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Scoping Review

Examination of the Clinical Utility of Eating Disorder and Disordered Eating Screening Tools in Young Athletes: A Scoping Review

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Background and Purpose

Many screening tools are used to identify eating disorders (ED) and disordered eating (DE) in individuals. The purpose of this scoping review was to identify the most commonly used ED/DE screening tools for young male and female athletes.

Study Design

Scoping Review

Methods

Following the Johanna Briggs Institute scoping review guidelines, PubMed, CINAHL Complete, PsycInfo, SPORTdiscus, and Web of Science Core Collection databases were searched using keywords related to eating disorder, disordered eating, athletes, and screening. Included articles were randomized controlled trials, cohort studies, or cross-sectional studies published in English between 2011-2023; included primarily non-aesthetic athletes aged 14-24 years; and utilized an ED/DE screening tool for diagnostic purposes. Articles were excluded if analysis of ED/DE was a secondary purpose or < 20 athletes participated. Tools utilized and demographic and outcomes data were extracted and qualitatively analyzed.

Results

Thirty articles were included. The Eating Attitudes Test-26 (EAT-26), the Sick, Control, One, Fat, Food (SCOFF) questionnaire, and the Eating Disorder Inventory (EDI) were most used among all included articles. Three articles examined only males and used a variety of tools. Five articles utilized a tool specifically designed for athletes: the Eating Disorder Screen for Athletes (EDSA), Brief Eating Disorder in Athletes Questionnaire (BEDA-Q) or the ATHLETE questionnaire.

Discussion

While the EAT-26 is most used for diagnosing ED/DE risk within young athletes, clinical utility of screening tools for male athletes is varied. Combinations of tools utilized for examining ED/DE risk in athletes are not agreed upon. Continued research is needed to assess the clinical utility of screening tools that identify ED/DE risk specifically in athletes. Tool adjustment or development for male athletes may be necessary.

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Level of Evidence

2a

INTRODUCTION

Eating disorders (EDs) and disordered eating (DE) are clinically relevant issues in both male and female athletes[1-4] The majority of the current research focuses on female athletes, while emerging evidence includes male athletes.[1,5] The prevalence rates of EDs and DE are higher in athletes than in non-athletes, but vary across age and sports, as well as by the screening tool used to identify eating pathology.[1, 3] Beals and Hill found that 25% of female collegiate athletes from seven different sports met the criteria for DE or ED.[6] Karrer et al. assert that despite having been "largely ignored by research, the number of elite male athletes with EDs is growing, surpassing that of male non-athletes."[7(p1)]

The Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) defines EDs as "a persistent disturbance of eating or eating-related behavior that results in the altered consumption of food and that significantly impairs physical health or psychological functioning."[8(p329)] Wells et al. describe DE in athletes as being "on a spectrum between optimized nutrition and ED."[9(p1)] Athletes may suffer from an undiagnosed ED, engaging in DE behaviors that are not recognized until further manifestation. Kennedy et al. defined DE as, "intentional chronic abnormal, unhealthy eating/drinking behaviors that can lead to clinically relevant problems and do not necessarily meet DSM-5 criteria for eating disorders."[10(p2)] Both EDs and DE behaviors in the athletic setting can occur due to the negative effects of low energy intake in highly active individuals. DE can lead to longer recovery times after workouts, more frequent musculoskeletal injuries, and extended time away from sport.[9] DE behaviors may be triggered by teammates and/or coaches through body-focused comments or observed DE behaviors among teammates.[2,3,9] Thus, it is important to look beyond the definition of EDs to be ready and able to screen for unsafe eating habits in the athletic population, with the intention of preventing worsening effects and facilitating referrals for nutritional guidance.

Low energy availability (LEA) occurs when an athlete does not consume an adequate number of calories to match their energy needs. Relative energy deficiency in sport (RED-S) is used to describe the multiple system effects of LEA in athletes. The International Olympic Committee originally defined RED-S as, "impaired physiological functioning caused by relative energy deficiency, and includes but is not limited to impairments of metabolic rate, menstrual function, bone health, immunity, protein synthesis, and cardiovascular health."[11(p316)] It is essential that all members of the healthcare team, including physicians, physical therapists, nurses, athletic trainers, sports psychologists, and other relevant health professionals have the ability to recognize signs of and screen for ED/DE risk, for the overall health and safety of the athlete. Members of the healthcare team should work collaboratively to ensure that early identification of ED/DE occurs[12] and that athletes are referred to the appropriate providers, each operating within their area of expertise and scope of practice.

The most commonly used measures in previous research appear to be the Eating Attitudes Test (EAT), the Eating Disorder Inventory (EDI), the Bulimia Test Revised (BULIT-R), the Questionnaire for Eating Disorder Diagnosis (QEDD), and the Eating Disorder Examination Questionnaire (EDE-Q).[13] Pope et al.[13] assert that these measures have been used more frequently for assessing EDs in athletes than several measures that have been specifically developed for athletes, such as the Weight Pressure Sport Scale for Male Athletes, the Athlete Questionnaire (ATHLETE), and the Athletic Milieu Direct Questionnaire.

