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Eating disorders among professional athletes. A narrative review

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ABSTRACT

Introduction: Eating disorders are potentially mortal health conditions affecting mostly young people. The reasons for that in general population are connected to vulnerable self-image, following the current beauty standards and co-existing psychiatric comorbidities. Athletes may be in danger of developing a pathological eating pattern due to sport specific reasons such as higher scores related to thinner body.

Aim of study: The main aim of the study was to examine the relationship between eating disorders in professional athletes' population, evaluate causes and risk factors and to assess health consequences to eating disorder in sport.

Materials and methods: This article is based on the literature found in PubMed and Google Scholar Database with the use of keywords such as "eating disorders", "sport", "athletes", "anorexia nervosa in athletes", "eating disorders in sport", "disordered eating in sportsmen", "female athletes", "bulimia nervosa", "binge eating", "ED and sport", "mental health and sport", "consequences of eating disorders", "sport education".

Results: Investigation of available literature revealed the connection between developing eating disorder in professional athlete sample. The reasons behind it are mostly sports' oriented and connected to the desire to achieve better results and perfectionism. However,

developing an eating disorder results in worse sports' performance, menstrual irregularity, lower bone mineral density, cardiovascular issues and can be potentially mortal.

Conclusion: Athletes are in danger of developing eating disorders. There should be a focus on evaluating people in sport in terms of eating patterns, however available questionnaires are inefficient because players tend to underreport their problems. Coaches and families of the athletes need to be educated in the topic as they can recognize dangerous behaviors first.

Key words: eating disorders, professional athletes, sport, anorexia nervosa, bulimia nervosa, mental health

Introduction

Eating disorders (ED) remain a significant issue in a healthcare environment. Females represent approximately 90% of those who seek medical care for an eating disorder, yet males can be affected as well[1]. According to recent data[2] 5.5-17.9% of young women and 0.6-2.4% of young men have experienced an eating disorder classified in Diagnostic and Statistical Manual of Mental Disorders (DSM-5)[3] by early adulthood. Occurrence of disordered eating can lead to serious medical conditions as all DSM-5 ED have a negative impact on health, lead to lower quality of life and present an elevated mortality risk[4, 5]. This is particularly concerning because of the age statistics and the fact that the diseases are observed mainly among young people[2]. Young adults and adolescents are, in general, in danger of developing eating disorders because of the vulnerable self-esteem, desire to meet certain beauty standards and in some cases, a belief that they can have control over their lives due to dietary restrictions[6-8]. Moreover, many ED patients have at least one more psychiatric diagnosis, reportedly clinical depression, general anxiety and substance abuse[9, 10]. Sportsmen and sportswomen who perform professionally are mostly in the same age group as people who typically develop ED. Furthermore, in this circumstance certain physical features such as lower body mass or slim figure can be perceived as an advantage in sports' discipline[11]. Pressure to receive the best results can develop into a pathological eating pattern and then, to an eating disorder. This study aims to investigate incidence of ED in professional athletes population, compare pathophysiology of the sample to the general population and evaluate possible treatment paths.

Methods

We searched online databases, PubMed and Google Scholar, with keywords: ”eating disorders”, “sport”, “athletes”, “anorexia nervosa in athletes”, “eating disorders in sport”, “disordered eating in sportsmen”, “female athletes”, “bulimia nervosa”, “binge eating”, “ED and sport”, “mental health and sport”, “consequences of eating disorders”, “sport education”. Retrospective and observational studies were considered with no restriction on the date of publication, up to June 2024. We excluded publications with no information about professional sport performers’ population and the ones irrelevant to the study. There were no restrictions regarding athletes’ age and gender. The information was selected and presented in Table 1 and Table 2.

Results

Table 1. Demographic characteristics of the participants and prevalence of eating disorders among athletes.

