

Behind the athletic body: a clinical interview study of identification of eating disorder symptoms and diagnoses in elite athletes

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ABSTRACT

Eating disorders are more prevalent in athletes than in the general population and may have severe consequences for sports performance and health. Identifying symptoms can be difficult in athletes because restrictive eating and slim body images are often idealised in a sports setting. The Eating Disorders Examination Questionnaire (EDE-Q) and the SCOFF (Sick, Control, One stone, Fat and Food) questionnaire (SCOFF) are widely used generic instruments to identify symptoms of eating disorders. This study aimed to investigate the instruments' validity and explore eating disorder symptoms in a sample of athletes.

A sample of 28 athletes (25 females) competing at a national level was interviewed based on the diagnostic criteria for eating disorders. We interviewed 18 athletes with a high score on EDE-Q and 10 with a low score. All interviews were transcribed and analysed from a general inductive approach. We identified 20 athletes with an eating disorder diagnosis, while 8 had no diagnosis. EDE-Q found 90% of the cases, while SCOFF found 94%. EDE-Q found no false-positive cases, while SCOFF found one. The qualitative results showed that most athletes reported eating concerns, restrictive eating, eating control (counting calories), weight concerns, body dissatisfaction (feeling fat and non-athletic), excessive exercise and health problems (eg, pain, fatigue).

In conclusion, EDE-Q and SCOFF seem valid instruments to screen athletes' samples but may fail to find 6%–10% cases with eating disorders. Despite athletic bodies and normal body mass index, many athletes report severe eating problems and dissatisfaction with weight and body appearance. Implementation of regular screening may identify these symptoms at an early stage.

INTRODUCTION

Eating disorders (EDs) in athletes are increasing interest and debate topics. EDs may be triggered by performance pressure, comments from coaches or teammates, public weigh-ins or societal expectations of an athletic or skinny body.¹ EDs may have serious negative health consequences, low energy availability and reduced sports performance.^{2–6}

Key messages

What is already known

- ⇒ Eating disorders are more prevalent in athletic samples than in the general population.
- ⇒ Previous studies have explored the prevalence of eating disorders using generic questionnaires but are missing diagnostic interviews verifying the results.

What are the new findings

- ⇒ Despite strong athletic bodies, athletes suffer from emotional distress and physical health problems.
- ⇒ Eating disorders may be overlooked by trainers when athletes strive for top performances.
- ⇒ The most prevalent eating disorder among athletes in this sample is Eating Disorder Not Otherwise Specified, with restrictive eating, body dissatisfaction and fear of weight gain.
- ⇒ Eating Disorders Examination Questionnaire and SCOFF questionnaire are valid instruments to identify eating disorder symptoms in athletes.

Symptoms of EDs are described in the diagnostic manuals: WHO's 'International Statistical Classification of Diseases and Related Health Problems, 10th revision' (ICD-10)⁷ and 'The Diagnostic and Statistical Manual of Mental Disorders, fifth edition' (DSM-5).⁸

Anorexia nervosa (AN) is characterised by restrictive eating, low body weight, fear of weight gain and disturbed body image. Atypical AN can be diagnosed if one symptom is not present (atypical anorexia nervosa (AAN)). It is noteworthy that, unlike AN, low body weight is not a criterion for AAN. Bulimia nervosa (BN) is characterised by binge eating and compensatory behaviours such as vomiting or excessive exercise. EDs with lower severity or frequency of symptoms are classified as Eating Disorders Not Otherwise Specified (EDNOS) in ICD-10 and as



Other Specified Feeding and Eating Disorder (OSFED) in DSM-5.

Subclinical conditions are often labelled as disordered Eating (DE), comprising a range of irregular eating behaviours and negative body image not fitting the diagnostic criteria.

The prevalence of ED/DE has been investigated across countries and athlete populations, including Danish,⁹ Spanish¹⁰ and Slovenian.¹¹ Previous studies found that 10%–20% reported symptoms of EDs.^{12–18} Athletes have higher prevalence rates than non-athletes, especially in weight-sensitive sports such as endurance, antigravity and aesthetic sports.^{17, 19} Female athletes have a higher risk than male athletes, with studies finding 20% of females compared with 8% of males in a Norwegian study.¹⁷

Different instruments have been validated and used to measure ED symptoms in the general population or clinical samples. The SCOFF questionnaire (SCOFF) is widely used to screen larger populations. SCOFF is an acronym for the five assessed symptoms (Sick, Control, One stone, Fat and Food).²⁰ With only five items, SCOFF is an easy and simple tool used to measure symptoms of an ED. The Eating Disorder Examination Questionnaire (EDE-Q) is a 28-item self-reported questionnaire designed to assess the range and severity of features associated with a diagnosis of an ED.²¹ It has been used in athletic samples to identify ED symptoms.^{16, 22–24}

However, these tools cannot assess the specific ED diagnosis nor the severity of symptoms. For that purpose, conducting a clinical interview addressing eating patterns, body image and exercise pattern is imperative. Using diagnostic manuals to assess athletes' ED pathology can provide information about the screening instruments' symptom load and diagnostic validity.

