**EÖTVÖS LORÁND UNIVERSITY**

**FACULTY OF EDUCATION AND PSYCHOLOGY**

Doctoral (PhD) dissertation thesis

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**Disordered eating and eating disorder risk in sport**

**Screening methods and treatment options in outpatient dietetic care-**

**the role of education**

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1. **Introduction**

Independently from the type of sport (whether it is an aesthetic, endurance, team or combat sport) competition places quite high demands on its practitioners (Stoyel et al., 2021; Jeukendrup, 2017; Petrie & Greenleaf 2007). It was considered an unexplored area for a long time, but today we know that adequate nutrition and sport-specific nutrition counseling does play an essential part of the preparation. However, it is not uncommon for athletes to seek help not from a qualified specialist, but rather from fellow athletes, coaches without nutritional qualifications, etc. (Elsahoryi et al., 2021; Couture et al., 2015; Nattiv et al., 2007). These multiple pathological eating strategies can lead to disordered eating and eating disorders (Lutter, 2017; Greenleaf et al., 2009; Nichols et al., 2007). According to the 2019 report by the International Olympic Committee, the prevalence of disordered eating (DE) and/or eating disorders (DE) among female athletes was between 6-45% and 0-19% among male athletes (Reardon et al. 2019). The rate is constantly increasing and appears more frequently compared to the general population (Chatterton & Petrie, 2013; Sundgot-Borgen & Tortsveit, 2004).

EDs can take a long time to be diagnosed, as symptoms remain hidden for an extended time (American Psychological Association-APA, 2023; Tan et al. 2016). It happens that subclinical disorders are not addressed at all, as they believe that the person concerned is “not sick enough” (Kohlné et al., 2023). Often, under the “slogan” of a healthy lifestyle, we can encounter restrictive eating that reaches the level of an eating disorder (EMMI EüK 2020/7). Thus, early recognition and treatment DE are particularly important, so that those affected can receive targeted care by referring them to the appropriate professionals.

The question has arisen as to how long we can talk about nutritional habits that support health and sports performance among athletes, where food plays a decisive role in achieving best performance beyond training and rest, and at what point can we say that restrictive behavior, even reaching the level of an eating disorder, is present. In outpatient dietetic care, we have increasingly encountered athletes with low body mass and/or body fat percentage, and during the nutritional anamnesis, pathological eating strategies have also been revealed several times, e.g. skipping meals, performing compensatory activities, compulsive calorie counting, strict eating rituals, rewarding or punishing with food, etc. It is interesting that the appearance of the problem showed a very colorful picture in terms of gender, age and sports. The past years have provided several memorable and attention-grabbing examples. Such was the case of the 16-year-old hurdler girl, who, with a critically low body fat percentage and a series of ankle injuries within a season, could not meet the expectations of her coach. Or the eternally dissatisfied 25-year-old vaulter, who had a body composition that was perfectly suited to her sport, yet regularly made herself vomit and did not accept the help of a psychologist. Also the 18-year-old female shooter who lost her period for almost a year by restricting her diet. Furthermore, the 23-year-old male high jumper who, with a critically low body fat percentage, severely restricted his fat intake and reported a lack of sexual desire. Most notably, the 21-year-old female orienteering athlete whose symptoms escalated from untreated disordered eating to an eating disorder, which resulted in the revocation of her competition license two years later. The question arose as to how informed these athletes are about sports nutrition? Who do they seek (if they do) for nutritional advice? Do they have the opportunity to regularly contact a dietitian? Do they have a need for such a service at all? How do we sum up these problems, which do not yet meet the diagnostic criteria for eating disorders? What happens to these athletes in the long term if they are removed from the care system without intervention? Who can really influence them toabandon unhealthy habits and dispel misconceptions about nutrition and body weight?

