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Case Report: From disordered eating to an eating disorder—a case study of an orienteering athlete with anorexia nervosa and the shortcomings of the multidisciplinary approach

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This case study explores the transition from disordered eating (DE) to an eating disorder (ED) in a 23-year-old female orienteer. Despite her talent as an athlete, her eating habits and training practices led to significant health concerns. After following an ovo-lacto vegetarian diet for 3 years, she exhibited symptoms of DE, including low energy intake (1,200 kcal/day), low body weight (50.1 kg, BMI: 16.9), and amenorrhea. Her condition deteriorated over 2 years, resulting in a diagnosis of anorexia nervosa (AN) by February 2023. During the treatment process, the athlete utilized a multidisciplinary approach that included dietitians, psychologists, and physicians. Despite achieving some initial progress, including a slight increase in body weight and the return of menstruation in July 2022, her health declined after psychological consultations were halted, leading to a further decrease in body fat and persistent low serum iron levels. This case highlights the importance of continuous monitoring, timely intervention, and a coordinated multidisciplinary team in addressing DE and ED in athletes. It also highlights the significance of effective communication among healthcare professionals and the need for comprehensive treatment strategies that include psychological, nutritional, and medical support. This study highlights the significance of early detection, suitable intervention, and the prevention of long-term health complications, such as decreased bone density and cardiovascular issues, in athletes with DE and ED.

KEYWORDS

disordered eating, eating disorder, athlete, anorexia nervosa, multidisciplinary approach

Introduction

Adequate nutrient intake is essential for achieving optimal athletic performance (Holtzman and Ackerman, 2021; Jeukendrup, 2017). Individualized nutrition strategies, developed by dietitians and sports nutritionists, play a crucial role in health promotion, body composition optimization, performance enhancement, and postinjury recovery (Chatterton and Petrie, 2013; Martinsen and Sundgot-Borgen, 2013; Sundgot-Borgen and Torstveit, 2004). However, many athletes depend on unqualified sources—such as coaches, parents, or teammates—for nutrition advice. This can lead to unsupervised practices that increase the risk of disordered eating (DE) and eating disorders (ED) (Mancine et al., 2020).

The prevalence of DE and ED among athletes is rising and is notably higher compared to the general population (Ghazzawi et al., 2024; Martinsen and Sundgot-Borgen, 2013; Sundgot-Borgen and Torstveit, 2004). While it was once believed that only female athletes suffer from DE and ED, it is now recognized that male counterparts can also be affected (Chatterton and Petrie, 2013). However, female athletes still exhibit a higher prevalence of these conditions (Hazzard et al., 2020; Cabre et al., 2022). Every sport discipline is affected, but those involving esthetics (dance, gymnastics, rhythmic gymnastics, etc.), endurance (running, canoeing, diving, etc.), and weight-dependent sports (wrestling, judo, taekwondo, karate, etc.) are particularly at risk (Mancine et al., 2020; Sundgot-Borgen and Garthe, 2011). Additionally, team sports have been recognized as including a group of vulnerable athletes (Kampouri et al., 2019; Gouttebarga et al., 2018).

Among athletes, DE includes all pathological behaviors aimed at periodically reducing body weight, such as meal restriction, the use of weight-loss pills, binge eating, and purging, or enhancing sports performance (Wells et al., 2020). Clinical EDs are characterized by more severe and frequent behaviors, such as fasting, binge eating, and purging several times a week. Unlike DE, which involves a less pervasive preoccupation with food, ED significantly disrupts an individual's daily life (Wells et al., 2020).

DE and ED are multifactorial conditions that exist on a spectrum, as described by the Australian Institute of Sport (AIS) and the National Eating Disorders Collaboration (NEDC) in 2020 (Wells et al., 2020). Optimal nutrition serves as the foundation, supplying the energy necessary for both health maintenance and athletic performance. When this balance is disrupted, symptoms of DE may appear. Without intervention, DE can progress to ED, a clinical condition with serious health implications (Wells et al., 2020).