If EDE-Q and SCOFF can identify EDs in athlete samples, they may be useful for regular screening of athletes that need support and treatment. Regular screening of athletes has been requested in previous research investigating EDs in athletes.^{1, 12–15} Still, there is little evidence of the validity of using generic ED tools in athletic samples, and widespread or routine screening has not been adopted. In addition, clinical interviews have been requested,¹⁶ but only very few studies^{6, 17, 18} have conducted clinical interviewing, and none of them has used ICD-10 or DSM-5.

Aims

This study aimed to use a diagnostic interview to assess the external validity of generic ED questionnaires (EDE-Q and SCOFF) to identify athletes with EDs and to explore the subjective experience of symptomology in a sample of athletes competing at the national or international level.

METHODS

Design

The present study's design was mixed methods, employing a triangulation design to validate a quantitative model

and interpret quantitative and qualitative data in conjunction.²⁵ The first part was a psychometric study validating the diagnoses identified by generic EDs questionnaires; the second part was based on 28 semi-structured interviews using a 'general inductive approach (GIA) for analysing'. The study followed the Consolidated Criteria for Reporting Qualitative Studies.²⁶

Participants

Elite athletes (competing at the national or international level) were recruited from a Danish survey study published in 2020²⁷ using EDE-Q and SCOFF to assess the prevalence of ED symptoms. A sample of 417 Danish male and female national team athletes, including national team recruiting squads, completed an online questionnaire. All participants were invited by email in 2019 and 2020 (mean age 20 years, 51% females) from the following sports categories: running, cycling, orienteering, triathlon, swimming, track and field, martial arts, rowing, sports dance, ice skating, gymnastics, badminton, handball and football. The questionnaires were repeated in January–March 2021 to obtain a current score useful for the interview study. We invited 75 athletes with a high score and 75 with a low score on SCOFF and EDE-Q. We had 59 responses (17 with a high score and 42 with a low score), of whom 28 (17 with a high score and 11 with a low score) were invited to participate in the interview and 18 were accepted (10 with a high score and 8 with a low score).

Furthermore, we recruited participants from a similar study conducted on subelite athletes (competing at a national level but not on a national team). A total of 206 subelite athletes (29 with a high score and 177 with a low score) (mean age 21 years; females 52%) completed the questionnaires in February–April 2021 from the following sport disciplines: running, cycling, orienteering, triathlon, swimming, track and field, martial arts, rowing, sports dance, ice skating, gymnastics, badminton, handball and football. We invited 16 athletes (10 with a high score and 6 with a low score) to participate in the interview, and 10 accepted (8 with a high score and 2 with a low score).

The final sample consisted of 28 athletes. Of these, 18 had high scores on EDE-Q (cut-off 2.3) and SCOFF (cut-off 2), while 10 had low scores. The age span was 16–47 years (mean age 23 years) with 25 females (89%). The athletes came from the following sports: track and field (n=10), rowing (n=6), cycling (n=4), triathlon (n=2), swimming (n=2), orienteering (n=2), martial arts (n=1) and ice skating (n=1).

Instruments

The Eating Disorder Examination (EDE-Q) is a gold standard for assessing the severity and type of ED pathology.²¹ The scale contains 28 items and 5 subscales: restraint, eating concern, shape concern and weight concern. A total score called 'global score' is an average of the subscales. We used a Danish version of the EDE-Q

validated in athletes.²⁷ A global score of >2.3 has been used to categorise female athletes at risk of EDs,^{28–29} while >1.7 has been suggested for male athletes.³⁰ SCOFF has five items designed to assess ED symptoms.²⁰ The responses are scored dichotomous as ‘yes’ or ‘no’, with two or more positive answers indicating the risk of an ED. A meta-analysis of the diagnostic accuracy of the SCOFF scale showed excellent performance.³¹ SCOFF has been translated and validated in Danish, showing reasonable sensibility and sensitivity.³²

In this study, we used the EDE-Q as the main instrument to identify ED symptoms as the interview guide was developed on the EDE interview.

We also included basic sociodemographic data such as age, gender, height, weight, athletic level and type of sport in the survey.

Interviews

The interviews followed an interview guide based on the EDE interview adapted to assess ED symptoms from DSM-5 and ICD-10. The present study developed an interview guide to diagnose EDs in athletes. The guide was called the Eating Disorder Interview for Athletes (EDIA). The EDIA is attached in online supplemental appendix 1.

Five interviewers conducted all 28 interviews between March and June 2021. All interviewers were certified in using the EDE interview. None of the interviewers had previous relations with the athletes.

The interviews were conducted on video due to restrictions from the COVID-19 pandemic. All interviews were transcribed based on audio recordings that lasted 31–114 min in high-risk athletes and 20–98 min in low-risk athletes. After the interview, all participants were offered oral feedback and evaluation with information about diagnosis and treatment options.

Qualitative analyses

Qualitative data from the semi-structured interviews were analysed through a GIA.³³ GIA is frequently used within the health area as it offers a straightforward method of systematic analysis of qualitative data to derive findings linked to evaluation questions. GIA is generic and, as such, not guided by explicit philosophical assumptions. Thus, findings are to emerge inductively from the themes in the raw data without restraints imposed by structured methodologies.

The interviewers summarised the main themes of the transcriptions based on the EDIA. The main themes were the central ED symptoms: eating concerns, weight concerns, shape concerns, excessive exercise and health problems. Data analysis was inductive and carried out through multiple readings of raw text regarding subthemes embedded in the content under these categories. All authors conducted the coding, and no software was used. Raw data were interpreted into a condensed summary format. The interpreters decided what data to use and what not to. Thus, one text segment may have

been coded into more than one subtheme, and some may not have been coded if not relevant to the categories. Essential quotations were added. The authors assessed trustworthiness by checking each other’s coding.