Study	Year	Country	Population	No. of participants	Age (years)	Gender F-M	Observed ED prevalence in athletes	Observed ED prevalence in non-athletes (control group)
Sundgot-Borgen[12]	1993	Norway	Adolescent and adult female elite athletes and	193	12-35	Athletes: F 133 M 0 Controls:	18%	5%

			controls			F 60 M 0		
Thiel, Gottfried, and Hesse[13]	1993	Germany	Male wrestlers and rowers	371	Mean: 21.1 ± 2.4	Athletes: F 0 M 84 (25 wrestlers, 59 rowers) Controls: F 183 M 104	11%	N/R
Hulley and Hill[14]	2001	UK	Adult female elite runners	181	Mean: 28.5	F 181 M 0	16%	N/R
Byrne and McLean[15]	2002	Australia	Adolescent and adult female and male elite athletes and controls	526	15-36	Athletes: F 155 M 108 Controls: F + M 263	F 22% M 4%	F 5,5% M 0%
Sundgot-Borgen and Torstveit[1	2004	Norway	Norwegian male and female	2462	15-39	Athletes: F 572 M 687	F 20% M 8% (p <	F 9% M 0,5% (p <

6]			elite athletes and controls			Controls: F 574 M 629	0.001)	0.001)
Toro et al.[17]	2005	Spain	Female elite athletes	283	Mean: 15.3 ± 3.1	F 283 M 0	ED through EAT: 11% ED through CETCA: 22,9%	N/R
Beals and Hill[18]	2006	USA	Collegiate female athletes	112	Mean: 19.5+-1.2	F 112 M 0	25%	N/R
Pernick et al.[19]	2006		High-school female athletes	453	Mean: 15.7 ± 1.2	F 453 M 0	19,6%	N/R
Nichols et al.[20]	2006	USA	High-school female athletes	170	13-18	F 170 M 0	18,2%	N/R
Nichols et al.[21]	2007	USA	High-school female athletes	423	Mean: 15.7 ± 1.7	F 423 M 0	20,0%	N/R
Torstveit et al.[22]	2008	Norway	Adolescent and	331	13-39	Athletes:	32,8%	21,4%

			adult female elite athletes and controls			F 186 M 0 Controls: F 145 M 0		
Petrie et al.[23]	2008	USA	Collegiate male athletes	203	Mean: 20.3 ± 1.6	F 0 M 203	ED: 0% Symptoms of ED: 19,2%	N/R
Greenleaf et al.[24]	2009	USA	Collegiate female athletes	204	Mean: 20.2+-1.3	F 204 M 0	ED: 2% Symptoms of ED: 25,5%	N/R
Quah, Poh, Ng, and Noor[25]	2009	Malaysia	Adolescent and adult female elite athletes	67	13-30	F 67 M 0	Risk for ED: 89,2%	N/R
Rosendahl et al.[26]	2009	Germany	High-school female and male elite athletes and age-matched	867	14-18	Athletes: F 210 M 366 Controls: F 169	F 26,7% M 10,4%	F 36,1% M 12,3%

			non-athletic female and male controls			M 122		
Schtscherbyna et al.[27]	2009	Brazil	Adolescent female elite swimmers	78	11-19	F 78 M 0	44,9%	N/R
Martinsen et al.[28]	2010	Norway	Hisgh-school elite female and male athletes and age-matched female and male controls	961	15-16	Athletes: F 217 M 389 Controls: F 158 M 197	Symptoms of ED: F 44,7% M 13,1%	Symptoms of ED: F 70,9% M 30,5%
Schaal et al.[29]	2011	France	Adolescent and adult female and male elite athletes	2067	12-35	F 35,2% M 64,8%	Ongoing eating disorder: M 4% F 6% Lifetime eating disorder: M 5.5% F 11.2%	N/R

Thein-Nissenbaum et al.[30]	2011	USA	High-school female athletes	311	Mean: 15.4+-1.2	F 311 M 0	35,4% (p value 0.56)	N/R
Arcelus et al.[31]	2014	UK	Meta-analytical population of general dancers and ballet dancers	3337 (including 1729 ballet dancers)	Mean: 19.5±5.76 12.6-38	N/R	overall 12% (16,4% in ballet dancers group)	N/R

M-male; F-female; ED-eating disorder; N/R- not reported; EAT- eating attitudes test; CETCA-eating disorders assessment questionnaire based on DSM-III diagnostic criteria;

Table 2. Prevalence of AN, BN, BED, EDNOS and AA among athletes.

