International Journal of EXERCISE SCIENCE

Original Research

Self Reported History of Eating Disorders, Training, Weight Control Methods, and Body Satisfaction in Elite Female Runners Competing at the 2020 U.S. Olympic Marathon Trials

BERG SOPHIA†[1], PRITCHETT KELLY‡[1], DANA OGAN‡[1], and ABIGAIL LARSON‡[2]

[1]Department of Health Sciences, Central Washington University, Ellensburg, WA, USA; [2]Department of Kinesiology and Outdoor Recreation, Southern Utah University Affiliation, Cedar City, UT, USA

†Denotes graduate student author, ‡Denotes professional author

ABSTRACT

International Journal of Exercise Science 15(2): 721-732, 2022. Athletes participating in endurance sports report frequent attempts to lose weight and greater training volumes in attempt to gain a competitive advantage. Increased exercise energy expenditure through training, weight periodization, and prevalence of eating disorder (ED) may affect energy availability. Low energy availability (LEA) is associated with negative physiological effects and an increased risk of bone fractures and illness in athletes. This study investigated the relationship between self-reported history of an ED with training, body satisfaction, and weight-control methods among female Olympic marathon trials participants. Female runners (n = 146; 30.8 ± 5.0 years of age) who participated in the 2020 U.S. Olympic Team Trials Marathon completed an online questionnaire examining training volume, weight-control methods, and self-reported diagnosis of an ED. 32% of participants reported previous ED while 6% reported a current ED and were grouped together based on a self-reported lifetime diagnosis of ED (current or past) or no ED for further analysis. A Chi-square analysis indicated a statistical difference when $p \leq 0.05$. Runners who reported ED were significantly more likely to experience weight dissatisfaction ($\chi 2_{3,146} = 9.59$, $p = .022$) and restricting or reducing food in the three months prior to the marathon ($\chi 2_{5,146} = 17.58$, $p = .004$). Consistent with previous literature, a substantial percentage of participants reported ED. This investigation suggests that ED may be associated with weight control methods and feelings of body dissatisfaction in competitive female runners.

KEY WORDS: Eating disorders, marathon runners, body satisfaction, body image

INTRODUCTION

Nutrition and body composition play important roles in athletic performance and are often emphasized in elite sports where athletes are seeking to gain a competitive advantage (8, 21). An emphasis on diet and body composition, however, is a double-edged sword and can often put athletes at risk for disordered eating (DE) or an eating disorder (ED). The Australian

Institute of Sport (AIS) and the National Eating Disorders Collaboration (NEDC) suggest that there is a spectrum of athlete eating habits that ranges from high performance nutrition to DE to a clinical ED. Furthermore, athletes may move along this spectrum over the course of their career and various training cycles. DE is a general term used to describe unhealthy or harmful eating habits to lose weight and may be an indicator for the development of an eating disorder. DE range from what is perceived as normal dieting to some of the same characteristics as an eating disorder (e.g. skipping meals, and compulsive exercise) but with lower severity. Clinical diagnosis of an ED, includes behavior that meets the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) for a feeding and ED including Anorexia Nervosa, Bulimia Nervosa, Binge Eating Disorder, and other specified feeding and eating disorders (OSFED). Furthermore, it is more likely to observe DE, although more difficult to identify and evaluate, rather than a clinical eating disorder in athletes, however DE increases the risk for an developing an ED (25). Identifying risk for DE/ED is further complicated by weight periodization commonly practiced in sport for performance purposes (12, 21).

An increased prevalence of eating disorders has been reported among endurance athletes which may be attributed to the thought that extra weight negatively affects performance (19, 23). Risk factors for disordered eating in athletes include body dissatisfaction, low self-esteem, personality traits such as perfectionism, physical ideals, coaching behaviors and accepted "norms" within the sport, and participating in sports emphasizing leanness (including endurance sports, antigravitation sports such as pole vaulting, and sports with aesthetic considerations such as gymnastics) (8, 23, 25).