RESULTS

First, we present the ED diagnoses that athletes’ symptom descriptions indicated in the interviews. Next, we present the symptoms derived from the inductive approach for analysing interview data.

Eating disorder diagnoses in the athletes based on the clinical interview

An overview of the participants, the scores on EDE-Q and SCOFF and the suggested diagnoses are presented in [table 1](#) (the double line distinguish confirmed diagnosis from no diagnosis). The most common diagnoses, based on ICD-10, were EDNOS with restrictive eating patterns (EDNOS-r) (n=12) and atypical anorexia (AAN) (n=6).

EDE-Q was the main instrument for classification in this study. It identified 18 cases with scores above EDE-Q cut-off 2.3 and 9 cases with low scores on EDE-Q. However, EDE-Q failed to identify two athletes (ID 20 and ID 23) diagnosed with an ED in the interview.

SCOFF identified 18 cases with scores above the cut-off 2 and 8 with low scores. However, SCOFF failed to identify one athlete with an ED diagnosis (ID 18), while it found an ED not confirmed by the interview (ID 21).

[Table 2](#) contains the counts on true and false positive and negative results on EDE-Q and SCOFF, respectively. EDE-Q has a sensitivity of 90% and a specificity of 100%, while SCOFF has a sensitivity of 94% and a specificity of 88%.

A qualitative analysis of the eating disorder symptoms presented in the interviews

Based on the 28 interviews, the following categories were identified within the 22 subjects who displayed ED symptoms: eating concerns (restrictive or irregular eating, distress and guilt related to eating, binge eating and compensatory behaviours), weight concerns, shape concerns, excessive exercise and health problems. [Table 3](#) presents an overview of the ED symptoms derived from the EDIA. None of the above-mentioned themes emerged in subjects with no diagnosis (n=6). Thus, the qualitative results, including citations, are based only on subjects with confirmed ED diagnoses (n=20) and DE (n=2). We will examine the most prominent aspects of each category individually below: eating concerns, weight concerns, shape concerns, excessive exercise, and health problems.

Eating concerns

Restrictive or irregular eating

Athletes with ED symptoms reported having chaotic, irregular or restrictive eating patterns. All athletes indicated that they recently had restrained or did restrain the amount of food consumed, periodically or constantly.

**Table 1** Participant's sport, level, gender, BMI, EDE-Q, SCOFF and diagnoses based on ICD-10 and DSM-5

ID	Interviewer	Sport	Gender	BMI	EDE-Q	SCOFF	Diagnose ICD-10	Diagnose DSM-5
1	TTH*	Martial arts	F	19.8	5.29	5	AAN	OSFED—AAN
2	KKJ†	Rowing	F	28.0	4.74	3	EDNOS-r/AAN	OSFED—AAN
3	MBL‡	Rowing	F	24.9	4.38	Missing	EDNOS-r	OSFED
4	MBL	Cycling	F	22.9	4.24	4	AAN	OSFED—AAN
5	KKJ	Rowing	F	24.7	4.24	3	EDNOS-r	OSFED
6	TTH	Track and field	F	22.5	3.98	4	EDNOS-r/AAN (previous AN)	OSFED—AAN
7	ER§	Rowing	F	21.7	3.88	3	AAN	OSFED—AAN
8	MBL	Ice skating	F	19.8	3.68	Missing	AAN (previous AN)	OSFED
9	ER	Track and field	F	19.3	3.58	3	EDNOS-r	OSFED
10	TTH	Track and field	F	21.6	3.33	2	EDNOS-r	OSFED-r
11	KKJ	Cycling	F	19.7	3.23	2	EDNOS-r (previous AAN)	OSFED-r
12	ER	Track and field	F	19.2	3.22	3	EDNOS-r	OSFED-r
13	ER	Triathlon	M	25.8	3.13	2	EDNOS (mild)	OSFED (mild)
14	KKJ	Rowing	F	23.8	3.02	2	EDNOS-r	OSFED-r
15	ER	Swimming	F	22.6	3.03	2	EDNOS-r	OSFED
16	JB¶	Cycling	F	21.5	3.02	2	AAN	OSFED-r
17	MBL	Track and field	F	20.2	2.95	3	EDNOS-r	OSFED
18	ER	Track and field	F	22.1	2.79	1	AAN	OSFED-r
23	KKJ	Track and field	F	17.8	0.78	2	AAN	OSFED-AAN
20	KKJ	Cycling	F	20.5	1.59	2	EDNOS-r	OSFED-r
19	JB	Orienteering	F	24.1	2.22	0	No diagnosis (DE)	No diagnosis (DE)
21	KKJ	Swimming	F	22.3	1.48	2	No diagnosis (DE)	No diagnosis (DE)
22	ER	Track and field	F	17.3	1.29	1	No diagnosis	No diagnosis
24	TTH	Triathlon	F	20.1	0.29	0	No diagnosis	No diagnosis
25	TTH	Track and field	M	20.4	0.06	0	No diagnosis	No diagnosis
26	JB	Track and field	F	23.5	0.4	0	No diagnosis	No diagnosis
27	ER	Track and field	M	19.7	0	0	No diagnosis	No diagnosis
28	KKJ	Rowing	F	22.7	Missing	0	No diagnosis	No diagnosis

*is a female clinical psychologist and research assistant.