Study	Prevalence of AN in athletes	Prevalence of BN in athletes	Prevalence of BED in athletes	Prevalence of EDNOS in athletes	Prevalence of AA in athletes
Thiel, Gottfried, and Hesse[13], 1993	N/R	N/R	52% confirmed the occurence of binge eating	N/R	N/R
Sundgot-Borgen[12], 1993	1,3%	8,0%	N/R	N/R	8,2%
Johnson , Powers,	None of the athletes met the	1.1% met the criteria for	N/R	N/R	N/R

and Dick[32], 1999	DSM IV criteria for anorexia nervosa. 1.96% of the athletes believed they might have anorexia nervosa, respectively. Subclinical anorexia was identified in 2.9% of the women.	bulimia nervosa. 5.5% of the athletes believed they might have bulimia nervosa, respectively. Subclinical bulimia was identified in 9.2% of the women.			
Hulley and Hill[14], 2001	F 3,87%	F 1,1%	N/R	F 11,05%	N/R
Byrne and McLean[15], 2002	M 1,85% F 3,23%	M 0,93% F 6,45%	N/R	M 0,93% F 12,26 %	N/R
Beals and Manore[33], 2002	3.3% of the athletes self-reported a diagnosis of clinical anorexia.	2.4% of the athletes self-reported a diagnosis of bulimia nervosa.	N/R	N/R	N/R
Sundgot-Borgen et al.[16],	F 1,92% M 0	overall 4,21% F 6,3%	N/R	overall 6,04%	overall 2,38%

2004		M 2,47%		F 7,9% M 4,5	F 4,02% M 1,02%
Toro et al.[17], 2005	-	-	27,3%	-	-
Pernick et al.[19], 2006	N/R	N/R	African American- 5,5% Caucasian- 5,4% Latina- 12,6 % p-value <.05	N/R	N/R
Beals and Hill[18], 2006	1,79% P = 0.218	0,89% P = 0.386	N/R	N/R	N/R
Schaal et al.[29], 2011	Current (<6months) 0,2% M 0,2% F 0,2% Lifetime (all) 1,1% M 0,5% F 2,1% p<0.01	Current (<6months) 0,4% M 0,2% F 0,6% Lifetime (all) 1,4% M 0,7% F 2,6% p<0.01	N/R	Current (<6months) 4,3% M 3,6% F 5,9% p<0.1 Lifetime (all) 6,2% M 4,8% F 9% p<0.01	N/R

Arcelus et al.[31], 2014	Ballet dancers group: 4% Overall in dancers: 2%	Ballet dancers group: 2% Overall in dancers: 4,4%	N/R	Ballet dancers group: 14,9% Overall in dancers: 9,5%	N/R
Fewell et al.[34] (2018)	69,2%	12,1%	4,4%	6,6%	N/R

AN- anorexia nervosa, BN- bulimia nervosa, BED- binge eating disorder, EDNOS- eating disorders not otherwise specified AA- anorexia athletica, M-male, F-female, N/R- not reported

DSM-V eating disorders' classification

Diagnostic and Statistical Manual of Mental Disorders (DSM-V)[3] differentiate following eating disorders: anorexia nervosa (AN), bulimia nervosa (BM), binge eating disorder (BED), avoidant/restrictive food intake disorder (ARFID) and other specified feeding or eating disorder(OSFED).

