

# **Eating disorders, Body Image, obesity and Non-Pharmacological Inventions with Emphasis on Physical Exercise: An Integrative Review and Clinical Implications**

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**Keywords— Anorexia, Body Composition, Bulimia, Eating Binge, Overweight, Obesity.**

**Abstract—** *Background: Eating disorders, obesity, and body image has a relationship with health outcomes along the life, however the prescription of physical exercise as tool against eating disorders need to be further explored. Objective: To investigate the relationship between eating disorders, obesity, and body image distortion and discuss non-pharmacological interventions based on physical exercise and their clinical implications. Methods: The search conducted in Medline and Scopus databases, in English and Portuguese of the last 10 years involving studies with human approaches, integrative and systematic reviews with free full text resulted in 2049 manuscripts, after the application of all exclusion criteria 1992 articles were excluded, and 57 articles were used in this review. Results: The results suggest that binge eating anorexia and bulimia are the most common disorders with increasing worldwide prevalence. Additionally, it was verified that physical exercise can be considered a non-drug intervention as an adjunct measure in this respecting necessary care. Therefore, although not all people have the whistles to receive exercise as an intervention the prescription of physical exercise, when done by a multidisciplinary team, with slow progression and strictly monitored can be a valuable to the treatment of eating disorders. Conclusions: The physical exercise is a valuable tool against several eat disorders, improve the body image, fight against the obesity due their power of decrease the eat binge. Nonetheless, the increasement of caloric expenditure during and after the session leading to a fat loss and could be a central non-pharmacological invention in this scenario.*

## I. INTRODUCTION

Obesity, the main health burden of the 21st century, is a chronic disease that affects individual quality of life physiologically, economically and psychologically, regardless of cultural, financial or ethnic origin (Blüher, 2019). An excessive amount of body fat not only reduces the quality of life with regard to physical states, but also psychological, this condition is therefore associated with the development of a large number of health disorders, including diabetes, cardiovascular complications, cancer, asthma, sleep disorders, liver dysfunction, renal dysfunction, diabetes and eating disorders (Manna & Jain, 2015). Public health concerns about the increased cost caused by weight disorders or malnutrition have become increasingly evident.

The World Health Organization (WHO) defines overweight as a body mass index (BMI) of 25.0 to 29.9 kg/m<sup>2</sup> and obesity as a BMI of  $\geq 30$  kg/m<sup>2</sup> (OMS/WHO, 2016). However, as a defining parameter, BMI has limitations, as it does not distinguish the difference between lean mass and fat or identify the distribution of fat both critical to stratify and classify (Blüher, 2019). Recent studies have shown that the risk factors associated with obesity depend not on excess body weight itself, but on the regional distribution of excess body fat (Swainson et al., 2017).

Epidemiological studies have shown that the prevalence rates of DA are around 0.5% to 1% for the general population, and may increase when considering syndromes called EDNOS (Ruscitti et al., 2016). These studies also provide relevant information on the distribution of ED, showing that these are clearly more prevalent in women than in men, in a ratio of 10:1 (Phillips, 1997). Individuals who develop AT use an arsenal of methods to control body mass, including excessive physical activity.

Although there is an increased concern with eating disorders and lack of control of body weight, the ratio of the simultaneous cost of these health conditions is commonly ignored, although the links between physical and mental health are well described. Binge eating, eating disorderly, is an important and perpetuating factor of obesity, usually mediated by psychological states such as bad mood or negative affect. Similarly, psychological concomitants of high body mass index, such as body dissatisfaction and stigma of high weight, contribute to the

increase in the burden of eating disorders worldwide, as well as increased dissatisfaction with body image (G. L. de Oliveira, de Oliveira, de Pinho Gonçalves, et al., 2017).

Regarding non-drug interventions that can compose the treatment of eating disorders, psychotherapeutic treatment is one of the most assertive indications, however, physical exercise is also one of the interventions that most successfully bring when used as a main or adjuvant intervention, being, therefore, the subject of discussion of this manuscript. In view of what had been exposed, the objective here was to conduct an integrative literature review to investigate the relationship between eating disorders, obesity, and body image distortion and discuss non-pharmacological interventions based on the effect of physical exercise on disorders with their clinical implications.

## II. METHODS

Research strategy in the English language and Portuguese in the electronic databases PubMed and Scopus were conducted from the beginning until February 1 to May 15, 2020. The articles were retrieved from electronic databases using the following research criteria: "aerobic exercise and eating disorders" OR "resistance exercise and eating disorders" OR "high intensity intermittent exercise and eating disorders" OR "diet and eating disorders" OR "physical exercise and obesity" OR "diet and malnutrition" And Humans.