According to the American Psychology Association (APA) Dictionary of Psychology, clinical utility is defined as "the extent to which diagnostic testing is useful in facilitating beneficial health outcomes from interventions that are initiated based on test results."[14(p194)] Another definition from the APA's Criteria for Evaluating Treatment Guidelines states that clinical utility is, "the applicability, feasibility, and usefulness of the intervention in the local or specific setting where it is to be offered."[15(p1053)] Tyson and Connell define clinical utility as the "cost, time taken to complete, need for specialist training or equipment, and the portability."[16(p826)] Thus, clinical utility is herein operationally defined as the ability of a diagnostic screening tool to recognize disorders relevant to the health outcomes of the patient from a holistic standpoint. Clinical utility includes, but is not limited to, the feasibility, usefulness, applicability, and time/cost-effectiveness of relevant screening tools.

As the clinical utility of ED/DE screening tools within the non-aesthetic athletic population has not been well-studied, a scoping review was chosen to cast a wide net to capture the breadth of current available literature. The purpose of this scoping review was to identify the most commonly used ED/DE screening tools for young male and female athletes.

METHODS

This scoping review was conducted following the Johanna Briggs Institute Scoping review protocol and the associated PRISMA-ScR framework. This scoping review was not registered.

For articles to be included they had to be randomized controlled, cohort, or cross-sectional study articles published between January of 2010 and April of 2023, written in English, that utilized a DE/ED screening tool for diagnostic purposes. The articles also had to include over half of the athletes participating in non-aesthetic National Collegiate Athletic Association (NCAA) sponsored sports, between the ages of 14 to 24 (herein defined as "young athletes"). Less than 50% of subjects could have participated in aesthetic sports. The focus on athletes from non-aesthetic sports was chosen because athletes within these sports have been

studied less regarding their risk of ED/DE than those in aesthetic sports. Non-aesthetic sports were operationally defined for this scoping review as sports without a subjective scoring system, or sports in which athletes play together or contribute to an overall team score.

Excluded from this scoping review case reports, case series, and narrative reviews/clinical commentary. Other exclusion criteria were articles including athletes from only non-NCAA-recognized sports, only aesthetic sports, and articles where establishing an ED/DE diagnosis was not the primary purpose. Finally, research that included less than 20 athletes was excluded due to the potential for decreased internal validity.

In collaboration with a university research librarian, five electronic databases (PubMed, CINAHL Complete, PsycInfo, SPORTDiscus, and Web of Science Core Collection) were initially searched in April 2021, with an updated search completed in April of 2023 using keywords related to eating disorders, disordered eating, athletes, and screening. A detailed summary of the search strategy used for each of the databases can be found in Appendix A. Due to the purpose of this scoping review, a gray literature search was not performed.

After the searches were completed, duplicate articles were manually removed by two reviewers. Once the duplicates were removed, titles and abstracts were screened independently by two reviewers to ensure that the inclusion and exclusion criteria were met. Titles and abstracts were divided into three groups and each reviewer screened two groups; thus, two reviewers independently screened each abstract, and if the reviewers were unsure of the disposition of an article, a third reviewer was consulted. If disagreements were not resolved, a fourth reviewer (BJH, senior author) performed an additional review to reach consensus. All articles included after title and abstract screening went on to full-text assessment, using the same procedures for determining inclusion as during title and abstract screening. All 30 of the final articles were included unanimously.

Data were extracted by a single author, confirmed by a second author, and entered on a spreadsheet including publication year, number and type of participants, sports included, ages, setting/location, screening tools used, study objectives, phenomenon of interest, and objective outcomes/results. The compiled results were qualitatively analyzed to develop the synthesized tables and narrative.

RESULTS

The initial broad search of the literature produced 4,341 articles. After removing duplicates, 2,419 articles remained. After title and abstract screening, 96 articles remained for full-text screening. Thirty articles were included following the full-text screening. Figure 1 outlines the study selection process.

STUDIES INCLUDED IN THE SCOPING REVIEW

Athlete demographics and study characteristics of the 30 articles are summarized in Table 1 and Appendix C. A total of 12,009 athletes were included in the studies contained in this scoping review, 5,202 of which were male, 6,806 female, and one that identified neither male nor female. The articles included athletes from 74 different non-aesthetic and aesthetic (e.g cheerleading, dance, gymnastics, and synchronized swimming) and non-aesthetic (e.g rugby, soccer, track and field, volleyball) sports and 15 different countries.

TOOLS UTILIZED

A total of 13 different ED/DE screening tools were utilized as well as 17 other screening tools that examined a variety of psychosocial factors such as body image, perfectionism, and self-esteem (Appendix B). Table 2 provides the screening tools utilized and in which studies they were used.

