Clinical Nutrition & Hospital Dietetics

Review Article

Clin Nutr Hosp Diet. 2024; 44(S1): 01-07
DOI: 10.12873/0211-6057.44. S1.008

The importance of precision nutrition in binge eating disorder

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Received: 10-Sep-2024, Manuscript No. CNHD-24-147699; **Editor assigned:** 13-Sep-2024, PreQC No. CNHD-24-147699 (PQ); **Reviewed:** 30-Sep-2024, QC No. CNHD-24-147699; **Revised:** 07-Oct-2024, Manuscript No. CNHD-24-147699 (R); **Published:** 14-Oct-2024, DOI: 10.12873/0211-6057.44. S1.008.

ABSTRACT

Binge eating disorder is considered the most prevalent disorder in the athletic population (compared to anorexia and bulimia nervosa), however, there is still a lot of research to be done, especially from an interdisciplinary perspective. For this reason, in this article we present the most updated research on genetic predisposition, eating behavior, relationship with stress and other eating diseases or addiction to sport and analyze whether precision nutrition offers tools to offer effective work guidelines from its scope. In the literature consulted, factors in which nutrition can work in both prevention and treatment are observed. For this reason, knowing the genetic factors, function of the microbiota and psychosocial aspects of each athlete could be important to prevent the appearance of eating disorder in general and binge eating disorder. However, although precision nutrition may be key, interdisciplinary work is also essential (psychiatry, psychology, nursing, nutrition and other specialists depending on the need). And, although future research will provide more information in this regard, it is known that the Mediterranean Diet pattern still offers an important preventive tool.

Keywords: BED (Binge Eating Disorder), ED (Eating Disorder), Athletes, Precision Nutrition, Prevention

1. INTRODUCTION

The main Eating Disorders (ED) described by the Diagnostic and Statistical manual of Mental disorders (DSM) are Anorexia Nervosa (AN), Bulimia Nervosa (BN) and Binge Eating Disorder (BED) [1]. Binge Eating Disorder (BED) is the most common among Western society, with a prevalence between 2% and 4%, and may be underdiagnosed because it is confused with overweight or obesity [2,3]. Broadly speaking, it is characterized by recurrent binge eating (≥ 1 time per week, minimum for 3 months), brief (≤ 2 h) and distressing, during which patients feel a lack of control in which they consume large amounts of food compared to most people in similar circumstances [1].

In the athletic setting, BED prevalence rates are believed to be higher than among society in general due to strict requirements regarding weight and body composition, prolonged caloric restriction, stressors linked to competitions, and even social and media pressures [4]. Moreover, it seems to be a disorder of similar prevalence among men and women (unlike the mostly female AN or BN) [3,5]. However, there is still much research to be done on this topic and it should be taken into account that specific circumstances of athletes can induce episodes of binge eating without being considered BED, such as a boxer's eating after pre-competition weigh-in [6].

In the present article we analyze the main causes related to ED in athletes, especially BED, to discuss the role of precision nutrition in the emergence, prevalence and perhaps prevention of this disease.

2. LITERATURE REVIEW

2.1 BED and genetic predisposition

Genetics plays a fundamental role in the manifestation of BED. Specifically, genetic factors predispose approximately 41% to 57% to BED [7]. This makes research in this field

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necessary, however, there is still little literature compared to AN or BN and the one that exists does not yet show a clear focus due to the lack of information regarding the underlying physiological mechanisms [8-9]. In particular, certain dopaminergic and serotonergic SNPs have been studied for the relationship between nervous system influence and BED (Ankyrin repeat and kinase domain containing, Dopamine receptor D2, Opioid Receptor Mu1, Serotonin transporter gene) [10-15]. Also related to fat mass (fat mass and obesity associated gene, fatty acid binding protein), regulation of appetite and satiety (Taste Receptor Type 1 Member 2, Melanocortin 4 Receptor, Ghrelin and Obestatin Prepropeptide) or the circadian clock (Circadian Locomotor Output Cycles Kaput) influencing the matching of food intakes to physiological needs [16-23]. Nevertheless, and despite the different lines opened in the field of genetics, we think that these studies do not end up offering complete solutions for the existence of BEDs either. Other research shows that there is a relationship between microbial genetics, appetite and body weight, therefore, the Binge Eating Genetics Initiative (BEGIN) has emerged as an innovation in terms of BED, a multidimensional research that examines the interaction of the genome with the gut microbiota and phenotypic data to establish treatment responses to BED and BN [24-25].