Elite athletes participating in endurance and weight-sensitive sports report more frequent attempts to lose weight, greater variation in weight during the year leading up to competition, and lower mean body weight in comparison to athletes in sports which do not emphasize leanness, including ice hockey, volleyball, and sailing (8). While attempts to lose weight and weight fluctuations may be signs of disordered eating, they should not be confused with body composition periodization in elite athletes, as described by Stellingwerff (2018) (21). Weight periodization if carefully overseen by a registered sports dietitian nutritionist to ensure that the athlete has adequate optimizing energy availability (EA), may help athletes achieve body composition goals while minimizing illness and injury risk, and maintaining eumenorrhea (21). For endurance athletes specifically, low body weight has been associated with faster race times (19, 21). However, Ackerman et al. (2020) states that body composition assessments for performance purposes should only be implemented in elite athletes with positive self-body image (1). Furthermore, weight periodization that implements healthful methods to achieve weight goals should not be "labeled" as disordered eating.

Body satisfaction plays an important role in the development of eating disorders (2, 18, 25). Anderson et al. (2016) notes that female athletes may be susceptible to both appearance and performance-related weight ideals (2). In addition, Prnjak et al. (2019) observed that

perfectionism is a trait present in many high-level athletes which can stimulate both beneficial tendencies, like striving for high achievement, and harmful tendencies, like disordered eating.

Manipulating training volume, such as weekly mileage, is an important part of the training regimen for marathon runners; however, athletes with a history of ED and body weight dissatisfaction may use excessive exercise to control weight (11,14). Karp (2007) found that among female runners who qualified for the U.S. Olympic Marathon Trials, elite runners had higher mileage training volumes per week compared to national-class runners. Hulley and Hill (2001) found that elite female distance runners with a history of an eating disorder trained slightly more hours than the control group per week, although not significant (8, 11,14). Therefore, elite endurance athletes clearly have high training volumes, which may also be associated with disordered eating. For example, marathoners may reduce their energy intake intentionally to achieve a goal body composition which may be compulsively related to the presence of disordered eating, or due to unintentional under compensation of dietary intake relative to exercise energy expenditure (15, 21). Diets low in fat and high in carbohydrates make unintentional low energy intake more likely. Whether intentional or unintentional, and imbalance in energy intake compared to energy expenditure can lead to low energy availability. Low energy availability (LEA), defined as < 30 kcal·kg FFM^{-1} ·day^{-1}, exists when there is either a decrease in energy intake or an increase in exercise energy expenditure, or both, and can lead to negative physiological effects on bone, endocrine, and immune health (15, 25). The multitude of consequences associated with LEA are collectively referred to as Relative Energy Deficiency in Sports (RED-S) (16).

Many studies have evaluated the prevalence and risk of disordered eating, RED-S, and LEA among elite athletes (2, 5, 6, 11). However, to gain an understanding of the relationship between specific weight control methods, training volume, and self-reported history of /or current eating disorder, studies are warranted among sub-elite runners. Therefore, the purpose of this study is to investigate the relationship between eating disorders, weight-control methods, training, and body satisfaction among sub-elite/elite female runners.

METHODS

Participants

Female participants who qualified for and participated in the 2020 U.S. Olympic Team Trials Marathon (February 29, 2020; Atlanta, Georgia) of any age or ethnicity were eligible to participate in the study. Two weeks post-race, 396 qualified athletes were contacted via Facebook or Instagram direct message requesting their voluntary participation in the study. Athletes who chose to participate were directed to the Qualtrics survey via a link, and upon entering the Qualtrics site were given participation information regarding estimated time requirements, assurance of confidentiality, nature of the questions, and directions to be included in a random drawing for one of three $100 Amazon gift cards for completing the questionnaire. Participants then agreed to the terms outlined in the informed consent (Question 1 of the survey) or could choose to close their browser window. All data collected was anonymous and email

addresses could not be traced back to any of the original survey responses. This study was granted approval by the Human Subjects Review Committee at Southern Utah University (#26-01202b), and the research was conducted fully in accordance with the ethical standards of the International Journal of Exercise Science (17).