The most commonly used tool was a version of the EAT (n=15), the majority of studies used the EAT-26[17-19,25,26,29,34,35,37-39,42-44,46] and only studies by Hernandez and Karaağaç et al. used the EAT-40.[25,26] Several authors combined the EAT with another ED screening tool such as the SCOFF,[34] and the ATHLETE questionnaire,[38,44] and one study utilized both the ORTO-15 and the YBC-EDS.[37]

Five articles utilized the SCOFF questionnaire.[27,30,32,34,36] Two authors utilized the SCOFF as an accessory tool to the EDI.[27,32] Pustivšek et al. were the only authors to use the SCOFF questionnaire as a stand-alone tool.[36]

The EDI was used in two forms (EDI-3 and EDI-2) in five studies.[23,27,32,33,41] Muia et al. combined the EDI with the TFEQ while Gapin and Kearns combined the EDI with the QEDD.[23,33] The EDE-Q was utilized in four studies.[22,24,30,40] The ATHLETE and ORTO-15 were utilized in three studies each and one study utilized ORTO-11[26] instead of the ORTO-15[21,37,38,43-45]

The Q-EDD was also utilized in two studies.[20,23] Chatterton and Petrie utilized the Q-EDD due to its validity and because it has been used to assess ED in male collegiate athletes.[20] Each of the following tools was used only once: the EDSA, the ESP, the TFEQ, the BULIT-R, the YBC-EDS, and the BEDA-Q.[20,24,28,31,33,37]

In three studies that included only males the Q-EDD,[20] BULIT-R,[20] EDE-Q,[22] and EAT-26[44] and ATHLETE[44] were utilized. In the 19 studies where both male and female athletes were examined, the trends followed those seen in the overall results, the EAT-26/EAT-40 was used most commonly,[17,19,25,26,29,39,43] followed by the SCOFF.[27,30,36] None of the studies including athletes and non-athletes used an athlete-specific questionnaire within the screening process.

Overall, 10 articles used a single tool,[19,21,22,28,29,35,36,40,41,45] 12 articles used two tools,[17,20,23,24,30,32-34,38,42,43,46] and eight articles used three or more tools.[18,25-27,31,37,39,44] (Appendix B) When a single tool was used, it was most commonly the EAT-26 (n=3) or the EDE-Q (2), while all other stand-alone tools were used in a single study (5). When more than a single tool was chosen, multiple combinations of tools were used, no patterns emerged; some were grouped to test similar constructs of ED/DE, whereas in other cases the selected tools tested very different con-