Thus, we argue that the fields of nutrigenetics (variations in the gene that induce certain dietary behaviors) and nutrigenomics (effects that nutrients ingested through the food intake exert on the individual's own genome) are of great importance [16,26,27]. However, due to the complexity of mechanisms and influential factors, we wonder if a diet based on these results can be really practical and/or effective.

2.2 BED and caloric restriction in an athletic population: The fact that BED in athletes is linked to caloric restriction may help prevent its appearance. However, this alone is not the determining factor. Nevertheless, we raise the possibility that those in charge of preparing the athlete's diet should propose nutritional strategies based both on improving performance and avoiding an insufficient intake of nutrients that could lead to harmful situations for their health. There is sufficient scientific evidence to demonstrate that prolonged caloric restriction (as may occur in dance, gymnastics, boxing, athletics, etc.) alters hunger and satiety signals, generating a desire to overeat, for example, related to low levels of leptin and insulin [11,17]. In addition, a diet insufficient in certain macros and micronutrients (proteins, fats, carbohydrates, vitamins and minerals) can promote increased appetite [28,29].

There are also studies that highlight the modulation through food of the microbiota-intestine-brain axis, so that prolonged situations of food restriction produce dysbiosis related to ED [30-32]. However, we understand that the cause-effect direction is not yet clear due to the fact that, on the one hand, there are those who highlight that modifications in the bacterial composition of the intestine produce changes in eating behavior [33,34]. And, on the other hand, that situations of ED presence describe a microbial profile different that shown when the disease has been overcome [35]. However, most studies in this regard are performed in murine models and, in addition the composition of the intestinal ecosystem is unique to each individual, so working individually on each bacterial strain may be an error that could be mitigated by analyzing the functionality of digestive system as a whole [36].

2.3 BED and stress in the athletic population: In BED, periods of stress have been associated with those of binge eating, perhaps due to variations in terms of brain receptors, hormonal or even the aforementioned relationship in terms of the microbiota-intestine-brain axis [26,36,37].

Specifically, the athlete population is subjected to stress related to excessive exercise, caloric restriction, competition pressures, etc. [38]. Which may emphasize the predisposition to manifest this disorder. We advocate for an adequate psychological intervention not only linked to performance but also in the prevention of this type of disease, with emphasis on the promotion of joint work with the nutritionist and trainer, the latter being vital in the safety and confidence of the athlete [39]. Clear examples can be seen in cases published in press in which the athletes describe the pressure from their coach to have a lower weight. In addition, this extends to society (and the media), which establish standards about the ideal physique of athletes, and they are not even aware of the pressure exerted [4].

2.4 BED and sports addiction: Addiction disorders are more prevalent in patients with ED than in the general population and vice versa so it is assumed that there is a common intrinsic component linked to addiction [13]. We argue that, in the case of the athlete population, this addictive behavior can materialize in excessive sports practices, as for example shown in the study by Monserrat-Hernández et al., regarding long-distance

runners (more hours, more training sessions and inadequate recovery rest) [40]. At this point it should be noted that the obsession with physical exercise can lead to and/or strengthen an ED or vice versa, so there is controversy as to whether the most susceptible groups to take part in a sport that requires a certain physique are people with ED (more research has been done on AN) [41]. It is argued that excessive exercise and ED represent expressions of the same preoccupation with body control, and that excessive exercise may be perceived as a more acceptable alternative to an eating disorder, but how can this be measured in a sport where excessive exercise is a daily routine?