Protocol

Data collection for this study was performed online from March 14, 2020 to April 8, 2020. A cross-sectional study was implemented where participants completed a survey via Qualtrics that included 34 questions, which included specific questions from a validated and reliable survey the LEAF-Q (Low Energy Availability in Female Athlete Questionnaire). For the purpose of this study, only questions 1-19 were analyzed. These questions included anthropometrics, fastest marathon time, body weight at fastest marathon time, average and peek week training volume (i.e., km per week), types of training (running, strength training, swimming, etc.) were analyzed. Questions regarding self-reported history or current ED, weight satisfaction, weight-control methods (through energy restriction), pursuing a race weight, are as follows:

- *Have you ever been diagnosed with any of the following eating disorders?*

(Anorexia, Bulimia, Binge Eating Disorder, OSFED, NO)

- *Do you currently struggle with any of the following eating disorders?* (select all that apply) (Anorexia, Bulimia, Binge Eating Disorder, OSFED, NO)
- *"In the past three months have you been dissatisfied with your weight, meaning have you wanted to weigh less? (no, slightly dissatisfied, moderately dissatisfied, markedly dissatisfied)*
- *"In the last three months were you trying to achieve or maintain a specific weight?" (Y/N)*
- *"Do you consciously try to restrict or reduce the overall amount of food that you eat?" (Y/N)*
- *"If yes, how did you achieve or maintain or "attempt" to maintain weight? (please select all that apply)*

  (By reducing kcalorie intake, By increasing exercise, using dietary supplements, Purging behaviors, Using pharmaceuticals, I didn't try to maintain a specific weight, Other, please explain)

- Do you consciously try to restrict or reduce the overall amount of food that you eat? (daily-never)

If participants answered "yes" to either question regarding self-reported history or current ED they were placed in the ED group. If participants answered "no" they were placed in the No ED group.

Statistical Analysis

Data was analyzed using Microsoft Excel and SPSS. Descriptive data was reported as mean $\pm$ standard deviation (SD) for age, weight, and height. Body mass index (BMI) was calculated using self-reported height and weight and was measured in kg/m^2. Chi-square tests were performed to analyze nominal data, including presence of eating disorder, weight dissatisfaction, pursuing a race weight, food restriction, and training methods. Independent *t* tests and one-way analysis of variance (ANOVA) tests were used to compare longest training

run, training volumes (kilometers; km) and performance outcomes (marathon finish time) related to weight control methods and reported eating disorders. *P* values less than 0.05 were considered statistically significant.

RESULTS

Out of 158 responses, 146 participants completed the questionnaire satisfactorily (90% or above completion status). Participant descriptive characteristics, longest training run, and performance are displayed in Table 1. Seven participants were excluded due to failure to complete the questions regarding past or current eating disorder. Five additional participants were excluded for reporting "I'm not sure" for both past ED and current ED (questions 18 and 19). There were no significant differences for descriptive characteristics, longest training run, and marathon performance between participants who self-reported ED versus NO ED (Table 1). The most frequently reported average weekly training volume was 129.6 – 144 km/ week, and peak week training volume was 129.6 – 144 km/ week. The most frequently reported peak week training volume for self-reported ED was 129.6 – 144 km/ week, and 113.6 - 128 km/week for the NO ED group. The most frequently reported average training volume self-reported ED 113.6 - 128 km/week, and NO ED was 129.6 – 144 km/ week.

Table 1. Participant descriptive characteristics, longest training run, and marathon performance.

Variable	Total (mean ± SD)	ED reported (mean ± SD)	No ED (mean ± SD)
N	146	48 (32.88%)	98 (67.12%)
Age (y)	30.80 ± 5.00	29.07 ± 4.39	31.71 ± 5.08
Height (cm)	166.39 ± 7.53	167.27 ± 7.56	165.96 ± 7.52
Weight (kg)	53.76 ± 4.75	54.27 ± 4.90	53.52 ± 4.69
BMI (kg/m^2)	19.41 ± 1.42	19.47 ± 1.63	19.38 ± 1.33
Approximate weight at fastest marathon time (kg)	53.09 ± 4.70	53.61 ± 5.0	52.85 ± 4.58
Longest run in training (km)	35.98 ± 3.90	35.73 ± 3.80	36.13 ± 4.00
Fastest marathon time	2:39:57 ± 0:08:05	2:40:12 ± 0:9:16	2:39:49 ± 0:07:27

Data are displayed as mean ± SD. BMI, body mass index.

Approximately 32% of participants reported an ED. Self-reported past diagnosis of ED was found to be significantly related to current presence of ED ($\chi 2_{1,146} = 14.47$, $p < .001$). Of those who reported an ED, 97% reported past diagnoses and 18% reported current struggles with an ED. Fifty-one percent of participants who reported past ED indicated anorexia nervosa, while

55% of participants who reported current ED indicated OSFED (Table 2). Several participants reported experiencing more than one type of ED (Table 2).