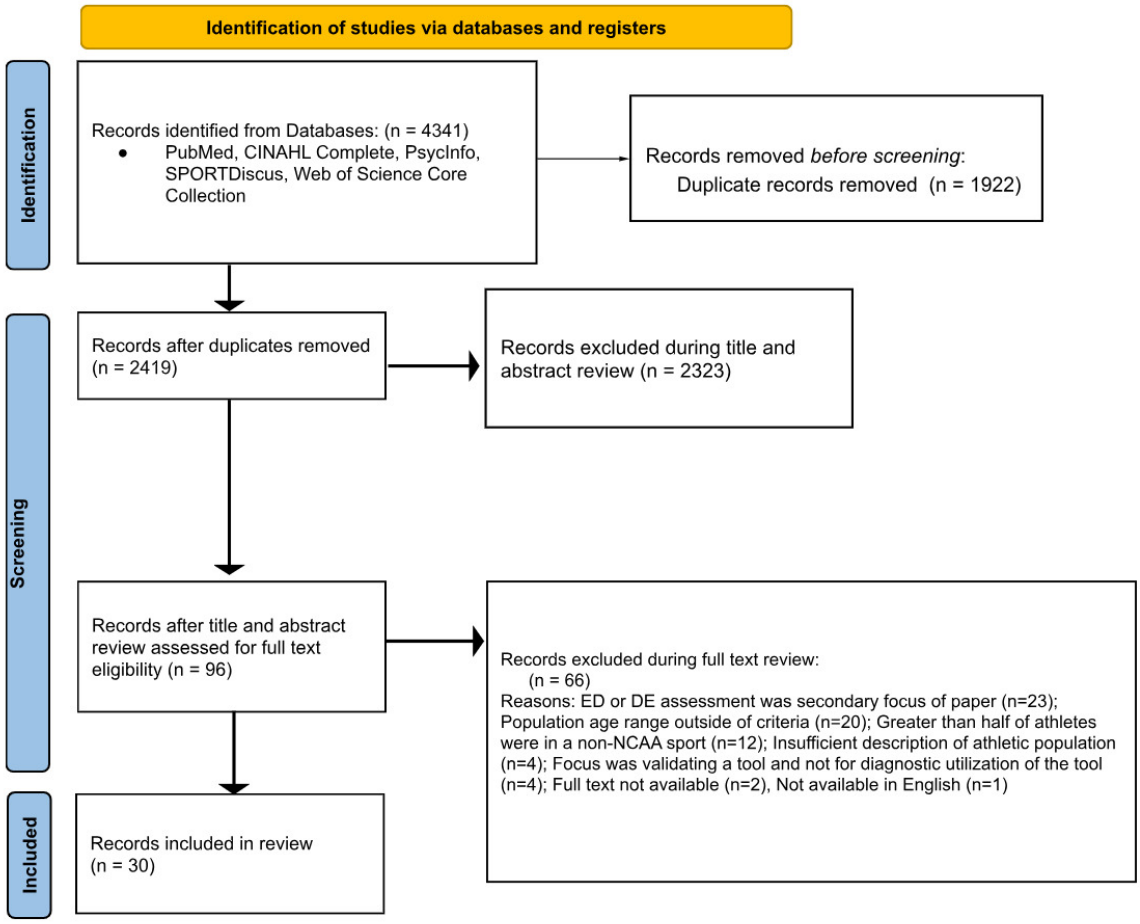

Figure 1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) diagram demonstrating study selection process for inclusion into the scoping review.

structs (e.g. ED/DE and exercise, motivation, or psychological factors).

DISCUSSION

A variety of studies are available in the literature regarding screening young athletes for ED/DE risk, and the results of this scoping review highlight significant findings in the research regarding clinical utilization of specific tools for young athletes in general as well as males and females.

The most commonly utilized tool in this systematic review was the EAT-26 (with two instances of the EAT-40),[17-19,25,26,29,34,35,37-39,42-44,46] possibly because it has the longest history of utilization in both clinical and non-clinical settings and is easily administered. The EAT was reportedly selected for its prevalence in practice,[18,34,46] and because the test has commonly been used with athletes.[17,38,44] Wollenberg et al., Segura-García et al., Lanfranchi et al., and Soubliere and Gitimu incorporated the EAT-26 due to its reliability, validity, and internal consistency.[29,37,38,46] However, this tool developed to screen for eating disorder risk in the general population was not developed specifically for athletes, possibly affecting its usefulness in athletic populations, which could be a drawback to its use.

The second most utilized tool was the SCOFF,[27,30,32,34,36] consisting of only five "yes or no" questions, which makes this test appealing due to the short amount of time required for completion. Petisco-Rodriguez et al. assert that while the SCOFF is often utilized due to the ease of application, whether the SCOFF is sensitive enough to detect ED/DE in the athletic population (as compared to the general population) remains unexplored.[34] Kutz et al. claim that the SCOFF questionnaire is the most widely used screening measure for EDs within the general population; however, they concluded that while this test is effective for screening for AN and BN, it may not be clinically useful for detecting the vast array of EDs experienced by athletes and described in the DSM-5.[47] While utilization of a short, uncomplicated tool such as the SCOFF is feasible and might decrease the common problem of under-reporting, it may also miss key DE/ED's in athletes.

Multiple articles included utilized tools that focus on identification of specific types of EDs and therefore may have limited the clinical applicability for identifying overall ED/DE patterns in athletes. For example, the BULIT-R focuses on the diagnosis of BN, and not EDs or DE in general as compared to the EAT-26 and other tests.[48] The authors of this review believe the BULIT-R may lack usefulness for screening for the variety of EDs and DE seen within the

Table 1. Article Demographics (n=30)