1. **Objectives, research questions**

The aim of our studyis to get known with the sports most at risk of disordered eating and eating disorders in Hungary, and to assess the sports nutrition knowledge of athletes and coaches. We are looking for connections between the risk of disordered eating and eating disorders, as well as nutrition knowledge and body composition results. We are curious about how the coaches of the athletes participating in the study view eating disorders, what eating patterns they have, and how they feel about their current body weight and body image. We would like to find out what experience dietitians working with athletes have in caring for athletes struggling with disordered eating and eating disorders, what their relationship is with coaches and other health professionals, and how effective they consider their work. Our results may fill a gap in the field of education and sports science. In educational science, it can shape sport-specific nutrition education and make the transfer of knowledge more effective, as we can find out in which area(s) there are deficiencies or misinformation. In sports science, we can learn about the most endangered domestic sports. The correlations with sports nutrition knowledge affect sport-specific education, and at the same time, they also facilitate the design of a preventive program and an outpatient care protocol, which aims to prevent disordered eating and eating disorders among athletes. We are looking for answers to the following research questions.

**Q1**. Can the DESA-6 questionnaire be used to screen for disordered eating among athletes?
**Q2.** What correlations can be recognized when comparing the DESA-6 and EAT-26 measurements?
**Q3**. What general and sports nutrition knowledge do athletes and coaches have?
**Q4.** What characterizes the eating behavior of coaches and how do they relate to their own body image?
**Q5.** How do dietitians working with athletes view disordered eating and eating disorders among athletes and their coaches?

1. **Hypotheses**

**H1:** We expect that the statistical analysis of the DESA-6 questionnaire responses will yield valid and reliable results, enabling the identification of athletes with disordered eating behaviors.
**H2:** We assume that there will be athletes who can be classified as being at risk based on both their DESA-6 and EAT-26 scores, making them vulnerable not only to disordered eating behaviors but also to the development of eating disorders.
**H3:** We assume that both athletes and coaches have insufficient knowledge of sports nutrition.
**H4:** We expect that among coaches, nutritional mistakes and eating behaviors that do not support health or athletic performance may occur. We also assume that there will be coaches who are dissatisfied with their body image.
**H5:** We assume that dietitians do not feel their work is sufficiently effective and that they do not achieve lasting improvement in treating athletes with disordered eating behaviors or eating disorders. We expect that their relationship with coaches significantly influences their professional success and recognition in caring for athletes.

1. **Materials and methods
*4.1 Quantitative Research Phase***
* The A-NSKQ (*Abridged Nutrition for Sport Knowledge Questionnaire*, Trakman et al., 2017) is a questionnaire designed to assess knowledge of sports nutrition. Our aim was to examine the nutrition knowledge of elite athletes, recreational athletes, and coaches over the age of 18. Elite athletes were recruited from the National Institute of Sports Medicine in Budapest (OSEI), while the recreational athlete group was selected from students majoring in sports at the Faculty of Education and Psychology Eötvös Loránd University (Budapest) and the Faculty of Health and Sports Sciences at Széchenyi István University (Győr), using convenience sampling.
* We also used body composition results from the elite athletes in our research (while ensuring participants anonymity), with particular focus on body weight, BMI, and body fat percentage.
* The DESA-6 (*Disordered Eating Screen for Athletes*) is a six-question screening tool used to examine disordered eating behaviors in athletes (Kennedy et al., 2021). After linguistic validation, the Hungarian version was named DESA-6H (*Zavart Evési Magatartás a Sportban Kérdőív*). The focus group consisted of elite and recreational athletes over the age of 14. The recruitment and questionnaire completion process was conducted similarly to that of the A-NSKQ.
* Alongside the DESA-6H tool, participants also completed the EAT-26 questionnaire, with the goal of assessing the risk of disordered eating behaviors. We aimed to explore the correlations between DESA-6 and EAT-26 scores, following the validation procedure of the original DESA-6 questionnaire.