Table 2. Types of Eating Disorders Reported

	Anorexia	Bulimia	BED	OSFED	Participants reporting multiple EDs
Past ED	24 (51%)	12 (26%)	9 (19%)	18 (38%)	12
Current ED	3 (33%)	0 (0%)	1 (11%)	5 (55%)	0

Data reported in number of participants. OSFED, other specified feeding and eating disorders. BED, binge eating disorder

Of all athletes, 67.1% reported consciously restricting or reducing energy intake, 44.5% reported some form of weight dissatisfaction, and 24.7% reported trying to achieve or maintain a specific race weight in the three months prior to the marathon (Table 3).

Table 3. Frequency of self-reported weight control methods in all athletes, and in ED vs. NO ED.

	All athletes (n = 146)	ED (n = 48)	NO ED (n = 98)	Chi square Test *p*
Restricting food, in any respect	98 (67.1%)	41 (85.4%)	57 (58.2%)	
No	48 (32.9%)	7 (14.6%)	41 (41.8%)	
Total (n, %)	***146 (100%)***	***48***	***98***	0.001*
Weight dissatisfaction, in any respect	65 (44.5%)	30 (62.5%)	35 (35.7%)	
No	81 (55.5%)	18 (37.5%)	63 (64.3%)	
Total (n, %)	***146 (100%)***	***48***	***103***	0.002*
Trying to achieve or maintain race weight, in any respect°	36 (24.7%)	13 (27.1%)	23 (23.5%)	
No	109 (74.7%)	35 (72.9%)	74 (75.5%)	0.658
Total (n, %)	***145 (99.4%)***	***48 (100%)***	***97 (100%)***	

* Significant difference between ED and NO ED when $p < 0.05$. °n = 145, missing one response. Data are reported as n (%).

Figures 1 and 2 display frequency of self-reported weight dissatisfaction and frequency of self-reported energy restriction, respectively. Participants with a higher body weight were more likely to report weight dissatisfaction ($p = .004$). In addition, participants who reported ED were significantly more likely to consciously restrict food ($\chi2_{5,146} = 17.58$, $p = .004$) and experience weight dissatisfaction in the three months prior to the marathon ($\chi2_{3,146} = 9.59$, $p = .022$) than

those reporting no ED. ED was not associated with a significant difference in training volume, performance outcomes, or trying to achieve or maintain a specific race weight prior to the marathon. Figure 3 displays frequency of techniques participants used to achieve race weight. If participants answered "other" they were asked to explain. Some of the common answers included: "healthy eating, but not restricting", "hoping it would take care of itself via the training plan", "no sugar or alcohol", "reducing kcal but increasing protein intake to 2.2-2.4 grams/kg of body weight", and "keeping calories and energy expenditure the same.