Author/ Year	Total number of participants	Athletes/ Non-Athl	Gender	Mean age (yrs ±SD)	Sports included*
Abbot et al. (2021)[17]	n=406	Athletes (n=227) Controls (n=179)	Males (n=198) Females (n=208)	Males Athletes 21+/-5 Controls 25+/-6 Females Athletes 23+/-4 Controls 26+/-6	Soccer
Aleksić Veljković et al. (2020)[18]	n=120	Aesthetic Athletes (n=54) Non-Aesth Athletes (n=66)	Females (n=120)	Aesthetic Athletes 19±3 Non-Aesth Athletes 20±3	Artistic & Rhythmic Gymnastics, Dance , Synchronized Swimming, Volleyball, Soccer, Basketball
Boudreault et al. (2022)[19]	n=424 (total) n=314 (who completed EAT-26)	Athletes (n=424)	Females (n=197) Males (n=116) Other (n=1)	Athletes 21.83 +/- 2.6	Soccer, Volleyball, Ultimate, Rugby, Cheerleading, Cross-country running, Swimming, Track and field, Badminton, Basketball, Ice Hockey
Chatterton and Petrie (2013)[20]	n=732	Athletes (n=732)	Males (n=732)	Athletes 19.91	*Technical* (Bowling, Golf, Fencing, Skiing) ; *Endurance* (Swimming, Track and Cross-Country) ; *Aesthetic* (Diving) ;*Weight class* (Crew/Rowing, Wrestling) ; *Ball game* (Baseball, Basketball, Football, Hockey, Lacrosse, Soccer, Tennis, Volleyball)
Clifford and Blyth (2019)[21]	n=215	Athletes (n=116) Non-Athl (n=99)	Males (n=74) Females (n=141)	Athletes 21±1 Non-Athl 21±2	Track, Basketball, Cheerleading, Cricket, Cycling, Dance, Diving, Football, Golf, Gymnastics, Hockey, Judo, Korfball, Lacrosse, Netball, Olympic Weightlifting, Orienteering, Rowing, Rugby, Sepak Takraw, Swimming, Taekwondo, Table Tennis, Trampolining, Triathlon, Ultimate Frisbee, Volleyball, Water Polo
Gorrell et al. (2019)[22]	n=611	Competitive Athletes (n=429) Non-Comp Athletes (n=183)	Males (n=611)	Total Population 20.99	Swimming, Rugby, Rowing/Crew, Lacrosse, Football, Ultimate Frisbee, Soccer, Cycling, Wrestling, Ice Hockey, Triathlon, Basketball, Running/Cross Country/Track/ Field, Volleyball, Fencing, Gymnastics, Cheerleading, Baseball, Water Polo
Gapin and Kearns (2013)[23]	n=133	Athletes (n=133)	Males (n=57) Females (n=76)	Total Population 19.77± 1.26	Rowing
Hazzard et al. (2020)[24]	Part 1 n=434 Part 2 n=862	Part 1 Division I Athletes (n=434) Part 2 Majority reported competing at DI (n=588) or club (n=257) levels	Part 1 Males (n=229) Females (n=205) Part 2 Males (n=312) Females (n=550)	Total Population 20.16± 1.47	Cross Country, Gymnastics, Rowing, Swim and Dive, Track and Field, Baseball, Basketball, Football, Golf, Soccer, Volleyball

Author/ Year	Total number of participants	Athletes/ Non-Athl	Gender	Mean age (yrs ±SD)	Sports included*
Hernández et al. (2021)[25]	n=167	Athletes n=167	Females (n=70) Males (n=97)	Total Population 24± 2.12	Cross-Country and Track running
Karaağaç, et al. (2022)[26]	n=168	Athletes (n=66) Non-Athl (n=102)	Females (n=63) Males (n=105)	Athletes 21.36±2.02 Non-Athl 21.94±2.02	Football, Volleyball, Basketball, Sailing
Kraus et al. (2018)[27]	n=113	Competitive Athletes Lightweight (n=45) Heavyweight: (n=32) Non-Comp Athletes (n=37)	Males (n=71) Females (n=42)	Total Population 21.19±6.20 Non-Comp 26.3 ± 6.7 Competitive 18.7 ± 4.1	Rowing
Krebs et al. (2019)[28]	n=638	Athletes (n=638)	Males (n=366) Females (n=272)	Males 19.99±.07 Females 19.86±.08	Track (800m or greater distances) , Cross Country
Lanfranchi et al. (2014)[29]	n=770	Athletes (n=335) Non-Athl (n=435)	Males (n=341) Females (n=429)	Total Population 14.61	Dancing, Hiphop, Figure Skating, Gymnastics; Boxing, Kickboxing, French Savate, Wrestling, Aïkido, Judo, Karate, Kung Fu Taekwondo, Fitness, Rowing. Swimming, Cycling, Jogging, Mountain-Biking, Rock Climbing, Twirling, Olympic Walk. Alpine Skiing, Badminton, Tennis, Water Polo, American Football, Rugby, Basketball, Soccer, Handball, Volleyball, Shooting, Archery, Pétanque, Fishing, Golf, Rollerblading, Horse Riding, Pelota, Powerlifting, Sailing, Scuba Diving, Skateboard, Table Tennis, Tai-Chi-Chuan
Lichtenstein et al. (2022)[30]	n=28	Athletes (n=28)	Females (n=25) Males (n=3)	Athletes 23	Track And Field, Rowing, Cycling, Triathlon, Swimming, Orienteering, Martial Arts, Ice Skating
Magee et al. (2023)[31]	n=94	Athletes (n=94)	Females (n=42) Males (n=52)	Athletes 18.09±2.44	Soccer, Football, Track/Cross-Country, Wrestling, Baseball, Volleyball, Gymnastics, Basketball, Weight/Power Lifting, Dance, Softball, Tennis, Crossfit
Molnár et al. (2016)[32]	n=130	Athletes (n=65) Non-Athl (n=65)	Females (n=130)	Athletes 23.27±5.13 Non-Athl 22.11±2.04	Soccer (Football)
Muia et al. (2016)[33]	n=110	Athletes (n=61) Non-Athl (n=49)	Females (n=110)	Athletes 16.5** Non-Athl Does not report	Mid- to Long Distance Running
Petisco-Rodriguez et al. (2020)[34]	n=120	Athletes (n=80) Non-Athl (n=40)	Females (n=120)	Gymnasts 16.60±2.62 Footballers 17.98±3.42 Non-Athl 17.13±2.16	Gymnastics, Football
Prather et al. (2016)[35]	n=225	Athletes (n=225)	Females (n=225)	Athletes 16.4±4	Soccer