***4.2. Qualitative Research Phase***

* We conducted a content analysis, a research technique for the objective and systematic description of the open content of communication (Macnamara, 2018; Hsieh & Shannon, 2005). The data sources were semi-structured interviews, with the aim of identifying patterns within the communication content. We searched for expressions in an explicit (overt) manner.
* We worked with two groups: coaches (n = 15) and dietitians working with athletes (n = 14). Our goal was to understand what former and current eating patterns can be observed in the background of the coaches’ lack of nutritional knowledge. Additionally, we aimed to explore whether satisfaction with current body weight influences eating habits, based on the interviewees' perspectives. In case of the dietitians, we sought to understand how they perceive their role and effectiveness in teamwork when working with athletes who have or may have eating disorders.
* Coaches were recruited at the National Institute of Sports Medicine (OSEI), and dietitians were recruited via social media platforms (Facebook), using purposive sampling in both groups (Nikolopoulou, 2023).
* Out of the 29 interviews, eight were conducted in person, 17 online via Google Meet, and four via phone.
1. **Data Analysis**
* For the DESA-6H questionnaire, we calculated the Guttman split-half coefficient, and for the EAT-26 questionnaire, the Cronbach’s alpha coefficient was used to estimate internal reliability. In addition to using descriptive statistical methods (mean, standard deviation), we conducted normality testing using the Shapiro–Wilk test. To assess convergent validity, Kendall’s tau-b correlation was used to analyze the relationship between total scores of the DESA-6H and EAT-26, as well as between DESA-6H and the three subscales of the EAT-26. The same method was applied to test the potential linear relationship between the eating behavior questionnaires and the number of weekly training hours.
* In order to test relationships between nominal variables, we used the chi-square test. The Mann-Whitney *U* test was used to examine potential differences in sociodemographic (gender) and sport-related (level of participation in sport) groups regarding DESA-6H and EAT-26 scores.
* For Kendall’s tau-b correlations, the strength of the relationships was interpreted as follows (Akoglu, 2018): *r* ≤ 0.3 (weak), 0.3 < *r* ≤ 0.6 (moderate), 0.6 < *r* ≤ 0.9 (strong). To determine effect size, we used Cohen’s d, interpreted as follows (Cohen, 1998; Fritz et al., 2012): *d* < 0.3 (small effect), 0.3 ≤ *d* < 0.5 (medium effect), *d* ≥ 0.5 (large effect).
* For the nutrition knowledge data, we applied descriptive statistical procedures (mean, standard deviation), and used the Mann-Whitney U test to compare gender differences.
* When comparing the three questionnaires (DESA-6H, EAT-26, A-NSKQ) and body composition results, we applied descriptive statistics (mean (M), standard deviation (SD), frequency (%)) to present data on gender, age, BMI, body fat percentage, classification into high-risk vs. non-risk sports, and scores from DESA-6H, EAT-26, and A-NSKQ.
* Kendall’s tau correlation was used to analyze the relationships between DESA-6H and EAT-26 total scores and BMI, body fat percentage, and general and sports nutrition knowledge.
* Mann-Whitney U tests were used to examine pairwise differences between the following variables: DESA-6H and EAT-26 scores, and high-risk vs. non-risk sports based on both the DESA-6H and EAT-26 scores.
* The Cohen’s kappa (κ) coefficient was used to determine agreement between classifications based on the DESA-6H and EAT-26, regarding whether athletes could be categorized into risk groups or not. The interpretation was as follows: 0.01–0.20 (slight), 0.21–0.40 (fair), 0.41–0.60 (moderate), 0.61–0.80 (substantial), and 0.81–1.00 (almost perfect agreement) (Altman, 1999; McHugh, 2012).
* In order to evaluate the diagnostic accuracy of the DESA-6H, we used Receiver Operating Characteristic (ROC) analysis and calculated the Area Under the Curve (AUC). The Youden Index (J) was applied to determine the optimal cutoff value. For this analysis, we used EAT-26-based risk classification as the reference (Pope, 2015; Schaefer et al., 2021).
* Quantitative data were processed using IBM SPSS Statistics 29.0.
* For the qualitative data, we first transcribed the interviews and analyzed them using ATLAS.ti software.
* A selective reduction process was conducted by breaking the text into manageable categories. In order to summarize the data, we created codes, which were grouped into manageable code categories.
* Following the interpretation of the results, we linked the findings with the results of the quantitative research, and explored relationships with the data collected from real-world observations.
1. **Presentation of Results Based on the Research Questions**