In view of this, we believe that it would be advisable for coaches and sports psychologists to deal with and respond in advance to the presence of warning signs or to carry out assessments regarding motivation towards sport.

2.5 Relation between BED, AN and BN in the athletic population

In general, ED share altered eating behavior and times of food restriction, so it may be normal that they acquire a spectral functionality, fluctuating among those who suffer from them (a person with AN can have BN and the same can happen with BED) [1,42]. Specifically, and due to the lack of sufficient research, we consider the need to increase research in this regard. Athletes, in times of high stress and caloric restriction can manifest episodes of binge eating using a high frequency of training as a purge. We also think that athletes who have been very strict nutritionally and subjected to stress during periods of competition, during rest periods or at the end of their career compensate this situation by eating, thus considering an edorexia [43]. For all these reasons, we consider it especially important to work on the prevention of ED as a whole.

3. DISCUSSION

At this point, we consider that the need for interdisciplinary work in the prevention of any ED in sport is more than evident. Just as the team that surrounds the athlete is motivated by maximizing their performance, this team must be aware of prevention against the manifestation of disorders of this nature [39]. And, to this end, we consider it vitally important to establish work protocols in the areas of intervention (psychological, nutritional and training). The implementation of specific tests to detect addiction to sport, motivation towards it, as well as the danger of suffering from ED should be implemented constantly at the beginning of each season.

Similarly, the dimensions related to the possible manifestation of the disorder should be analyzed. In this regard, the undersigned team has validated a questionnaire to measure the risk of developing ED taking into account physical, psychological and social dimensions [44]. In this way, simpler and more focused lines could be established for effective intervention.

Specifically, nutritional planning should be considered more than a mere instrument, it has to be seen as an important factor in both prevention and improvement of the performance and health of athletes. For this reason, we put forward the need to carry out exhaustive controls regarding the adequate supply of nutrients throughout the season. At the level of macronutrients, it must be adapted to the needs of each athlete in the specific period, both carbohydrates and fats and proteins play a fundamental role [5,45]. In the case of micronutrients, there is sufficient scientific evidence that an adequate intake of vitamins D, E, C, B2, B3, B6 and B9 improves psychological well-being through their action as cofactors and coenzymes in the metabolic regulation of tryptophan or in brain methylation processes important in mood-influencing brain functions [46,47].

In a generalized way and according to the literature analyzed, it could be suggested to reduce the total glycemic load of carbohydrates and their Glycemic Index (GI) except in the meal prior to training or competition. Excessive consumption of sweeteners and processed foods (even if they are considered healthy) should be avoided, giving priority to natural foods. A diet low in high GI carbohydrates, adequate levels of protein, low in saturated fats and high in monounsaturated fats reduces inflammatory processes and lipid profile without the need to establish excessively restrictive diets [48]. In this regard, we believe that providing sufficient knowledge to athletes about the foods they should eat can promote less strict diets, as well as establishing menus appropriate to dietary preferences. This can be a great challenge for the field of nutrition education.

Guidelines and recommendations for precisión nutrition in Binge Eating Disorder (BED)

Genes analyzed with possible predisposition to BED (Specific SNP):

- *FTO* (Fat Mass and obesity associated gene): Promotes the increase of fatty foods
- *TAST1R2* (Taste Receptor Type 1 Member 2):

Regulates the sense of taste

- *GLUT2* (Glucose transporter 2): Under detection of blood glucose
- *DRD2* (Dopamine Receptor D2) and *DRD3* (Dopamine Receptor D3): Linked to dopamine, promotes over eating
- *ANKK1* (Ankyrin repeat and kinase domain containing I): Relation with other addictions
- *OPRM1* (Opioid Receptor Mu 1): Related to the opioid system. Eating for a sense of well being
- *FABP2* (Fatty Acid Binding Protein 2): Related to hormonal regulation (leptin and insulin). Increased appetite
- *CLOCK* (Carcadian Locomotor Output Cycles Kaput 1): Hormonal imbalances related to circadian rhythms
- *MCR4R* (Melanocortin 4 Receptor): Related to increased snacking and prevalence of binge Eating
- Other genes in research process: *BDNF* (Brain-derived Neurotrophic Factor), *OXTR* (Oxytocin Receptor), *FAAH* (Fatty Acid Amide Hydrolase), *5-HTTLPR* (Serotonin-transporter Gene), *SL6A4* (Solute carrier Family 6 member 4), *GHRL* (Ghrelin and Obestatin Prepropeptide)