Anorexia nervosa is a disorder characterized by restriction of energy intake leading to a significantly low body weight in the context of age, sex, developmental trajectory, and physical health. People affected by it have an intense fear of gaining weight, even though underweight, followed by body image disturbance, undue influence of body weight or shape on self-evaluation and denial of the seriousness of the current low body weight.

Bulimia nervosa occurs when the one has recurring binge eating episodes characterized by the following: eating large amounts of food within a 2-hour period and sense of lack of control and recurring inappropriate compensatory behavior (vomiting, laxatives, exercise, diet pills). Binge eating and compensatory behaviors occur, on average, at least once a week for three months in BN patients whose self-evaluation is unduly influenced by body shape and weight.

Binge eating disorder consists of recurring episodes of eating large amounts of food, more than most people would eat in similar circumstances in a short period of time, eating rapidly, eating beyond fullness and secret eating marked with distress around binges. People experiencing BED have sense of lack of control over eating during the episode (for example, a feeling that one cannot stop eating or control what or how much one is eating). Binge episodes occur at least once a week for three months.

ARFID can be described as an eating or feeding disturbance so pervasive that the person is unable to meet appropriate nutritional needs, resulting in one or more of the following: significant weight loss, nutritional deficiency, dependency on nutritional supplements, or interference in social functioning. The problem is not explained by a lack of food being available. This is different from both anorexia nervosa and bulimia nervosa in that the problems with eating are in no way related to what the person believes about his/her size, weight or shape, the disturbance is also not caused by a medical condition or another mental disorder.

Other specified feeding or eating disorder is applicable to individuals who are experiencing significant distress due to symptoms that are similar to disorders such as anorexia, bulimia, and binge-eating disorder, but who do not meet the full criteria for a diagnosis of one of these disorders.

ED problem in sport

There is a significant amount of publications reporting eating disturbances in sport world. A study by Sundgot-Borgen et al.[12] published in 1993 reported the prevalence of ED in Norwegian elite female athletes. Athletes (n=522) were compared to non-athletic controls (n=448). A significantly higher number of athletes (18%) than controls (5%) were found to actually suffer from ED, particularly athletes competing in sports in which leanness or a specific weight were considered important. When results from the screening study were compared to those from the interviews and clinical examinations, a significant underreporting of ED among athletes was demonstrated. The athletes also reported the use of other pathogenic methods in the screening study compared to what they reported in the interview. Another study[16] examined both female and male professional sport participants to controls.

Results were that more athletes (13.5%) than controls (4.6%; $P < 0.001$) had subclinical or clinical EDs. The prevalence of EDs among male athletes was greater in antigravitation sports (22%) than in ball game (5%) and endurance sports (9%; $P < 0.05$). The prevalence of EDs among female athletes competing in aesthetic sports (42%) was higher than that observed in endurance (24%), technical (17%), and ball game sports (16%). Moreover, the difference between ED occurrence related to certain types of sport was reported in yet another publication by Rosendahl et al.[26] that focused on male athletes. The prevalence of eating disorders among sportsmen was 10% in endurance sports, 17% in weight class sports and 42% in antigravitation sports. Lean-sports athletes are reportedly in greater danger of suffering from ED than their non-lean sports colleagues[35, 36]. Dancers are professionals that can take advantage from slimmer body as it perceived as more desirable. Arcelus et al[31] investigated ED problem in dancers' population stating that dancers have a higher risk of struggling with anorexia nervosa. Data from Table 1 reveal that women in sport are suffering from eating disorders more frequently than men.
A study by Johnson et al.[32] proves this observation. This research also underlines that the risk of developing an eating disorder is lesser in elite athletes which can be correlated with the fact that top sport performers have usually an extensive support team, well-educated coaches and dedicated dieticians. It should be considered that athletes might have different motivations behind restrictive diets that can lead to ED. In general population there is a belief that "thin is beautiful" and that triggers young people to develop pathological eating patterns. In sport population there is a thesis that "thin is going to win" and that puts pressure to control one's food intake[37]. A study by Arthur-Cameselle et al.[11] compared those different reasons. The investigation revealed that athletes reported sport-specific factors including performance pressure, team weigh-ins, and injuries, whereas family dysfunction, bullying, and puberty were more commonly reported triggers for non-athletes. There is also a term "anorexia athletica" dedicated to that sports' specific ED issue[38]. Co-existence of other psychiatric can worsen the prognosis. It was proved that people with ED are characterized by high perfectionism[39]. The feature is also often found in professional athletes as it may help to achieve better scores and feel the need to constantly improve the one's results. However, perfectionism in sport can lead to competitive anxiety[40] and induce an overwhelming fear of failure that provokes an extensive stress that leads to burnout[41]. Those factors are proven to be co-existing with eating disorders[9, 10]. Early identification and early intervention are associated with better treatment outcomes[42]. The most popular and clinically efficient