* Based on the results of Kendall’s tau correlation, a significant association between the DESA-6H and EAT-26 questionnaires was confirmed. There was a statistically significant, moderate positive correlation between the total scores of the two questionnaires across the full sample, particularly with the EAT-26 Dieting and Bulimia subscales. A weak positive correlation was also found between total scores and weekly training hours. Differences observed between athletes classified as being at risk based on the two questionnaires indicate a need for further research using additional objective measurement methods to refine the category boundaries. One possible reason behind these differences is that the number of sports included in the original validation of the questionnaire was significantly lower. In the second sub-study, using a Hungarian sample (n = 71) and applying the Youden Index (J), the DESA-6H max cut-off point was found to be 0.5 (J = 0.54) with 83.3% sensitivity and 70.2% specificity. In the first sub-study, no such procedure was applied, as the aim there was to test internationally established standards.
* According to the EAT-26, more athletes were classified into risk groups than with the DESA-6H, in both the first and second sub-studies. While the two tools measure different aspects (DESA-6H focuses on disordered eating, EAT-26 assesses the risk of eating disorders), their target areas are strongly interrelated, and the overlap is considered significant (Sundgot-Borgen & Tortsveit, 2020).
In the first sub-study, although no significant differences were found between groups based on athletic level, national team athletes in the adult group were more likely to score above the cut-off on both the DESA-6H and EAT-26 than their recreational athlete peers. These results support the convergent validity of the DESA-6H, as the findings were consistent with EAT-26 results when controlling for gender, age group, and level of athletic involvement. The agreement between the two tools was further supported by a significant but small Cohen’s kappa (κ = 0.294, p = 0.03), showing 63.3% and 24.03% overlap in distinguishing non-risk and risk cases, respectively.
* Among athletes, females scored significantly higher in general nutrition knowledge, while males performed better in sports nutrition knowledge, with the difference approaching statistical significance. However, neither gender reached the acceptable threshold score (≥ 50%) in total nutrition knowledge. Recreational athletes scored higher in general nutrition, while elite athletes scored better in sports nutrition.
* Among coaches, general nutrition knowledge scores were acceptable for both genders, but female coaches scored well below the threshold in sports nutrition knowledge. Unlike athletes, male coaches outperformed females in both general and sports nutrition knowledge. Interestingly, despite these lower scores, female coaches more often fell within the normal nutritional status category.
* Regarding coaches' eating attitudes, the results showed that childhood eating patterns had a significant impact on current habits. Most respondents reported a lack of health-conscious food choices in childhood, and despite living in agricultural environments, quality ingredients such as fruits and vegetables were not consumed regularly — a pattern that likely persisted into adulthood. A small group of respondents reported making efforts to change previously ingrained, unhealthy habits — typically in response to emerging nutrition-related issues. The main nutritional mistakes included meal skipping, ignoring food quality, and a lack of portion control.
Only five respondents indicated that they still try to maintain what they considered healthy childhood habits, such as a varied diet, selecting quality ingredients, and eating home-cooked meals. Regarding body weight satisfaction, most coaches expressed dissatisfaction, with two reporting previously unhealthy levels of concern. The smaller group of satisfied individuals did not necessarily fall within the normal weight category — some simply managed to maintain their body weight for years. In terms of weight control, comments mainly came from those involved in aesthetic, endurance, and weight-class sports, all of whom agreed that body weight plays an important role in athletic performance.
* The majority of the dietitians interviewed stated that a dietitian alone cannot achieve long-term improvement; the involvement of other professionals, particularly psychologists, is essential to improving the athlete's health. They unanimously agreed that the presence of a dietitian is indispensable, and that professionals are key players in the multidisciplinary team recommended by the literature. Regarding factors influencing their effectiveness, they mentioned various reasons, primarily the lack of opportunity to work in a team, resistance from coaches and parents, and the athlete's current condition, which exceeds the dietitian’s competencies.
1. **Conclusion**