Both DE and ED can be managed using a multidisciplinary approach, involving physicians, psychiatrists, and dietitians in the medical team (Cena et al., 2022; Temme and Hoch, 2013; Joy et al., 2003). Physicians assess overall health, prescribe medication when necessary, and suggest mental health and nutritional interventions (Mairs and Nichols, 2016; Woodruff et al., 2020; Cena et al., 2022). Dietitians examine eating behaviors, monitor physical symptoms, and develop personalized nutritional plans, while psychologists and psychiatrists provide psychotherapy, track mental health progress, and prescribe medication as needed. The multidisciplinary team may also involve physiotherapists, coaches, family members, teammates, or others essential to the athlete's recovery (Joy et al., 2016). Despite this structured approach, recovery outcomes remain challenging, with only 40–50% of patients achieving full recovery (Joy et al., 2003).

There are several internationally accepted manuals for diagnosing EDs, such as the *Diagnostic and Statistical Manual of Mental Disorders* (DSM) (American Psychiatric Association, 2013), the *International Statistical Classification of Diseases and Related Health Problems* (ICD) (World Health Organization, 2019), the *Chinese Classification of Mental Disorders* (CCDM) (Chen, 2020), *Psychodynamic Diagnostic Manual* (PDM) (Lingiardi and McWilliams, 2015). Currently, the *Diagnostic and Statistical Manual of Mental Disorders*, Fifth Edition, Text Revision (DSM-V-TR) with text revisions is the most comprehensive clinical resource available including updated diagnostic criteria and the International Classification of Diseases, Tenth Revision, Clinical Modification (ICD-10-CM) codes (American Psychiatric Association, 2024).

Insufficient nutrient intake can negatively affect various areas. Among athletes, prolonged low energy availability (LEA), lasting for weeks or months, can lead to a decrease in sports performance as well as health deterioration, as defined by the term Relative Energy Deficiency in Sport (REDs) by the International Olympic Committee's Medical Commission (Mountjoy et al., 2023). This syndrome affects multiple organ systems, including the endocrine system, cardiovascular system, immune system, and gastrointestinal system. It also impacts growth, bone health, and mental state (Cabre et al., 2022; Logue et al., 2020). Furthermore, the increased risk of injury contributes to the number of missed training hours, subsequently resulting in a decline in sports performance (Henninger et al., 2024; Joubert et al., 2020; Rauh et al., 2010).

Petrie and Greenleaf (2007) summarized a theoretical model highlighting several factors that may influence athletes' disordered eating behaviors. This model suggests that social and sport-related pressures can lead to body dissatisfaction, which may result in restrictive eating, followed by binge eating and the onset of other disordered eating behaviors. Different moderators play a role at each stage, with body dissatisfaction influenced by weight and body shape, while restrictive eating is shaped by perfectionism, body perception, neuroticism, and self-esteem. Family and peer behavior models also play a role in the occurrence of the problem (Petrie and Greenleaf, 2007).

Although longitudinal studies on the connection between DE and ED are limited, research indicates that DE rarely resolves without appropriate intervention (Mountjoy et al., 2014; Gouttebarga and Kerkhoffs, 2017). Both DE and ED have negative effects on health in various ways, including adverse changes in body composition (reduced body weight and fat ratio) and abnormal blood test results (serum iron, ferritin, fasting blood sugar, and hormonal imbalances). These complications can result in long-term health issues, such as amenorrhea and iron deficiency, which hinder performance (Attwell et al., 2022; Hulmi et al., 2017; Banfi et al., 2012; Gordon, 2010). The diagnosis of EDs is often delayed because symptoms can remain hidden for extended periods (Tan et al., 2016).

All of these conditions underline the importance of early recognition and prevention, as well as the need for continuous joint action of the multidisciplinary team. In our study, there was a lack of proper cooperation among the members of the medical staff which led to serious health deterioration.