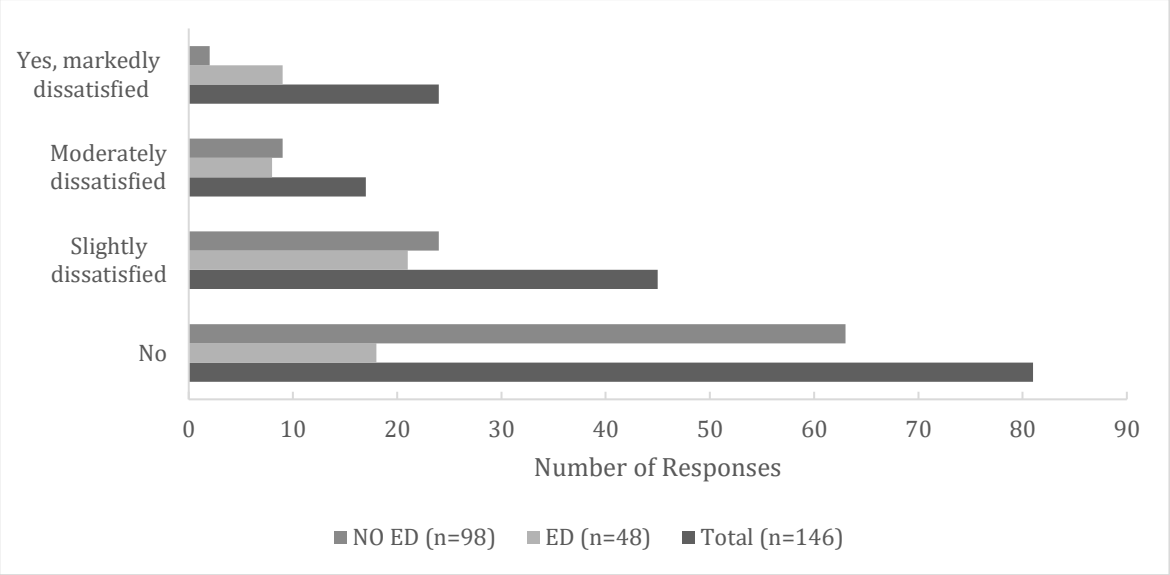

Figure 1. Frequency of self-reported weight dissatisfaction in three months prior to marathon among all athletes, and in ED vs. NO ED. The majority of athletes (62.5%) reported experiencing some level of weight dissatisfaction.

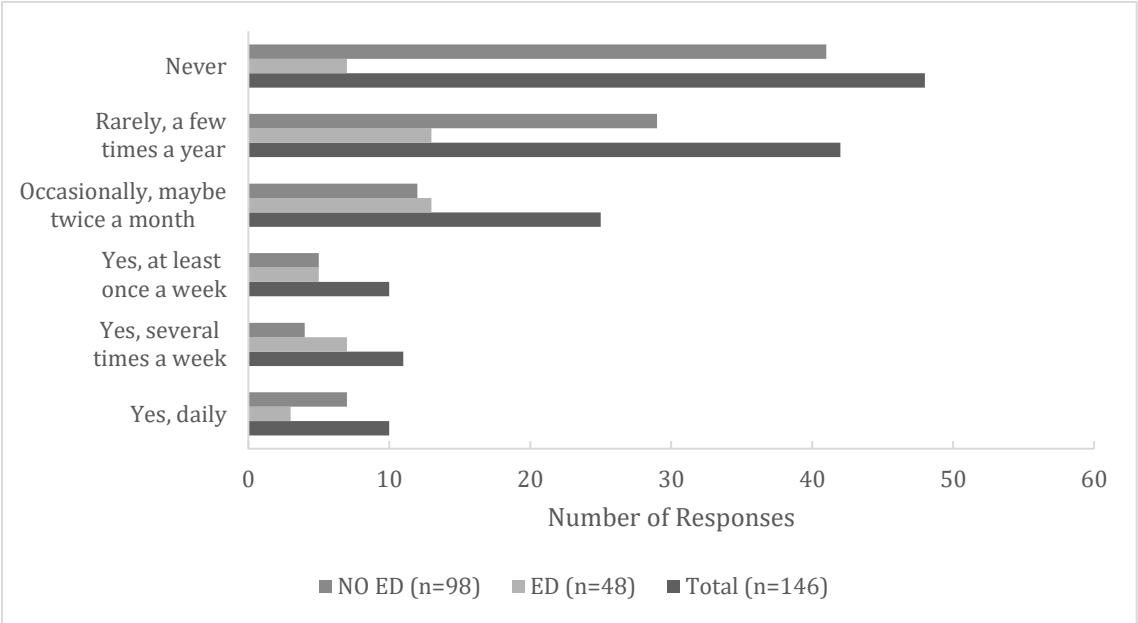

Figure 2. Frequency of "consciously restricting or reducing food eaten" among all athletes, and in ED vs. NO ED. Of athletes who reported NO ED, 41 reported never engaging in food restriction, compared to just 7 ED athletes. Most athletes reported engaging in some level of energy restriction over the course of 1 year.

