risk, yet many inconsistencies are evident when specific sports are studied. Athletes in sports that emphasize leanness are more susceptible to body-image concerns, disordered eating, clinical EDs, or all of these.[4,9,13,14,35] Meanwhile, that clarity fades when other sport types present with similar risks. This, in turn, leads to more ambiguity surrounding the idea of other sport types being at risk and what precautions should be taken. Clinicians are advised to screen all athletes, regardless of susceptibility, because of mixed results in individual sports.

Pathogenic Behaviors

The pathogenic behaviors we examined were binge eating; vomiting; use of laxatives, diet pills, or diuretics; excessive exercise; and losing $\geq$ 20 lb. The 2 most frequent pathogenic behaviors were use of diet pills, diuretics, or laxatives and binge eating. The use of laxatives, diet pills, or diuretics was associated with a large sex discrepancy: diet pill use among females was double that of males. The use of diet pills also varied greatly among sport types. The highest diet pill usage was among aesthetic (13.4%) and technical (12.6%) sport types. The literature is sparse on diet pill use because this behavior is not typically studied independently. Additionally, investigators have considered other abused over-the-counter drugs (ie, laxatives and diuretics) in this category, especially when using the EAT-26 assessment tool.[6,22,37–39] Nevertheless, lower percentages (1.5%–6%) were reported, except among Division I equestrian athletes (15.2%)[6] and marching band auxiliary units (color guard, dance line, majorettes: 18.9%).[38] Ambiguity surrounding the topic of diet pill use persists. Future authors should evaluate diet pill use among understudied aesthetic-like sports (eg, equestrian and marching band auxiliary units) that are composed predominantly of female populations. Moreover, binge eating differed between females 10% (n = 143/1423) and males 6.5% (n = 41/631). The prevalence of binge eating fluctuates from 3% to 25%. Findings of only 2 studies showed higher rates, with gymnasts at 36.7% (n = 25/68)[40] and female body builders and recreational lifters at 36.4% (n = 20/55).[41] Both of these sports are comparable with our aesthetic sport type, as they focus on appearance, and participants are scored based on their performances.

Excessive exercise was the third highest pathogenic behavior. We anticipated higher rates of excessive exercise in this athletic population, as earlier studies provided rates ranging from 4% to 80%.[6,10,40,41] Higher prevalence rates of *exercise addiction* (ie, pathological behavior with working out) and *exercise dependency* (ie, feeling the need to exercise and experiencing withdrawal symptoms if unable to exercise or exercising interfering with personal relationships) have been described in endurance athletes.[15] Our endurance group had the highest average (8.5%) excessive exercise prevalence; however, comparatively, it remained in the lowest quartile. The subsequent pathogenic behavior was vomiting (3.7%), a percentage that aligns with previous evidence in athletic populations (0.7%–11.6%).[10,31,40] Conclusively, the last behavior was losing 20 lb in the past 6 months, with a prevalence of 2.2%. This category is not as well documented in the literature, with far fewer researchers assessing this item, which could signify the risk of dramatic weight loss in individuals with clinical EDs. Rapid weight loss has adverse effects, including decreased cardiovascular and renal function, negative emotions, and

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poorer sport performance.[10] This is important to note because females constitute a greater percentage of the power sport category (females = 6.1%, males = 4.9%). Weight fluctuations should be monitored by a health care professional to ensure safety in nutrition and weight management.

Clinical Implications

According to the American Psychiatric Association, more than half of people with mental illness do not receive help for their disorder.[3] This is not any different for collegiate student-athletes, who may also resist seeking ED treatment for fear it will interfere with or disrupt athletic performance. A strategy to reduce the stigma is to view and discuss EDs as a continuum of sport-related injury and illness rather than brand them as a *disorder*. The *NCAA's Mind, Body and Sport for Eating Disorders*[42] provides educational materials and encourages athletics departments to develop a treatment protocol for student-athletes with EDs. However, whether the NCAA holds athletic departments accountable for having the necessary resources to develop or integrate these recommendations is unknown. The NCAA should not only supply educational resources but also require athletics departments to integrate universal guidelines or policies and integrate best practices to guide prevention (via education), recognition, evaluation, rehabilitation, treatment measures, and return-to-play guidelines regarding disordered eating and EDs.[1,24,43–45] Those at risk for EDs are more likely to acquire comorbidities (eg, depression, anxiety, substance use). Therefore, athletics department medical and staff members should familiarize themselves with the signs and symptoms of EDs and associated comorbidities. The "International Consensus Statement on the Psychological and Policy-Related Approaches to Mental Health Awareness Programs in Sport"[45] offers 6 recommendations for psychosocial and policy-related approaches to mental health awareness programs that may aid medical staff, coaches, and sport administration in implementing systematic change. Finally, a protective factor against EDs is having a healthy coach-athlete relationship. Coaches who understand proper nutrition and weight management and feel comfortable discussing EDs with their student-athletes may significantly decrease ED risk levels.

LIMITATIONS AND FUTURE RESEARCH

Although our sample population was varied and of sufficient overall size, our study inevitably had limitations. First, we used snowball sampling for recruitment. This recruitment was primarily conducted by athletic trainers at various institutions who provided an invitation letter to student-athletes asking if they wished to participate in a study to assess mental health. Our research may have lacked the participation of student-athletes who had already been diagnosed or were hypersensitive to mental health disorders if they chose not complete the survey. Second, the population sample was primarily female (69%), which may have inflated the overall ED risk. Third, our data were self-reported, and participants may not have been honest in their answers. We administered the EAT-26, which is widely used to screen eating attitudes and behaviors. However, the EAT-26 is not a diagnostic instrument; therefore, we cannot formally conclude that these at-risk athletes were diagnosed with an ED. Such a diagnosis would require formal interviews by a physician or mental health provider. Additionally, BMI is a factor in the EAT-26 and can overestimate the athlete's fat mass. The BMI has associated sex and age norms that can classify athletes as overweight because of their increased lean body mass. Lastly, the snowball sampling of athletic trainers was not conducted at 1 time, which may have prevented us from capturing whether student-athletes were in preseason, in-season, or postseason.

We recommend that future researchers access a larger sample of student-athletes beyond snowball sampling; identify whether athletes are in their preseason, in-season, or off-season sport; and ask student-athletes about current resources to assist with nutrition, mental health counseling, or both. Further examination of high-performance athletes is needed, specifically on prevention and treatment intervention studies. The prevention of EDs is highly devalued and unrecognized in health care. Conducting more studies on educational interventions and assessing the outcomes is critical. Also, athletic subpopulations with higher ED risks should be further evaluated. Lean sports have demonstrated higher risk, but the exact predisposing traits are not yet understood.

CONCLUSIONS

Although the representation of these data is only across 40 NCAA institutions, in this study, we provide the largest sample size to estimate ED risk within the United States. Authors of most other studies within the United States either focus solely on 1 sport, are sex specific, or both. In addition, studies with larger sample sizes are international studies and do not represent the United States' culture. Therefore, we conclude that our results revealed collegiate student-athletes are at risk for EDs. Predictably, females were at higher risk for EDs, but this should not construe that males are not at risk. Our hypothesis was partially met, with endurance-trained athletes being the highest risk; however, ball or team sports had the next highest risk and not aesthetic sports, as we originally hypothesized. Finally, collegiate student-athletes' most common risk factor for EDs was engaging in pathogenic behavior versus EAT-26 attitudes or low BMI; the most common behaviors were binge-eating and using diet pills, laxatives, or diuretics to lose weight.

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