Patient information

We present the 2-year case study of a 23-year-old female orienteer who has been involved in the sport since the age of 13 and has been following an ovo-lacto vegetarian diet for 3 years. She is a talented athlete; in the year prior to the intervention, she competed in 45 events and won medals in 20 of them. We aim to illustrate how her symptoms transitioned from DE to ED. This case study was approved by the Human Ethics Committee of ELTE Eötvös Loránd University, Faculty of Pedagogy and Psychology (license number: 2023/104). The athlete gave written permission to publish the results. Detailed first-year information is available from a previous study (Kovács and Boros, 2024). We sought special permission to disclose the data in the medical documentation from the institution where the treatments were conducted.

The starting point was in February 2022, when she visited the ambulatory dietetic care. She sought support from her coach and was also motivated by her own determination. Her current goal was to focus on achieving her best performance; however, her coach was rather worried about her health. According to her food diary, she consumed an average of 1,200 kcal/day (25.9 kcal/fat-free kgs) and trained 6 days per week. She was 1.73 meters tall, weighed 50.1 kg, had a BMI of 16.9 kg/m², and a body fat percentage (PBF) of 7.5%. She had not had her menstrual period and had not undergone a gynecological examination since 2020. The laboratory results confirmed low levels of serum iron. Before she became vegetarian, she weighed 57–58 kgs, and her periods were regular.

Therapeutic intervention and clinical findings

Following the nutritional assessment, she underwent consultations with an internist, psychologist, and psychiatrist, after which a common therapeutic assessment commenced in May 2022. According to the DSM-V, she did not meet the criteria of an ED, but she exhibited several DE symptoms. She counted calories but was not afraid of gaining weight; rather, she worried about not consuming a sufficient amount of energy. Moreover, she declined restaurant invitations because she believed that there would not be suitable dishes for vegetarians. Based on the medical team's decision, it was not necessary to revoke her competition license or reduce her training volume. Psychiatric medicine prescription and hospitalization were also deemed unnecessary. She started working with a sports psychologist, who also worked with the athlete's teammates. To help regulate her serum iron levels, Krauterblut syrup was recommended by the nutritionist (OGYI-NYTSZ-337/92).

Throughout the treatment process, monthly dietary assessments, biweekly psychological evaluations, and semiannual internal medicine examinations, including blood test analysis, were conducted. During the dietary consultations, body composition measurements [performed with an (InBody Co., Ltd., Seoul, Korea) device; [Brewer et al., 2021](#)] and food diary analysis (with Nutricomp DietCAD software) were conducted. The athlete did not want to follow a structured diet prepared by the specialist, but she agreed to discuss and review her meals during each meeting. The therapeutic goals were defined as follows: a minimum BMI of 18.5 kg/m² (~ 55 kg), a minimum of 12% body fat, and the maintenance of regular menstrual cycles. The medical team never convened a joint meeting to discuss the athlete's condition and further treatment recommendations, so the practitioners were informed by the athlete about the progress she was making in each of the respective fields. The internist and the dietitian were at the same institute, so they accessed each other's documentation regarding the athlete; however, there was no information about the psychological consultations.