Author/ Year	Total number of participants	Athletes/ Non-Athl	Gender	Mean age (yrs ±SD)	Sports included*
Pustivšek et al. (2016)[36]	n=583	Athletes (n=337) Controls (n=246)	Females (n=273) Males (n=310)	Athletes 15.87 Controls 16.09	Track And Field; Gymnastics/ Rhythmic Gymnastics; Judo; Mountain Running;, Cycling; Swimming; Xc Skiing;, Triathlon, Rowing, Alpine Skiing, Ski Jumping; Basketball; Football; Volleyball; Dodgeball; Handball; Tennis
Segura-García et al. (2012)[37]	n=794	Athletes (n=577) Controls (n=217)	Females (n=268) Males (n=526)	Male Athletes 23.2 +/- 5.5 Female Athletes 21.3 +/- 7.0)	Taekwondo, Boxing, Judo, Bodybuilding; Volleyball, Basketball, And Soccer; Etc.
Soubliere and Gitimu (2012)[38]	n = 56	Athletes (n=56)	Females (n=56)	Reported age range 18-22 y.o.	Soccer, Softball, Track and Field, Swimming
Stephens et al. (2021)[39]	n=101	Athletes (n=101)	Females (n=74) Males (n=27)	Athletes 20.34±1.38	Baseball, Basketball, Cross Country, Track And Field, Football, Golf, Rowing, Soccer, Softball, Tennis, Volleyball
Thein-Nissenbaum et al. (2011)[40]	n=311	Athletes (n=311)	Females (n=311)	Total Population 15.4±1.2	Tennis, Volleyball, Swimming, Softball, Golf, Basketball, Track And Field, Cross Country, Soccer, Cheerleading, Pom-Pom Squad, Dance Team, Diving, And Gymnastics
Torres-McGehee et al. (2020)[41]	n=121	Athletes (n=121)	Females (n=121)	Athletes 19.8±2.0	Equestrian, Soccer, Beach Volleyball, Softball, Volleyball, Ballet
Uriegas et al. (2023)[42]	n=1885 .	Athletes (n=1885)	Females (n=1312) Males (n=573)	Athletes 19.8±1.4	*Endurance* (e.g., Cross Country, Track: middle and long distance, Swimming) , *Aesthetic* [e.g., Cheerleading, Diving, Dance, Equestrian) , *Power* (e.g., Football, Track Sprints, Track and Field; Non-Lean Events [Discus, Shot-Put, Hammer]) , *Ball/Team* (e.g. Baseball, Softball, Basketball, Soccer, Volleyball, Beach Volleyball) And *Technical Sports* (e.g. Golf, Tennis, Track and Field Lean Events [High Jump, Javelin]) .
Uriegas et al. (2021)[43]	n=1090	Athletes (n=1090)	Females (n=756) Males (n=334)	Athletes 19.6±1.4	Cross Country, Track: middle and long distance, Swimming, Cheerleading, Diving, Dance, Equestrian, Football, Track Sprints, Throws, Baseball, Softball, Basketball, Soccer, Volleyball, Beach Volleyball, Lacrosse, Golf, Tennis, Track Jumps
Wadas and Debeliso (2014)[44]	n=68	Athletes (n=68)	Male (n=68)	Athletes 15.9 ± 1.0	Cross Country
Wells et al. (2015)[45]	n=83	Athletes (n=83)	Female (n=83)	"Collegiate age"	Cheer, Swimming, Volleyball, Cross Country, Basketball, Softball, Soccer, Golf
Wollenberg et al. (2015)[46]	n=527	Athletes (n=151) Non-Athl (n=376)	Females (n=527)	Athletes 19.50±1 Non-Athl 19.83±3	Soccer, Cross-Country, Track and Field, Basketball, Cheer/Pom/ Dance, Equestrian, Tennis, Golf, Softball

Non-aesth= non-aesthetic athlete; Non-Athl= non-athletes; Non-comp= non-competitive

* >50% of athletes in the study participated in NCAA-recognized sports (and therefore met the inclusion criteria)