Initially, titles and abstracts of the identified studies were verified by relevance by two reviewers (AAM and JRVS). Additionally, studies were identified through manual search and review of reference lists of relevant documents. All these steps were performed for 4 weeks.

Inclusion and exclusion criteria: participants, interventions, comparators, and results Studies with participants of all ages and genders, who directly or indirectly studied eating disorders, body image and exercises. Studies were excluded based on the following types of articles: letters to the editor, books, book sections, theses, films / broadcasts, opinion articles, observational studies and abstracts without adequacy data or analysis. Figure 1 shows the flow of articles during the selection process and the studies.

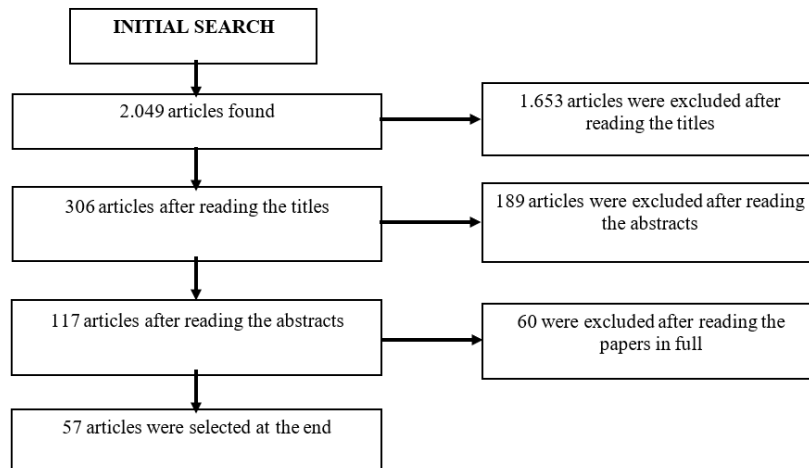


Fig.1: organization of the search process and selection of the articles used for this review.

### III. OBESITY AND ITS EPIDEMIOLOGY

The World Health Organization (WHO) defines overweight and obesity as abnormal or excessive accumulation of fat that presents health risk (World Health Organization, 2015). Body mass index (BMI), calculated by dividing body weight in kilograms by the square of height in meters, is a simple metric used to indicate general body fat (Marques et al., 2018). For adults, current guidelines from the U.S. Centers for Disease Control and Prevention (CDC) and WHO define a normal BMI range of 18.5 to 24.9, while a  $\text{BMI} \geq 25 \text{ kg/m}^2$  is considered overweight and a  $\text{BMI} \geq 30 \text{ kg/m}^2$  is classified as obese, with severe obesity defined as  $\text{BMI} \geq 40 \text{ kg/m}^2$  (World Health Organization, 2015). Despite this relatively simplistic definition obesity is a multifactorial disease that results from chronic positive energy balance, that is, when energy intake exceeds its caloric expenditure, the body does not despise it, it accumulates.

Excess energy is converted into triglycerides, which is stored in fat tissue deposits that increase in size, increasing body fat and causing weight gain. The globalization of food systems that produce more processed and affordable foods, and promote passive excessive consumption of energy-dense, nutrient-poor foods and beverages, has been identified as the main factor in the obesity epidemic, although a decrease in physical activity is also due to lifestyle modernization being involved, the idea of a coherent factor consonance (Manferdelli et al., 2019).

Obesity can occur at any age. Previous studies evaluating obesity trends have found that its prevalence increased in adults and children of all ages, regardless of geographic location, ethnicity or socioeconomic status (Chooi et al., 2019). In low-income countries, obesity is generally more prevalent among middle-aged adults from rich and urban environments (especially women) while in high-income countries it affects both sexes and all ages,

but its prevalence is disproportionately higher among disadvantaged (Chooi et al., 2019). These facts show the importance of this condition for world public health due to its prevalence, costs generated to the public health system directly or indirectly.

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## V. EATING DISORDERS

Eating disorders are severe psychiatric disorders characterized by abnormal eating or inappropriate behaviors for weight control. Errant attitudes errant towards weight, body shape and way of eating play a key role in the origination and maintenance of AD. The form of these concerns varies by gender, in men, for example, body image concerns can focus on muscle, while in women these concerns can focus more on weight loss. Obesity itself is not framed only as an eating disorder. All eating disorders considerably harm physical health and impair psychosocial functioning (Márquez & Molinero, 2013). The DA refers to a persistent disturbance of food or related behavior that causes a change in food consumption and that actually impairs the physical health the psychosocial stability of the individual, aggravating the condition of this disorder (Treasure et al., 2020).