†is a female MSc and research assistant.

‡is a female clinical psychologist and professor.

§is a male clinical psychologist and research assistant.

¶is a male BA in psychology

AAN, atypical anorexia nervosa; BMI, body mass index; DE, disordered eating; DSM-5, The Diagnostic and Statistical Manual of Mental Disorders, fifth edition; EDE-Q, Eating Disorder Examination Questionnaire; EDNOS, Eating Disorders Not Otherwise Specified; EDNOS-r, Eating Disorders Not Otherwise Specified-restrictive type; ICD-10, International Statistical Classification of Diseases and Related Health Problems, 10th revision; OSFED, Other Specified Feeding and Eating Disorder; SCOFF, Sick, Control, One stone, Fat and Food.

Twelve out of 22 athletes reported that they had devalued or skipped meals throughout the day to lose weight or influence body shape. Ten athletes counted calories or followed a 1300–1500 kcal diet per day. One athlete reported that she drank 8 L of water a day to suppress hunger. The motives were related to concerns about weight, body shape and sports performance. ID 1 explained it:

If I had gone a whole day without eating, I was satisfied with myself. And my training sessions were

often placed at dinner time, so when I came home, I said to myself: I'm not that hungry today, and then maybe I wouldn't eat throughout the whole day. I just don't think that I ate that much. I mean, I was trying to skip all the meals that I could get away with.

Twenty-two athletes reported avoiding specific foods, which they may otherwise like, typically high in fat, sugar, carbohydrates, calories or processed foods. Four athletes explicitly stated this was with the desire to lose weight. ID 18 elaborated:

Table 2 Sensitivity and specificity of EDE-Q (n=27) and SCOFF (n=26)

	Eating disorder confirmed	No eating disorder confirmed
Positive result	True positive EDE-Q=18 out of 20 (90%) True positive SCOFF=17 out of 18 (94%)	False positive EDE-Q=0 out of 7 (0%) False positive SCOFF=1 out of 8 (12%)
Negative result	False negative EDE-Q=2 out of 20 (10%) False negative SCOFF=1 out of 18 (6%)	True negative EDE-Q=7 out of 7 (100%) True negative SCOFF=7 out of 8 (88%)

EDE-Q, Eating Disorder Examination Questionnaire; SCOFF, Sick, Control, One stone, Fat and Food.

So, I've cut everything possible, whatever I could strip. I eat cheese with the lowest fat percentage, and I only drink skimmed milk. I like bread but haven't eaten it for many years. So, yes, that's it, and of course sweets and all that stuff, I also have no interest in eating that.

Distress and guilt related to eating

Twenty athletes reported that thoughts about food, eating or calories were distressing, disturbing, distracting, irritating, burdensome or took up much mental space. Seventeen athletes often experienced emotions of guilt

Table 3 Psychological, behavioural and physical signs/symptoms of eating disorders in interviewed athletes

Psychological signs/symptoms	Behavioural signs/symptoms	Physical signs/symptoms
Self-critical thoughts (especially related to body weight, size or shape)	Restrictive eating or dieting	Amenorrhoea or menstrual dysfunction
Low self-esteem	Skipping meals	Bloating
Need for a sense of control	Avoiding specific food types	Hypothermia
Depressive thoughts	Excessive exercise	Fatigue and muscle weakness
Fear or anxiety of weight gain	Exercise despite injuries or training restriction	Skin problems
Distress in relation to weighing	Restlessness	Hair loss
Desire to perform better and weigh less	Binge-eating	Dizziness
Thoughts about food affect the level of concentration	Use of laxatives	Sleep disturbances
Competitive attitude	Excessive weighing or monitoring	
Previous history with eating disorder diagnosis	Wearing oversized clothes	

and shame concerning eating. ID 16 had experienced it like this: *"If I feel I have been eating too much or too sugary... Well, I get the feeling and self-perception that I weigh—I don't know—20 kg more than I really do."*

Many statements linked these thoughts to poor self-esteem and self-image: ID 1 had felt it like this:

I just think I had a very poor self-image, and I didn't feel that I was good enough. I wasn't good enough at my sport, I wasn't good enough at looking good, and I wasn't good at anything at all. So, I tried to take control of my eating because perhaps that could help me.

Binge eating and compensatory behaviours

Nine athletes were concerned, anxious or fearful of losing control of their eating or experiencing a binge-eating episode. Eleven athletes had experienced a subjective or objective binge-eating episode. Six athletes reported compensatory behaviour after binge eating or eating 'unhealthy foods' such as sweets, cake, ice cream, etc, or carbohydrate or fat-dense foods, like pizza, pasta and cheese.

Additional training was also used as a compensatory behaviour to avoid feeling guilty about eating. Eight athletes reported previous purging behaviour to compensate for (subjective) binge eating or eating calorie-dense meals. Although most of these athletes did not purge anymore, four still had thoughts about doing it.

Changes in the ability to train normally due to injury, disease, vacation or lack of training accessibility could trigger compensatory behaviours such as restrictive energy intake (reducing carbohydrate intake and increasing intake of vegetables and protein-dense foods).