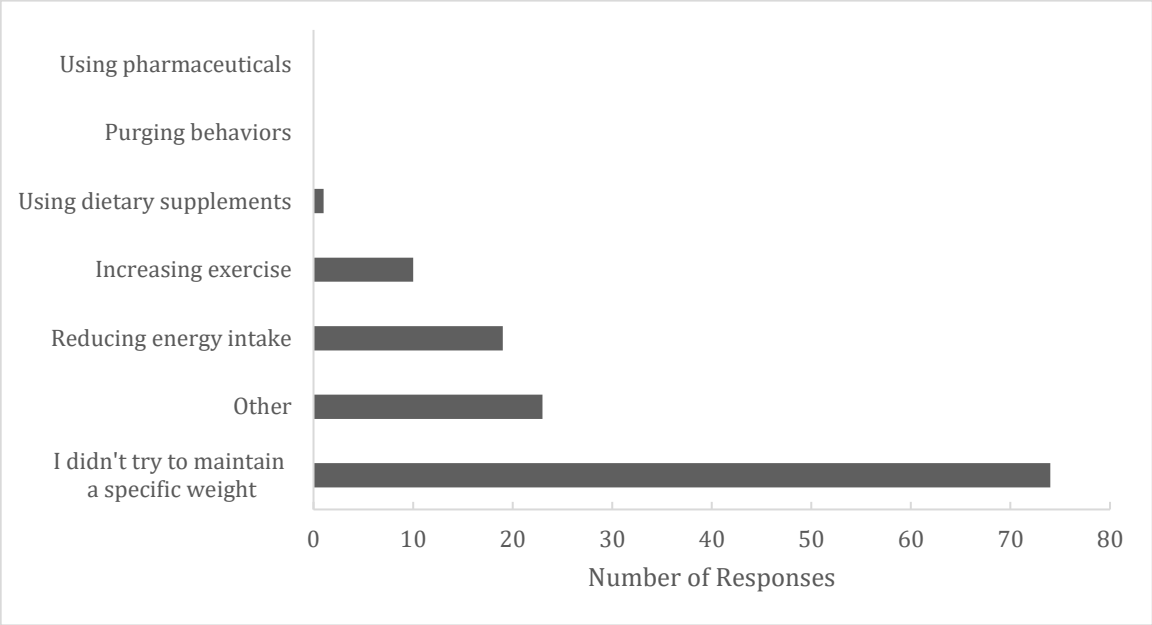

Figure 3. Self-reported techniques to achieve or maintain a "race weight" in the three months prior to the marathon. Reducing energy intake and increasing exercise were the most common methods used to achieve a race weight, although most participants reported not trying to achieve a specific race weight prior to the marathon. One participant reported using dietary supplements, while no participants reported using pharmaceuticals or purging behaviors."Other" allowed participants to type in a freeform answer.

DISCUSSION

The current study examined the relationship between self-reported ED, body satisfaction, training and weight control methods among sub-elite female endurance runners competing at the 2020 U.S. Olympic Marathon Trials. The primary finding of this investigation suggests, among elite female marathoners who self-report a diagnosis of an ED (past or present), that there is a higher prevalence of conscious caloric restriction and body weight dissatisfaction when compared to elite female runners of similar ability with no ED history. In addition, body weight, BMI, and training volume were not related to ED, which may be a result of the homogeneity of the sample and similar training volumes that the runners reported in the three months prior to the marathon.

One-third of participants in this study reported an ED demonstrating some aspects of the self-reported lifetime prevalence of an eating disorder in the elite female endurance athlete population, which is consistent with previous studies (3, 23). A previous study examining eating disorders in elite distance runners found 16% of participants had an ED at the time of the study (11), while 6% of participants reported such in the current study. The prevalence of disordered eating/ED in aesthetic sports is estimated to be 40%, and 15-30% for elite female athletes (3) which is consistent with the 32% of participants reporting ED in this study. In contrast, the prevalence of disordered eating in the general population can range up to 21% which is lower than the prevalence noted in athletes from previous studies (3, 23). Eating disorders are

historically underreported in the general population, and elite athletes may underreport eating disorders more frequently than non-athletes (22).
Athletes who reported ED were more likely to report body dissatisfaction than athletes that did not report ED, yet almost half of all the athletes reported some form of body dissatisfaction. Higher body weight was associated with greater body dissatisfaction. Research suggests that endurance athletes are more likely to suffer from disordered eating than athletes of other sports, and elite athletes likely possess a strong perfectionism trait (18, 22). These factors suggest that the elite female endurance athlete population is particularly vulnerable to body dissatisfaction and eating disorders. In fact, body satisfaction has been reported to be the largest independent predictor of dieting (18). Haakonssen et al. (2015) found over half of female cyclists reported a desire to change their body weight at least once a week, and about 14% of the cyclists reported a previous eating disorder diagnosis (7). While, another study showed body satisfaction acted as a mediator between perfectionism and disordered eating in synchronized swimmers (5).