Throughout the research, we gained a wealth of experience and insights, which we hope will provide a solid foundation for future study planning and implementation. Our current findings show that Hungarian athletes do not differ significantly from international trends in terms of disordered eating and eating disorder risk. However, in order to provide representative data, an increase in sample size is necessary. What we do know already is that it is crucial to emphasize prevention and screening, as international results also support that assistance is most effective when the problem is identified as early as possible. However, the presence of a single professional is insufficient for this. A multidisciplinary approach, respecting competency boundaries, is needed to support athletes toward better health.

1. **Limitations of the Study**
* Despite our efforts to comprehensively explore the topic of disordered eating, several limitations can be listed. These include sample size and sports disciplines. In the first sub-study, we managed to recruit 254 participants, while in the second sub-study, the number was 71. Due to the heterogeneity of the sample, we were unable to make comparisons between different sports disciplines, which will definitely be an area for improvement in future studies. The same issue arose with the completion of the A-NSKQ questionnaires, where, although the sample size (n = 1335) significantly exceeded the previous two sub-studies, the sample was still heterogeneous. In future studies, we aim to address this by applying targeted sampling, focusing on specific sport groups. No analysis was conducted on the reliability of the A-NSKQ questionnaire, which also opens up opportunities for further research. Currently, two studies are underway regarding this. Concerning the DESA-6H tool, we would like to incorporate the EDE 17.0 tool following the steps in the original validation article, which would require adapting the latter tool.
* The semi-structured interview questions covered multiple topics; however, this paper focused only on the parts of the interview material relevant to the research questions. In the future, we plan to analyze the remaining parts of the transcripts within a qualitative research framework. That would be interesting to triangulate this part of the study by involving athletes who have been diagnosed with eating disorders or who have previously struggled with such issues. Furthermore, in the minor group, parents should not be overlooked, as they can provide additional relevant information concerning the resolution of the problem. In order to have an extended view, we also wish to gather the opinions of doctors and psychologists regarding the challenges they face with athletes who have eating disorders or are suspected of having them, as well as their roles and opportunities in improving these conditions.
1. **Novelty of the Study**

We believe that our results are gap-filling, as the findings regarding nutrition knowledge revealed which areas we need to focus on more during consultations and lectures. Thus, the educational aspect of the research is significant. From a sports science perspective, we have learned which sports (based on the examined sample) are particularly at risk for the development of disordered eating, and therefore require special attention during care. This dissertation has provided novel data across multiple scientific fields and has also highlighted that there are still many unexplored areas, which will guide the direction of future research.

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28. **List of publications**
	1. ***Hungarian-language studies***
29. Kovács, R. E., & Boros, S. (2024). Problematikus evési magatartások és evészavarok az élsportban [Disordered eating and eating disorders among professional athletes]. *Orvosi hetilap*, *165*(8), 291–296. <https://doi.org/10.1556/650.2024.32969>
30. Kovács, R.E., Toman, J., Tornóczky, G.J., Boros, Sz. & Karsai, I.: A Disordered Eating Screen For Athletes magyar változata (DESA-6H) konvegens érvényességének vizsgálata– egy pilot study eredményeinek bemutatása, *Mentálhigiéné és Pszichoszomatika* (in press)
	1. ***English-language studies***
31. Kovács, R.E. and Boros, Sz. (2024). Case study: an orienteer athlete with disordered eating. *Magyar Sporttudományi Szemle*, *110*(4), 34-37.
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