Characteristics of microbiota:

- Increased production of SCFA (Propionate, butyrate, acetate)
- Maintaining adequate levels of lactobacillus and bifidobacterium

Micronutrients influencing stress and anxiety levels:

- Vitamin B6 and B12: For adequate functioning of the nervous system
- Vitamin C: Stimulate the adrenal glands (cortisol)
- Vitamin D: Ally in physiological stress processes
- Magnesium, calcium, potassium and zinc : Important for sympathetic and parasympathetic balance, rest and recovery in stress conditions
- Selenium and Vitamin E: To reduce oxidative stress in high-performance sport
- Tryptophan: Regulates the nervous system and favours rest and recuperation
- Glutamine: Contributor to the regeneration and protection of the intestinal wall

Effective amounts of macronutrients to avoid deficits in restrictive diets:

- Carbohydrates
- Recovery after 4 hours of moderate effort : 0.7 g/kg of weight, intervals of 2 h
- Optimal muscle glycogen recovery after exercise: 7 g-12 g/kg weight /day
- HC load prior to exercise of less than 90 min (36 h-48 h before) :10 g-12 g/kg bw/day
- Rapid recovery when the time between sessions is less than 8 h : 1 g-12 g/kg body weight immediately after and repeat ever hour until normality is established
- HC availability before prolonged training : 1 g-4 g/kg body weight 1-2 h before
- During sustained high-intensity exercise (45-75 min) : 30 g-60 g HC per hour
- During ultra-endurance exercise: 30 g-60 g of CH in the first hour, 60 g from the second hour and 90 g from the third hour
- During moderate intensity exercise or intervals of more than 1 h:0.5 g-1 g/kg body weight
- During high intensity exercise 1 g-1.5 g/kg body weight
- Fats : Increase consumption of monounsaturated fats, reduce consumption of saturated fats
- Omega 3 aids rest and recovery
- Optimal balance between omega 3 and omega 6
- Proteins
- Total daily intake of 1.2 g to 2.0 g protein per kilogram body weight (g/kg), appropriate to training intensity. Encourage elite athletes to adhere closer to the 2.0 g/kg side of this range, particularly during periods of higher volume training
- Variability in protein intake: fish, dairy, eggs, legumes, nuts, and meat

Psychosocial factors:

- Nutritional education to control stress generated by food
- Interdisciplinary work: Adapting nutritional guidelines to the advice of the sports psychologist

- Adapting the diet to the characteristics of each sports person. Including culinary tastes
- Avoid prolonged restrictions and food prohibition

4. CONCLUSION

With all that has been mentioned in this article, we can draw the following conclusions regarding nutritional intervention in BED: Nutrition is an important tool in the prevention of BED in athletes. The adequacy of macronutrients to the specificities of each athlete and training period is fundamental to correctly regulate the hunger-satiety processes. A correct intake of micronutrients will help to improve emotional well-being and prevent stress episodes linked to BED. Genetic analysis of predisposition to certain nutritional behaviors is having an increasing impact and is proving valid in diagnostic processes and personalized intervention.

5. AUTHOR CONTRIBUTIONS

D.S.G: Writing–review and editing, Conceptualization, Methodology, Project administration; J.C.O: Writing–review and editing, Conceptualization, Methodology; M.M.H: Writing–original draft, Conceptualization, Methodology; review and editing.

6. CONFLICT OF INTEREST

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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