**mean age averaged from reported median age of athletes and nonathletes

Table 2. Screening Tools Utilized in Included Studies

Eating Disorder/Disordered Eating Screening Tool	Studies that utilized the tool
Eating Attitudes Test (EAT-26 or EAT-40)	Abbott et al.[17] Aleksić Veljković et al.[18] Boudreault et al.[19] Hernández et al.[25] Karaağaç et al.[26] Lanfranchi et al.[29] Petisco-Rodriguez et al.[34] Prather et al.[35] Segura-García et al.[37] Soubliere and Gitimu[38] Stephens et al.[39] Uriegas et al.[42] Uriegas et al.[43] Wadas and DeBeliso[44] Wollenberg et al.[46]
Eating Disorder Inventory (EDI-2 or 3)	Gapin and Kearns[23] Kraus et al.[27] Molnár et al.[32] Muia et al.[33] Torres-McGehe et al.[41]
Sick, Control, One, Fat, Food Questionnaire (SCOFF)	Kraus et al.[27] Liechtenstein et al.[30] Molnár et al.[32] Petisco-Rodriguez et al.[34] Pustivšek et al.[36]
Eating Disorder Examination Questionnaire (EDE-Q)	Gorrell et al.[22] Hazzard et al.[24] Lichtenstein et al.[30] Thein-Nissenbaum et al.[40]
ORTO-15/ORTO-11	Clifford and Blyth[21] Karaağaç et al.[26] Segura-García et al.[37] Uriegas et al.[43]
ATHLETE	Soubliere and Gitimu[38] Wadas and DeBeliso[44] Wells et al.[45]
Questionnaire for Eating Disorder Diagnosis (QEDD)	Chatterton and Petrie[20] Gapin and Kearns[23]
Eating Disorder Screen in Primary Care (ESP)	Krebs et al.[28]
Three Factor Eating Questionnaire (TFEQ)	Muia et al.[33]
Eating Disorder Screen for Athletes (EDSA)	Hazzard et al.[24]
Bulimia Test Revised (BULIT-R)	Chatterton and Petrie[20]
Yale-Brown-Cornell-Eating Disorder Scale (YBC-EDS)	Segura-García et al.[37]
Brief Eating Disorder in Athletes Questionnaire (BEDA-Q)	Magee et al.[31]

athletic population. Another test, the TFEQ focuses on the cognitive "restraint" around food as compared to diagnosing EDs or DE in general.[49] Therefore, while it may be useful in identifying DE related to the restriction of caloric intake, it is likely less useful for detecting a wide scope of EDs. Finally, the ORTO-15 assesses risk for a specific condition, orthorexia nervosa, instead of EDs or DE in general. Due to the limited research and applicability associated with the BULIT-R, TFEQ, and ORTO-15 tools, the authors of this review do not currently recognize them as having good clinical utility.

The findings of this review were inconsistent regarding which screening tools were able to identify differences in ED/DE risk between male and female athletes, and to the authors' knowledge no tools exist for identifying ED/DE specifically in males. When using tools not developed for males, it may be important to take in consideration that male and female athletes may display different presentations of/driving factors toward ED which could impact how athletes answer questions. This seems to be consistent with suggestions from Lanfranchi et al. that certain statements like *think they are too thin* or if they are *striving to become thinner* on the EAT-26 are more likely to be negatively answered by male athletes. Lanfranchi et al. state that this could be due to males being significantly less likely to be concerned about the idea of being thin and more thoughtful about their body composition.[29] Perhaps future research should focus on adaptation of existing tools or development of new tools to better assess ED/DE in male athletes.

Although self-report measures such as the EAT-26, SCOFF, and EDI are well-studied and have been used to identify ED risk in a variety of competitive athletes, none of these tools were developed *specifically* for athletes. Pope et al. have reported that the use of questionnaires developed for the general population among athletes is more common than the use of athlete-specific questionnaires,[13] which is supported by the results of this scoping review.

Regarding athlete-specific tools, the ATHLETE, EDSA, and BEDA-Q questionnaires may be useful in formulating a targeted approach to screening athletes for ED/DE risk and may expose different results in athlete/non-athlete comparisons of risk. The ATHLETE questionnaire provides athlete-specific measures that assess psychological predictors of DE.[45] The ATHLETE may be a strong option to consider as multiple studies included in this scoping review used the ATHLETE for its utility in examining the etiology of DE in athletes.[44] The ATHLETE contains specific measures for psychological predictors of ED[45] and questions aimed at gaining information regarding other factors leading to DE, which may positively affect its usefulness in athletes.[38]

Although the EDSA was not widely utilized, Hazzard et al. examined the validity of the EDSA, to assess the risk of EDs within male and female athletes, specifically.[24] The EDSA has demonstrated excellent criterion validity when compared to the EDE-Q, and was accurate in predicting ED risk status for both male and female collegiate athletes across several levels of competition and sports types.[24] With a reported sensitivity of 96% and specificity of 80% for male athletes, and a sensitivity of 96% and specificity of 64% for female athletes,[24] the authors of this review suggest that the EDSA should be considered when assessing athletes based on its applicability. Finally, Magee et al. utilized BEDA-Q, to assess the ED risk in athletes.[31] The BEDA-Q has been reported to have a sensitivity of 82.9% and specificity of 84.6%[31] and reports of acceptable accuracy for identifying athletes with and without an ED, supporting the consideration of its use in athletes versus other tools.[31]