This pattern is also common on days off from training. Athletes reported feeling anxious, depressed, frustrated or fearful of becoming fat or gaining weight. While injured from running, ID 23 mentioned that she chose not to participate in a family vacation because she experienced distress at the thought of not having access to a gym: *"As we were heading to Malta, I was about to die not knowing if there was a gym because I was unable to run... it's alright that I am not running now, but then I do excessive bike sessions on my home trainer."*

Weight concerns

Twenty athletes reported being unsatisfied with their weight, and 15 athletes had a desire to lose weight. ID 4 explained: *"I want to do everything to become the best, but if I am to be the best, I have to be sickly thin. All cyclists are constantly dieting, and there are no limits to how thin you can be."*

Reasons for weight concerns included body image, sports performance and feeling uncomfortable after weight gain. Eighteen athletes were anxious about gaining weight during an injury. They felt triggered by comments from coaches or teammates, and ID 4 experienced

pressure from her family: *“My father says that cyclists starve themselves. He says I shouldn’t weigh more than 60 kg.”*

Five athletes were ambivalent about their weight. On the one hand, they wanted to lose weight, while on the other hand, they worried about losing muscle mass negatively impacting sports performance: ID 8 explained: *“If I lose weight, I will think of my thighs—my legs look tiny as if I am losing muscle mass.”*

The athletes had varying attitudes towards weighing themselves. Some strived for control by weighing themselves regularly, while others avoided the scale because they felt emotional distress from seeing their weight.

Shape concerns

Twenty-one athletes experienced dissatisfaction with their bodies, especially their legs, waist, hips, arms, ribs and stomach. Three athletes reported a feeling of being fat on the face, shoulders or back. ID 5 expressed: *“There are some days where I just don’t want to be in my body.”*

The athletes reporting shape concerns used terms like embarrassment (shame), distress, feeling fat, chubby, sad and insecure. The feeling of shame caused some athletes to cover or hide their bodies in oversized clothing. ID 15 elaborated: *“Well, I think that as a swimmer... you are almost undressed when you do your sport. I look down at my body every single day. I don’t think a day passes where I don’t think that I want my legs to be skinnier.”*

The reasons for being dissatisfied with the body were aesthetical, comments from coaches or teammates about their body, a great desire to have an athletic appearance (toned muscles and visible blood vessels), comparing bodies in sporty outfits, striving for weight optimisation and a fear of others’ thoughts.

Twenty-one athletes tried to control their body and appearance by assessing body fat percentage, body weight and muscle mass and checking their bodies in the mirror or windows. Furthermore, 12 athletes used an app to monitor body size, assess fat around the stomach or thighs or check if the clothes still fit. However, eight athletes said that they tried to protect themselves from scales, mirrors and photographs to prevent triggering a negative body perception.

Excessive exercise

All athletes described increasing exercise volume and intensity to burn calories, prevent weight gain or modify body shape and tone muscles. The athletes practised various cardio exercises, usually long walks, cycling as transport, running and strength training. These extra workouts were usually beyond their coach’s recommendations. However, two athletes had been told by their coach to do extra cardio to lose weight. Twelve athletes reported that they had exercised or regulated their diet in periods where they dealt with injuries. ID 17 expressed how exercise satisfied the need for control: *“There is so much control connected to training in minutes and distance. I don’t want to let that control go at all.”*

Health problems

All athletes reported that body and health were influenced by their eating and exercise patterns. Nine athletes experienced amenorrhoea due to low body fat, ranging from a couple of days to >2 years. Eleven athletes explained that they often felt pain and tenderness during training. In addition, seven athletes reported increased cold sensitivity and freezing due to prolonged training and insufficient energy intake. Despite wearing more clothes than others, they still felt cold, especially around their fingers and toes. Other health issues were skin problems, hair loss, hunger, energy loss and dizziness.

Twelve athletes experienced physical or mental fatigue in general and in connection to training. They explained that they felt exhausted and the body needed a longer recovery time. They also reported poor sleep, not being able to relax and more illness. For example, ID 9 explained how fatigue influenced physical health: *“I clearly feel days where I am, like, have avoided eating or haven’t eaten, I clearly feel that I become much more tired and that I become tired faster. Also, my muscle recovery becomes a lot worse.”*

The athletes also experienced that their mental health was affected by obsessive exercise and weight loss. ID 9 further elaborated on fatigue and mental health: *“I mean, when I become tired and such, I don’t perform how I am supposed to in training, and then I become sad or disappointed. I become disappointed about myself and my performance.”*

DISCUSSION

Eating disorder diagnoses in athletes

Clinical interviews using EDIA found 20 athletes with ED diagnoses according to ICD-10 and DSM-5. Of these, 72% were diagnosed with EDNOS, and 28% had atypical anorexia. The EDIA found ‘no diagnoses’ in eight athletes, but two of them presented subclinical symptoms (DE). None of the athletes in the present study had AN because body mass index (BMI) was over 18.5 (probably due to high muscle mass), and none presented regular binge-purging behaviour. Two athletes reported that they had previously been diagnosed with AN but had increased body weight during the year before the interviews.

Unspecified ED diagnosis was the most prevalent pathology in female athletes presenting for ED treatment in a study by Strandberg *et al.*,³⁴ finding 60% with OSFED, 33% with AN and 7% with BN. EDNOS or OSFED are conditions that may be less visible or perceived as normal in the sports culture. This reality contributes to the perception of not being ‘sick enough’ to warrant treatment. It serves as an obstacle to assessment and timely intervention, putting athletes’ health at risk.