Many factors contribute to the development of an ED, including body dissatisfaction, perfectionism, caloric restriction, compulsive exercise, and striving for a particular weight before competitions to enhance performance. Almost two-thirds of participants reported restricting or reducing food intake, however, the level of calorie restriction is unknown. These athletes may be participating in weight periodization which may help athletes reach desired body composition for competition while maintaining optimal EA (10, 21). While energy restriction may have been related to weight periodization, less than one-third of participants reported striving to achieve a particular race weight. Heikura et al. (2018) found that female athletes may be more conscious of extra carbohydrate and energy intake when engaging in weight periodization practices. Seventy-nine percent of female endurance athletes were found to eat significantly less energy on easy training days in comparison to 52% of the male athletes (10). Similar to Heikura et al. (2018), it is unclear if energy restriction is due to lower energy requirements of females, lack of knowledge, body image concerns, disordered eating, or a combination of factors in the current study.

No differences in training metrics (longest training run, weekly training volume) were found between participants that reported ED versus NO ED. These results may be attributed to the questions referring to the training in the three months prior to the marathon with athletes generally following similar training regimens in those months. No significant differences were found in performance metrics between participants reporting ED versus those that reported NO ED. Body weight and body mass index were not associated with marathon finishing time, in contrast to previous studies such as Rust et al. (2011) who found body mass index to be related to race time, although their study participants were male half marathoners (19). The lack of association in this study may be due to sampling of a homogenous population of athletes with similar body weights and marathon finish times. Similar to Sjodin and Svendenhag (1985), which notes that while there is a strong correlation between VO_2 max and marathon finish time in heterogenous populations, this relationship does not exist in homogenous populations (20).

Limitations of this study include the lack of a validated assessment tool to confirm a current or past diagnosis of ED, however there are only tools available to assess current risk of an ED, and are not diagnostic. Given the nature and timing of the survey as well as our very specific population of interest (females who Qualified for US Olympic Trials in the marathon), it would be almost impossible to have given the survey on multiple occasions to determine reliability. The survey was distributed at a very specific time point, thereby limiting any opportunity to determine test-retest reliability. However, including additional a validated eating disorder screening tool to assess ED risk would have increased the length of the survey but 34 may have enhanced the data collected on the behaviors associated with EDs in this population. In regards to the survey questions about weight control methods, it is not defined whether the weight control method used is healthful or not as this may be difficult to define in certain cases. For example, purging is not a healthy method, but some forms of energy restriction and increased exercise can be done in a healthful manner. Although we did not find a difference in training volume between ED and NO ED, assessing risk of exercise dependence in elite athletes may also be a beneficial metric since it often occurs in conjunction with disordered eating (4). Nevertheless, research concerning the relationship between eating disorders, training, body weight satisfaction, weight control methods in the elite female endurance athlete population is limited, especially among Olympic-caliber populations.

Disordered eating in athletes can contribute to an array of negative consequences including RED-S and negative performance effects (13). Prevention and early detection of disordered eating in athletes is vital for addressing the high prevalence of EDs among this at-risk population. Health and wellness should be emphasized over thinness ideals (25). Dieting is a primary risk factor for EDs, and should be avoided unless necessary for specific performance goals (24, 25). Dieting and weight periodization cannot realistically be fully eliminated from an athlete's training regimen, but they should be implemented mindfully. Frequent weighing, body composition testing, and team weigh-ins have been found to have negative effects on athletes (25). Providing thorough education on dieting, disordered eating, negative physiological and performance outcomes associated with LEA and the female athlete triad is one way to increase awareness among athletes (6, 21). Athlete should be referred to a registered sports dietitian nutritionist (RDN) when disordered eating is detected is important for accurate assessment and treatment (24). Finally, additional research focused on studying disordered eating among elite female endurance athletes is warranted, as they appear vulnerable to a dangerous combination of risk factors associated with eating disorders.

REFERENCES

1. Ackerman KE, Stellingwerff T, Elliott-Sale KJ, Baltzell A, Cain M, Goucher K, Fleshman L, Mountjoy ML. #REDS (Relative Energy Deficiency in Sport): Time for a revolution in sports culture and systems to improve athlete health and performance. Brit J of Sports Med 54(7): 369-370, 2020.

2. Anderson LM, Reilly EE, Gorrell S, Anderson DA. Running to win or to be thin? An evaluation of body dissatisfaction and eating disorder symptoms among adult runners. Body Image 17 : 43–47, 2016.

3. Coelho GMO, Gomes AIS, Ribeiro BG, Soares EA. Prevention of eating disorders in female athletes. Open Access J Sports Med 4(5):105–113, 2014.