method of ED treatment is therapy[43], there is limited evidence that use of psychotropic medications in the treatment of eating disorders is associated with improved clinical outcomes.

Consequences of disordered eating in sport

Chronic restriction of food intake has not only a negative impact on the quality of life in general[44] but also result in many somatic impairments. While eating disorders affect people of all ages, reproductive stages and genders, they are most prevalent in women of reproductive age and can have a profound impact on fertility and obstetric outcomes. Females with ED typically experience menstrual dysfunction- irregularity of menstruation, amenorrhea and difficulties with getting pregnant [30, 45, 46]. Moreover, ovarian suppression impairs sport performance[47]. There is also a phenomenon called Female Athlete Triad[48] which is a syndrome occurring in physically active girls and women. Its interrelated components are disordered eating, amenorrhea, and osteoporosis. Girls and women with one component of the Triad should be screened for the others. Alone or in combination, Female Athlete Triad disorders can decrease physical performance and cause morbidity and mortality. Musculoskeletar injuries occur frequently to athletes experiencing eating disorders[30]. Bone fractures are related to lower bone mineral density that can cause osteoporosis[45]. Sport specific research by El Ghoch et al[49] indicates that eating disorders have a negative effect on physical fitness and sport performance by causing low energy availability, excessive loss of fat and lean mass, dehydration, and electrolyte disturbance. The cardiovascular complications in EDs are primarily linked to malnutrition, and patients presenting with AN are most often at greatest risk of structural and functional cardiac abnormalities[50, 51], including sinus bradycardia, a prolonged QT interval on electrocardiography, arrythmias, myocardial mass modification and hypotension; other cardiovascular abnormalities are secondary to electrolyte imbalances, as seen in patients with BM. It is necessary to remember about the mortality statistics of ED as every eating disorder has an increased mortality risk[1, 52] demanding a special focus on both medical team and the sports' team of the affected one.

Conclusion

Eating disorders occur frequently in professional athletes. Sensitive training for coaches, teachers and educators to identify risk behavior, and, if necessary, weight loss supervised by

a dietitian could help to prevent the transition of problematic eating behavior and attitudes into disordered eating and the development of eating disorders in athletes. For younger athletes still living at home, engagement and alignment with parents or guardians is critically important. Knowing that chaotic or disruptive family situations (such as divorcing parents) can contribute to the development of an eating disorder, it is imperative that the multidisciplinary treatment team understands the environment in which the athlete lives, and takes that into account when developing and implementing treatment plans.

Author's contribution:

Conceptualization: EO and OS; methodology: OS; software: AK; check KC, KB; formal analysis EW, JJ; investigation EO, OS; resources OŁ, AMK, EO; data curation KB, KC, EW, EO, OS, JJ, OŁ, KS, AMK, AK; writing - rough preparation EO, OS, KS, AK; writing - review and editing KB, KC, EW, EO, OS, JJ, OŁ, KS, AMK, AK; visualization KS, KB, KC; supervision EO, OS; project administration AK, KC, EO;

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