Sensitivity and specificity of EDE-Q and SCOFF

This study confirmed that EDE-Q and SCOFF presented high external validity in identifying ED diagnoses. EDE-Q presented 90% sensitivity and 100% specificity, while SCOFF presented 94% sensitivity and 88% specificity.

These findings indicate that EDE-Q and SCOFF can be used to screen athletes for EDs, but false negatives

(under-reporting) may appear using EDE-Q. At the same time, over-reporting was not an issue in the current study. Using SCOFF, there is a small risk of false positives (one case) and false negatives (one case).

Thus, previous prevalence studies on ED symptoms based on SCOFF and EDE-Q seem to be valid and reflect a true problem. However, a sport-specific screening instrument may increase specificity and increase the knowledge about sport-specific eating concerns and body dissatisfaction.

A study on eating disorders in sport by Fewell *et al*³⁵ found that athlete patients had significantly lower EDE-Q scores than ED in non-athlete patients, indicating under-reporting of athletes in self-report measures. The authors suggested using a clinical interview for more accurate accounts of ED symptoms, despite being less feasible due to time and expense. We recommend using a diagnostic interview such as EDIA to confirm the type and severity of the diagnosis in an athlete sample.

Athletes' eating concerns and patterns

The athletes often described their eating patterns as restrictive and irregular, with different attempts to reduce the number of calories per day (counting calories, eating healthy foods, skipping meals, following a diet and avoiding sugar and fat or processed food). Feelings of shame, guilt, anxiety and distress were typical food-related emotions. Compensatory behaviours reported after binge eating, 'eating unhealthy foods', injuries or vacations were restrained eating, obsessive exercise or purging attempts. Regarding injuries or changes in exercise routines as risk factors, our findings are consistent with findings from a qualitative analysis of factors related to ED onset in female collegiate athletes and non-athletes by Arthur-Cameselle *et al*.¹ They found that fears of weight gain because of less physical activity, for example, injuries or illness, could lead to overcompensation via restrictive dieting or purging.

Body dissatisfaction, triggers and health consequences

The current study found that motives for restricting eating were the desire for an athletic, muscular and aesthetic body in the athletic culture. Adding to this, Arthur-Cameselle *et al*¹ found that more than two-thirds of the athletes reported that the sports environment was related to the onset of EDs. Performance pressure was a trigger like an attempt to improve performance or achieve perceived body norms.

Moreover, athletes in our study reported embarrassment and dissatisfaction with their legs, stomach and hips, despite having normal BMI values and athletic bodies. A study from Iceland found high levels of body dissatisfaction in elite athletes across 20 different sports,¹⁶ pointing at the pressure to conform to an ideal body shape to improve performance. In that study, body dissatisfaction was a predictor of EDs. A Dutch study also found that negative body image was related to EDs in female elite athletes.³⁶ Athletes with EDs felt fatter than

athletes without EDs, despite no weight or body composition difference. The study also found that athletes often compare their bodies with competitors, triggering body dissatisfaction. These findings agree with the study by Arthur-Cameselle *et al*,¹ who found that almost all athletes reported poor body image or body image concerns, resulting in negative comparisons to peers, even though they were not overweight. More than two-thirds reported feelings of inadequacy when they compared themselves with others. The authors speculated whether this could be an example of a double bind, where the athlete feels competent in sports but inadequate when it comes to attractiveness.^{1 37 38}

Furthermore, several athletes in our study reported ambivalence about weight and shape. They feared weight gain and were striving for low body weight, but at the same time, they were aware that energy and muscle mass is important for sports performance. In a qualitative analysis of cultural and environmental associations with body image, diet and well-being in female distance runners,³⁹ a so-called 'runner-body' was described by one runner as a 'series of contradictions' where you were to be 'firm but shapely, fit but sexy, strong but thin'. The runners noted a complex and competitive perspective from two different contexts: they wanted to fit society's role of being 'skinny' but still look healthy and perform well within their sport. The nine athletes participating in a qualitative study about social pressure in elite sports and EDs by Stoyel *et al*⁴⁰ noted this duality of the ideal athlete body.

Some athletes in our study reported controlling or assessing their body dimensions daily. Others reported not weighing themselves or monitoring bodily appearance because it would lead to increased body control and restrictive behaviours. In the study by Arthur-Cameselle *et al*,¹ almost half of the athletes described perfectionism and a desire for control. Regulating food intake allowed them to feel 'perfect', which led to over-reliance on ED behaviour.