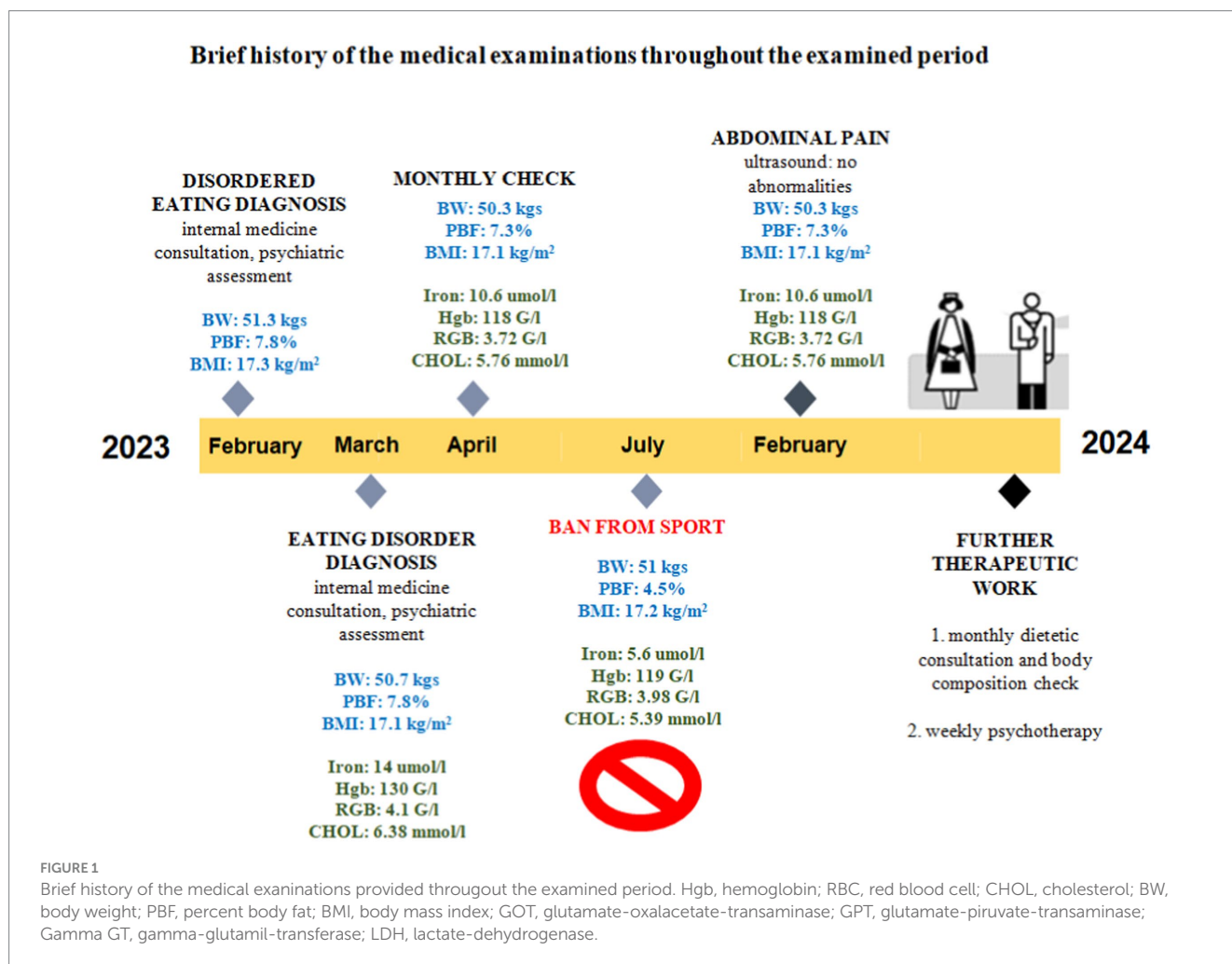
In her first year, she achieved initial success. Her body weight slightly reached the therapeutic goal (54.8 kg), so her body fat percentage (11%), and in July 2022, she had her menstrual period. The body composition results started to deteriorate after the suspension of the psychological

consultations (August 2022). By the end of the first year (February 2023), the orienteer was diagnosed with an ED [anorexia nervosa (AN)]. The events of the upcoming year are summarized in [Figure 1](#). Psychological consultations were recommended to be restarted urgently, but this time weekly instead of biweekly. Concerning the competition license, she was still not banned from sport. The most important thing for the athlete was to be still able to compete, but she was not aware of her serious health condition. In April 2023, the athlete's body weight dropped below 50 kgs (BMI 16.7 kg/m²). Her serum iron levels remained low, as did the red blood cell and hemoglobin concentrations. By July, the body fat percentage dropped to 4.5% when a cardiology examination was performed with no abnormalities. The medical team determined that AN clearly presented her medical history and current physical condition, which required the immediate revocation of her competition license. Hospitalization and psychiatric prescriptions were not recommended. At this point, the coach radically reduced the training volume rather than eliminating it entirely (as would have been necessary, but the athlete strongly opposed it). For the next 6 months, contact was made more difficult by an Erasmus scholarship program, which meant that the athlete was abroad. We overcame this by having her body composition checked at a foreign university, which was evaluated online by the dietitian. She also participated in individual online therapies with the sports psychologist. After returning home in February 2024, the athlete reported severe abdominal pain and spasms, especially after meals. An abdominal ultrasound was conducted, which revealed no abnormalities. However, the laboratory results indicated concerning findings for liver function (GOT-glutamate-oxalacetate-transaminase, GPT- glutamate-piruvate-transaminase, gamma GT- gamma-glutamyl-transferase, LDH-lactate dehydrogenase), and no further investigation was conducted. It was recommended to start psychotherapy with a clinical psychiatrist specialized in eating disorders instead of a sports psychologist. From then on, therapy included weekly psychiatric consultations (now with the ED specialist), monthly dietary counseling, and quarterly internal medicine check-ups.