APPLICATIONS FOR THE HEALTHCARE PROFESSIONAL

Because referral of athletes to other members of the healthcare team is made possible by screening, healthcare professionals should be well versed in the most current, commonly utilized ED/DE screening tools (the EAT-26/40, SCOFF, EDI, and EDE-Q) for clinical use and/or interpretation, including their limitations. Of the most utilized tools, the SCOFF is the shortest and most time-efficient and would be easily integrated into a clinical examination of an athlete. Lesser known and studied tools including the ATHLETE, EDSA, and BEDA-Q should be considered for more in-depth screening of athletes or be utilized in concert with another tool. The clinical utility of these newer tools needs to be further documented and studied. Regardless of the screening tool utilized, it is incumbent upon the PT as a primary health provider to refer to the appropriate mental health or medical provider when issues are identified by screening.

The use of clinical interviewing to assess ED/DE risk is considered the gold standard in diagnosis of EDs.[50] Trained medical providers can verify information reported in a questionnaire and gather additional information that the ED/DE screening tools may have missed.[13,20,22,23,29,34] Furthermore, according to Wells et al., the recommendation for assessing for DE is to utilize the ED/DE screening tools, and then to follow up with a clinical interview.[9] Only one study by Lichtenstien et al, utilized a clinical interview following a screening tool to assess the external validity of the tool and to look at the subjective aspect of symptoms.[30] The other 29 studies did not utilize clinical interviews to verify the quantitative responses of the screening tools and gain additional qualitative information that may have been missed with only the use of a screening tool. Of all the tools used in studies in this review, only the SCOFF has been described as having sensitivity (84.6%) and specificity (89.6%) compared to a clinical interview.[34] Regarding athlete versus non-athlete comparisons, Martisen and Sundgot-Borgen found that when self-report questionnaires (including EDI-2) were used alone to detect EDs in adolescent male and female athletes and a non-athletic control group, the prevalence was higher in the controls.[50] However, in their two-part study, when "at-risk" and matched controls participated in a clinical interview including assessing for DSM-IV criteria of EDs, athletes had a higher prevalence of EDs than among the controls. More athletes reported pathogenic weight control methods in clinical interviews than within screening methods.[50] Therefore, the authors of this review believe that clinical interviews should be frequently considered as part of a comprehensive ED/DE assessment of athletes, following the use of each/any of screening tools, to gain additional information and verify the responses.

LIMITATIONS

There are several limitations of this scoping review. The authors recognize that relevant data about ED/DE prevalence in different sports and athletes versus non-athletes, may have been excluded from the scoping review due to article inclusion and exclusion criteria. Excluding sports not recognized by the NCAA, athletes participating in aesthetic sports, and articles with a primary focus other than diagnosis of ED/DE, may have limited the available data for this review.

As is inherent to any systematic or scoping review, there is a potential for bias in the selection, evaluation, and interpretation of the relevant articles. To diminish the effect of personal bias in the selection of articles, 100% consensus for inclusion/exclusion was achieved by the authors during review of articles.

Most of the studies included in this scoping review were cohort studies, often with convenience samples from specific populations/teams, which varied significantly in their methodology. This may have contributed to the lack of racial/ethnic diversity within studies.[38,44] Several of the studies had small sample sizes, despite the decision to exclude studies with less than 20 participants.[18,23,25,29,44] Small and homogenous (athletes of only a specific sport, or from a specific country or region) samples make the re-

sults less generalizable to the global athletic community. The authors acknowledge that the variability of strength of evidence and potential for risk of bias for the articles included may make it difficult to justify the strength of the conclusions made in this scoping review.

Finally, the possibility of athletes under-reporting DE/ED symptoms is a limitation that was stated by many of the included articles.[19,20,22-24,27-30,34,36,39-43,45,46] The self-report nature of screening tools is believed to impact the accuracy of risk assessment as many athletes may be apprehensive in making their ED/DE symptoms known.[24] Even if the responses are kept anonymous, the possibility of athletes being untruthful with their about responses about DE/ED in surveys remains.[40]

CONCLUSION

The EAT-26/40, EDI, and SCOFF questionnaires are the most broadly clinically utilized and researched ED/DE screening tools. Of these, the SCOFF questionnaire is the shortest test to administer. The main limitation of each of these three commonly used tools is that they were not specifically developed for use in the athletic population. Relatively new, athlete-specific questionnaires such as the ATHLETE, EDSA, and BEDA-Q questionnaires may be useful for identifying ED/DE risk in young athletes and may be used to supplement efficient, well-known, and studied tools such as the EAT-26, EDI, or SCOFF questionnaires. Healthcare professionals should consider the use of various tools for assessment of young male and female athletes to assess risk of ED/DE.

CONFLICTS OF INTEREST

The authors have no conflicts of interest related to this manuscript.

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SUPPLEMENTARY MATERIALS

Appendix A

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Appendix B

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Appendix C

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