In addition, we found that comments from coaches, teammates or parents could trigger or maintain DE behaviours. These findings agree with Carson *et al*,³⁹ who found that coaches' comments about body weight and shape add further pressure on female athletes, regardless of whether the comments were targeted directly at them. Food-related and weight-related comments were reported to contribute to a harmful team environment and influence athletes' eating and exercise behaviours. Similarly, the study by Arthur-Cameselle *et al*¹ found that three-quarters of the athletes had experienced peer issues as triggers to the onset of EDs, and more than half of the athletes identified harmful influence from peers who modelled DE and exercise leading to an imitation of unhealthy habits or competitive dieting. Finally, a study by Byrne and McLean⁴¹ has shown that especially female athletes tend to experience sociocultural pressure to conform to a lean body shape, which is in concordance with our study. This constitutes a problem, as the same study indicated that thin-build athletes have

a greater risk of having or developing EDs than normal-build athletes.⁴¹

Finally, several athletes in the current study also reported health consequences. Examples were: amenorrhoea, pain, freezing, hair loss, dizziness, energy loss, fatigue, exhaustion, frequent colds, sleep problems, restlessness, stress, reduced performance and reduced recovery after exercise. Most of these symptoms are often seen in a well-described condition called relative energy deficiency in sport (RED-S), where the body lacks the energy to meet the demands of the performed amount of exercise. A strong association between EDs and RED-S has been reported.²⁻⁶

Clinical implications and future recommendations

To detect and address symptoms of EDs among athletes, we have summarised the symptoms covered in our study in table 3. Athletes, coaches and relatives can use the table to increase knowledge and awareness of ED symptoms in athletes. Systematic screening of athletes and referral to a multidisciplinary team was recommended in a review focusing on the assessment and management of EDs in athletes.⁴²

For further elaboration on how to detect, address and manage EDs in athletes, we refer to the guidelines by the National Athletic Trainers' Association and the 'Coach and Athletic Trainer Toolkit' by the National Eating Disorder Association.^{43 44} These guidelines emphasise the unique position of coaches to play an active role in detection of ED symptoms and encouraging referrals to health professionals for full evaluation and treatment of ED symptoms in athletes.

However, we discovered that sometimes coaches trigger and maintain these symptoms. Thus, it is of importance that athletes have a supporting environment, where especially coaches are educated in spotting ED symptoms and how to support athletes. This calls for structural changes in sports federations to ensure commitment from coaches. An issue in most sports is that coaches are often primarily volunteering with limited time for education.

Limitations of the study

This study did not include a control group of non-athletes completing the questionnaires and the interviews. Almost all participants were females, but future studies should include more males to explore potential gender differences in eating and body pathology.

To strengthen the study, the quantitative analyses, based on the questionnaires, were supplemented by the qualitative analyses from the interviews.⁴⁵ It is a strength that 28 athletes were interviewed, and data saturation was reached.

Limitations include that the transcripts were not returned to the interviewees for feedback on the correctness of the transcriptions and that the codes were not stakeholder checked⁴⁶ by letting the participants provide feedback on the findings.²⁶ However, it may increase the reliability and internal validity of the findings⁴⁷ and

enhance the credibility of the analysis that five researchers have worked together on coding the data.^{33 48}

CONCLUSION

This mixed-methods approach found that EDE-Q and SCOFF are valid instruments to identify athletes at risk of EDs with high sensitivity (>90% and >94%) and specificity (100% and >88%). Athletes do not over-report ED problems according to EDE-Q but may under-report. Sport-specific instruments are recommended to increase the sensitivity by identifying athletes with subclinical scores on generic tools. Still, despite SCOFF being a short, generic tool for large screening purposes, it picks up ED pathology.

The most prevalent symptoms of the athletes were restrictive eating patterns, weight and shape concerns related to athletic appearance, comments from coaches/teammates, fear of weight gain, body shame, excessive exercise, especially in periods with injuries and health problems (pain and fatigue). These findings indicate that athletes with ED symptoms are highly distressed about eating/foods, exercise and bodily appearance triggered by the sporting environment despite having athletic bodies.

Increased information about ED symptoms, routine screening with validated instruments and clinical interviews (such as EDIA) may help identify EDs and thus prevent severe cases.

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EATING DISORDER EXAMINATION INTERVIEW

The aim of this interview is to explore symptoms of eating disorders among athletes and based on the answers from the questionnaires, to evaluate whether we are able to find athletes that exhibit symptoms of an eating disorder. In addition, we aim to understand athletes' experiences with the development of an eating disorder in the elite sport environment. We invite both athletes with a high and low score in the EDE-Q and SCOFF.

Theme	Say out loud to the athlete
Introduction	<p>Welcome to this interview and thank you for participating.</p> <p>My name is XX, and I am part of this research project and trained in conducting this interview that we will go through together.</p> <p>I will record this interview and based on this interview we will publish a report and research articles in which you of course will stay anonymous. No one except for my research colleagues will get access to these data, and once we have analysed all our data, they will be deleted. Is that all right with you?</p> <p>The interview is about your eating habits and your relationship with your body, weight, food, and exercise.</p> <p>We will spend the next 1-1.5 hours together. I will ask you some questions that I would like you to answer as precise and honest as possible.</p> <p>I have confidentiality, and only the researchers in this project will be involved, unless we agree upon otherwise.</p> <p>After 1-2 weeks, once I have discussed it with my research colleagues, you will receive an oral evaluation based on our interview.</p> <p>Are you comfortable? Are you in a quiet place?</p> <p>I am at home/work, and no one can hear our conversation.</p> <p>I have this guide in front of me that I need to follow. Therefore, if you see me looking down, I am just reading the questions or taking notes. I will still hear everything you say. Some of the questions might seem very personal, and it is fully up to you whether you would like to answer or not. You might also experience that some of the questions does not make sense to you. I'll have to ask them anyway.</p> <p>If you need a break at some point - if you need to go to the toilet, or have something to drink, just let me know.</p> <p>As we are unable to do this interview in person, I need your oral consent. By doing so, you agree upon that we can obtain your personal information. If you regret, you can always withdraw your consent. If you want something from the interview deleted, just let me know.</p>