Follow-up and outcomes

Since then, the athlete's condition had improved. However, similar to the previous 2 years, there had been minor setbacks in body weight and body composition due to personal life problems. Her current weight was 54 kg, her body fat percentage was 10.8%, and her abdominal pain had disappeared. Although these values did not yet reach the target set at the beginning of the therapy, she had maintained them steadily in recent months. The frequency of psychiatric consultations had been reduced to once every 2 weeks. Psychiatric prescription was still not recommended.

In October 2024, after a joint decision by the medical team, the athlete was issued a 1-month competition license. Her training load had increased, but she had not yet returned to her preintervention level. The competition permit was renewed each month, with the consent of the dietitian and psychiatrist.



Regarding her eating habits, she continued to follow an ovo-lacto vegetarian diet. The blood test results indicated a slight increase in serum iron levels, hemoglobin, and red blood cells; however, these levels still remained low. Cholesterol and liver function markers had normalized. She has had her menstrual period once since then, marking the second occurrence since 2020. Consequently, the sports physician referred her for a dual-energy X-ray absorptiometry (DXA or DEXA) bone density test that revealed early-stage osteoporosis in the spine. Further endocrinological testing is ongoing.

Discussion

The relationship between low body weight, body fat percentage, and amenorrhea

The most serious issue in this case is the low body weight and body fat percentage, which was accompanied by amenorrhea. Low body weight, inadequate nutrition, and excessive physical activity can collectively disrupt the production of sex hormones (such as estrogen and luteinizing hormone), leading to menstrual irregularities or even the

complete cessation of menstruation (Berz and McCambridge, 2016; Klein and Poth, 2013; Winston, 2012). This is particularly critical among female athletes, as amenorrhea not only threatens reproductive health but also raises risks, such as decreased bone density and stress fractures (Costa et al., 2022). Therefore, restoring energy balance and maintaining adequate body fat levels are essential (Melin et al., 2019; De Bruin, 2017; Mountjoy et al., 2014).

The link between high cholesterol levels and anorexia nervosa

Throughout the observed period, the athlete's cholesterol levels remained consistently elevated. Previous studies indicate that in cases of AN, endogenous cholesterol production increases, likely triggered by the body's energy-deficient state (Hussain et al., 2019; Winston, 2012). This may arise from the liver's compensatory mechanism trying to maintain the necessary lipid levels necessary for cellular function. This increase in cholesterol poses long-term cardiovascular risks, especially if other metabolic issues are present. A thorough review of the diet and addressing nutritional deficiencies

are essential for managing the condition (Neglia, 2021; Melin et al., 2015).

Suspected superior mesenteric artery syndrome

Although the abdominal ultrasound report was negative, the symptoms indicated the possibility of superior mesenteric artery syndrome (SMAS). This condition typically occurs in cases of significant weight loss, where the reduction of abdominal fat causes the artery to compress the duodenum, resulting in digestive issues and severe pain (Bloomberg et al., 2023; Singh and Contrucci, 2023). SMAS is often associated with EDs and can serve as a warning sign of AN (Recio-Barbero et al., 2019; Sato and Fukudo, 2015). Nevertheless, SMAS is a relatively rare condition; however, its incidence is higher in patients with EDs, especially AN, than in the general population (Farina et al., 2017; Oliva-Fonte et al., 2017).