4. Cook B, Hausenblas H, Crosby R, Cao L, Wonderlich S. Exercise dependence as a mediator of the exercise and eating disorders relationship: A pilot study. Eating Behav 16:9–12, 2015.

5. Ferrand C, Megnan C, Rouviex M, Filaire E. Disordered eating, perfectionism and body-esteem of elite synchronized swimmers. Eur J Sport Sci 7(5):223–230, 2007.

6. Folscher LL, Grant CC, Fletcher L, Janse van Rensberg DC. Ultra-Marathon Athletes at Risk for the Female Athlete Triad. Sports Med – Open 1(29), 2015.

7. Haakonssen EC, Martin DT, Jenkins DG, Burke LM. Race Weight: Perceptions of Elite Female Road Cyclists. Inter J Sports Phys Perform 10: 311–317, 2015.

8. Hagmar M, Hirschberg AL, Berglund L, Berglund B. Special Attention to the Weight-Control Strategies Employed by Olympic Athletes Striving for Leanness Is Required: Clin J Sport Med 18(1): 5–9, 2008

9. Harris E, Barraclough B. Excess mortality of mental disorder. Br J Psych 173:11–53, 1998.

10. Heikura IA, Stellingwerff T, Burke LM. Self-Reported Periodization of Nutrition in Elite Female and Male Runners and Race Walkers. Frontiers Phys 9:1732, 2018.

11. Hulley AJ, Hill AJ. Eating disorders and health in elite women distance runners. Inter J Eating Dis 30(3):312–317, 2001.

12. Jeukendrup AE. Periodized Nutrition for Athletes. Sports Med 47(S1):51–63, 2017.

13. Joy E, Kussman A, Nattiv A. 2016 update on eating disorders in athletes: A comprehensive narrative review with a focus on clinical assessment and management. Br J Sports Med 50(3):154–162, 2016.

14. Karp JR. Training Characteristics of Qualifiers for the U.S. Olympic Marathon Trials. Inter J Sports Phys Perform 2(1): 72–92, 2007.

15. Loucks AB. Low Energy Availability in the Marathon and Other Endurance Sports: Sports Med 37(4):348–352, 2007.

16. Mountjoy M, Sundgot-Borgen J, Burke L, Carter S, Constantini N, Lebrun C, Meyer N, Sherman R, Steffen K, Budgett R, Ljungqvist A. The IOC consensus statement: Beyond the Female Athlete Triad—Relative Energy Deficiency in Sport (RED-S). Br J Sports Med 48(7): 491–497, 2014.

17. Navalta JW, Stone WJ, Lyons S. Ethical Issues Relating to Scientific Discovery in Exercise Science. Inter J Exerc Sci 12(1): 1-8, 2019.

18. Prnjak K, Jukic I, Tufano JJ. Perfectionism, Body Satisfaction and Dieting in Athletes: The Role of Gender and Sport Type. Sports *7*(8): 181, 2019.

19. Rust C, Knechtle B, Knechtle P, Barandun U, Lepers R, Rosemann T. Predictor variables for a half marathon race time in recreational male runners. Open Access J Sports Med 113, 2011.

20. Sjodin B, Svendenhag J. Applied physiology of marathon running. Sports Med 2(2):83–99, 1985.

21. Stellingwerff T. Case Study: Body composition periodization in an Olympic-level female middle-distance runner over a 9-year career. Inter J Sport Nutr Exerc Metab 28(4): 428–433, 2018.

22. Sundgot-Borgen J. Prevalence of eating disorders in elite female athletes. Inter J Sports Nutr 3(1): 29–40, 1993.

23. Sundgot-Borgen J, Torstveit MK. Prevalence of Eating Disorders in Elite Athletes Is Higher Than in the General Population. Clin J Sports Med 14(1): 25–32, 2004.

24. Sundgot-Borgen J, Torstveit MK. Aspects of disordered eating continuum in elite high-intensity sports: Disordered eating in elite athletes. Scand J Med Science Sports 20:112–121, 2010.

25. Wells K, Jeacocke N, Appaneal R, Smith H, Vlahovich N, Burke L, Hughes D. The Australian Institute of Sport (AIS) and National Eating Disorders Collaboration (NEDC) position statement on disordered eating in high performance sport. Br J Sports Med 54(21):1247–1258, 2020.