EATING HABITS

Eating habits	To start with, I would like you to give me a general description of your eating habits during the past 1-2 months. What does a normal day/week look like for you? Do you eat regularly and varied, for example breakfast, lunch, dinner, and snacks? Do you skip meals?
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	Do your eating patterns change from day to day? Does weekdays and weekends differentiate?
Restrictive eating behaviour	Have you deliberately tried to limit the amount of food that you consume during the day? What have you tried to do? Do you limit the food you eat with the intention of losing weight or because you are dissatisfied with your figure?
Avoiding eating behaviour	Have you had periods of 8 hours or more awoken hours without eating anything at all?
	Was it with the intention of influencing your shape or weight?
Avoidance of certain foods	Have you deliberately avoided certain foods that you normally like?
	Was it with the intention of influencing your shape or weight?
Diet restrictions	Have you tried to follow certain rules regarding your eating? For example, a certain calorie limit, a certain amount of food or rules concerning what or what not to eat, or when to eat?
	Are the rules to influence your shape or weight or to avoid binge eating?
	Have the rules been stressful for you and do you experience that they limit your life?
Excessive focus on food, eating or calories	Have you spent much time thinking of food, eating, or calories in between meals?
	Have these thoughts made it difficult for you to concentrate – for example during work, following conversations or reading?
Guilt of eating	Have you felt guilty after eating an ordinary meal? Does it happen often?
	Could you more explicitly talk about why you have a sense of guilt and how it affects you?
Fear of losing control of eating	Have you had concerns about losing control of over your eating? For instance, being concerned about continuing to eat without the capability of stopping again?
Binge eating episodes (If no binge-eating, move on to the next question)	Have you experienced binge-eating episodes in which you ate an unusually large amount of food within a short period of time? Do you experience these episodes when you get too hungry? Or when you feel sad, stressed, or lonely?

	<p>Do you feel a sense of losing control while bingeing?</p> <p>Is it impossible for you to stop eating even though you are feeling full?</p> <p>Do you experience a sense of shame and guilt while bingeing?</p>
	<p>How many times per week do you experience episodes of binge eating and a sense of lacking control?</p>

COMPENSATORY BEHAVIOR

Self-induced vomiting	<p>Have you deliberately tried to vomit as a means of controlling your weight or shape?</p>
	<p>If you succeeded in vomiting – on average, how often do you vomit per week?</p>
Laxative misuse	<p>Have you taken laxatives as a means of controlling your shape or weight?</p> <p>If yes – which and how often?</p>
Diuretic misuse	<p>Have you taken diuretics as a means of controlling your shape or weight?</p> <p>If yes- which and how often?</p>

EXERCISE BEHAVIOR

<p>Excessive exercise</p> <p>Excessive exercise can be an attempt of regulating weight (AN) or to compensate for binge eating (BN)</p>	<p>Have you been exercising as a means of controlling your weight, body or to burn calories?</p>
	<p>Do you exercise more than your coach recommends?</p>
	<p>How would it make you feel if you were unable to exercise?</p>
	<p>Do you exercise despite pain and injuries?</p>
	<p>Would you regulate eating if you were injured?</p>

WEIGHT CONCERNS

Weight concerns	Have you been dissatisfied or unhappy about you weight (the number on the scale)?
Strong desire to lose weight	Have you had a strong desire to lose weight?
Preferred weight	If you could choose your own weight, what would it be?
	How often do you weigh yourself on the scale?
Fear of gaining weight	Have you been worried that you might gain weight? Have you had a fear of gaining weight if you have been injured or exercised less than usual (or unable to exercise as usual)?

SHAPE CONCERNS

Shape concerns	Have you been dissatisfied or unhappy about your body shape?
Excessive focus on shape	Do you spend a lot of time thinking about your body shape?
Discomfort with body shape	Have you felt uncomfortable seeing your body, for example in the mirror, in a shop window reflection, while undressing or taking a shower?
	Have you avoided looking at your body?
Avoidance of body exposure	Have your felt uncomfortable about other people seeing your body – for example, in communal changing rooms, when swimming, or wearing tight clothes showing your body?
	How did it make you feel?
	Have you avoided that others would see your body? Do you often wear clothes that hide your body?
Feeling fat	Have you felt fat? If yes, in which part of your body, do you feel fat? For instance, your thighs or belly?
Body surveillance	Have you kept an eye on your body by studying yourself in the mirror, measuring your body or by checking that certain clothes fit?

Body composition	Have you had a strong awareness of your fat percent or muscle mass?
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HEALTH ISSUES

Health	Do you have any health issues due to your eating or over-training?
	Do you often experience soreness in your muscles/tendons/joints or lack of energy?
	Do you feel colder than usual?
Menstruation	In the past few months, have you lost your period or experienced that it was irregular? The question is only relevant for women who do not use contraceptives.

END OF INTERVIEW

	<p>Thank you for participating in this interview.</p> <p>How was it answering the questions?</p> <p>Is there anything, you would you like to add?</p> <p>During the next couple of weeks, I will evaluate our interview with my research colleagues. After this, I will give you oral feedback. I will get back to you as soon as possible.</p>
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