Challenges of vegetarianism for athletes

The athlete followed a vegetarian diet, which may be a challenge in restoring energy balance and adequate nutrient intake. However, numerous professional guidelines exist for the nutrition of vegetarian athletes, emphasizing that both health and performance enhancement can be achieved through proper planning (Craddock et al., 2016; Barr and Rideout, 2004). Nevertheless, these diets require careful attention, especially regarding adequate intake of essential proteins, iron, calcium, vitamin D, and vitamin B12 (Nebl et al., 2019; West et al., 2023). Collaborating with a sports dietitian is essential to ensure that the athlete's diet meets the requirements for recovery and hormonal balance restoration (Kussman and Choo, 2024).

Treatment recommendations and multidisciplinary approach

By the end of the first year, the athlete's condition further deteriorated, necessitating the revocation of the competition license. This decision aligns with other case studies that indicate better long-term outcomes when competition is suspended, allowing for a focus on rehabilitation (Quatromoni, 2017).

A multidisciplinary approach is essential for effective treatment as recommended by the IOC (Mountjoy et al., 2023). Collaborating with a psychologist or psychiatrist who specializes in ED is crucial, as psychotherapy assists in uncovering and addressing the underlying psychological causes (Grilo, 2024; Eichstadt et al., 2020; Hay, 2020; Petisco-Rodríguez et al., 2020; Murphy et al., 2010). Furthermore, a controlled and gradually increased nutritional intake, along with a temporary halt to physical activity, is vital for the body's recovery (Neglia, 2021).

This athlete's situation shows that improvement is possible with appropriate treatment. The condition can be reversed when physical, nutritional, and psychological

aspects are thoughtfully considered and addressed in an integrated approach.

Limitations

The case study presents a detailed overview of an athlete's journey. However, several limitations must be considered. This is a single case study, which means that the findings are specific to one individual. While it can provide valuable insights into the athlete's experience, these results cannot necessarily be generalized to all athletes, particularly those with varying eating habits, training routines, or backgrounds. Although psychological treatments and interventions were part of the athlete's care, we were unable to provide detailed information on the types of therapies used. Furthermore, an eating disorder specialist was involved only after a year and a half. The specific impact of these therapies on her recovery remains unclear. The athlete's progress was monitored by various specialists (internist, dietitian, psychologist, and psychiatrist) who did not always collaborate directly. This lack of coordinated care may have influenced the outcomes and indicates that a more integrated, multidisciplinary approach might have been more beneficial.

Conclusion

This case study highlights the need for developing effective preventive strategies to reverse the effects of disordered eating (DE) and to prevent the onset of eating disorders (EDs) in athletes. Early intervention is essential, and coaches play a vital role in identifying subtle shifts in an athlete's behavior, eating habits, or physical performance. Their awareness can help prompt early medical evaluations, preventing further progression of DE. However, once DE symptoms are recognized, medical staff must make informed decisions about temporarily suspending training or competitions to prioritize the athlete's physical and mental health.

Although a theoretical framework for multidisciplinary team care exists, practical challenges often hinder its implementation. Limited resources, time constraints, and challenges in coordinating professionals from diverse fields, each with unique priorities, can impede effective collaboration. This case study highlights the need for improvements in two key areas: early identification of at-risk athletes and better collaboration within multidisciplinary teams.

To address these challenges, developing more effective screening methods—such as regular check-ins or questionnaires for athletes and coaching staff—and emphasizing collaboration among medical team members—could provide early indicators of DE or ED.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author/s.

Ethics statement

The studies involving humans were approved by Eötvös Loránd University Human Ethics Committee. The studies were conducted in accordance with the local legislation and institutional requirements. Written informed consent for participation in this study was provided by the participants' legal guardians/next of kin. Written informed consent was obtained from the individual(s) for the publication of any potentially identifiable images or data included in this article.

Author contributions

RK: Investigation, Software, Writing – original draft. SB: Conceptualization, Visualization, Writing – review & editing.

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Conflict of interest

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Generative AI statement

The authors declare that no Gen AI was used in the creation of this manuscript.

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