Anorexia nervosa and bulimia nervosa are the most evident syndromes of this alteration in eating behavior and are directly related because they present as common symptoms the possible altered representation of the body shape, pathological fear of gaining weight and excessive concern with the loss of body mass. When in athletes, exercise compulsion exceeds the volume of training normally prescribed, resulting in health damage (Treasure et al., 2020).

The word anorexia originates in Greek (ann= without; orexis= desire or appetite), but in reality there is no loss of appetite in the early stages, only in the course of morbidity that anorexia manage to abolish it, so several authors consider the term anorexia inappropriate. The origin of the word bulimia is from the Greek (bous= oxen; limos= hunger), referring, therefore, to hunger as great as that of an ox animal or that is able to lead someone to eat an ox, which would justify the constant exaggerated episodes of food intake among people with this disorder. Bulimia nervosa is characterized by a large and rapid intake of foods with a feeling of uncontrollable, immediately

accompanied by inadequate compensatory methods for body mass control, such as self-induced vomiting, use of medications (diuretics, appetite suppressants, laxatives), severe diets and strenuous physical exercises, among others (Keski-Rahkonen & Mustelin, 2016).

Both the diagnosis and the Manual (DSM-5) and the International Classification Of Diseases (ICD-11) cover six main eating disorders (Udo & Grilo, 2019). This includes the family diagnosis categories of anorexia nervosa, bulimia nervosa and binge eating disorder. In addition, three disorders - previously seen mainly as childhood disorders were included. The DSM-5 also provides subtype qualifiers, severity indicators and remission definitions (Márquez & Molinero, 2013).

Anorexia nervosa is a highly distinct serious mental disorder disease characterized by an intense fear of weight gain or altered body image, or both, that motivates severe eating restriction or other weight loss behaviors (e.g., cleanliness, excessive physical activity). Concerns about weight and form distinguish anorexia nervosa from the restriction disorder or from preventing food intake. In addition, markedly disturbed cognitive and emotional functioning (Muñoz et al., 2018). Medical complications of anorexia nervosa affects all organs and systems and are usually due to malnutrition and weight loss (Gibson et al., 2019).

Gastrointestinal symptoms, affecting the total gastrointestinal tract, are particularly common and uncomfortable (Schalla & Stengel, 2019). Bulimia nervosa can occur with normal or high weight (if the weight is less than the threshold of bulimia nervosa, then a diagnosis of anorexia nervosa is given with excessive purging subtype as specifics). Bulimia nervosa is characterized by recurrent episodes of binge eating (i.e., eating large amounts with loss of control) and compensatory behaviors to prevent weight gain. The most common compensatory behavior is self-induced vomiting, but inappropriate use of medications, fasting or extreme exercise are also used. These behaviors are driven or by negative self-assessment related to weight, body shape or appearance. Binge eating disorder is characterized by distressing, recurrent episodes of binge eating, with fewer compensatory behaviors than in bulimia nervosa (Wade, 2019). Bulimia nervosa and binge eating disorder are often accompanied by, or lead to, obesity (30-45%) and metabolic diseases related to the disorders.

Other specified eating or eating disorders (DSM-5 and ICD-11) are a residual category. The disorder of restrictive food intake or avoidance of foods is now recognized as a neutral age disorder in DSM-5 and ICD-11. The main symptoms are avoiding or restricting food (in relation to volume or variety), along with one or more poor weight

loss or growth, nutritional deficiencies, dependence on tube feeding or nutritional supplements for sufficient intake, and psychosocial impairment. Symptoms may arise in the context of a general lack of interest in food and food selectivity based on sensory sensitivity and fear of negative consequences of eating related to aversion experiences such as asphyxia or vomiting (Eddy et al., 2019). The intake of non-nutritive or non-food substances for a period of a month or more where the main triggers are the taste of substance, boredom, curiosity, or psychological behavior tension. Rumination disorder involves regurgitation of food after eating in the absence of nausea, involuntary nausea, or disgust.

Psychiatric comorbidities are the norm in people with eating disorders (> 70%). The most common psychiatric comorbidities include mood and anxiety disorders, neurological developmental disorder, alcohol use disorders, and substances, and personality disorders (Udo & Grilo, 2019) people with diabetes have an increased prevalence of eating disorders (Wisting et al., 2019). This high prevalence produces an increased risk of diabetic complications and premature death, especially if insulin omission is used to compensate for feeding. Bidirectional associations were observed between eating disorders and autoimmune disorders, such as celiac and Crohn's disease (Hedman et al., 2019).

## VI. UNDERSTANDING THE NEUROSCIENCE OF EATING BEHAVIORS AND BODY WEIGHT

Articles and reviews frame these phenomena in four major research areas: first, an understanding of the neuroscience of eating behaviors and body weight in the bio psychosocial and cultural spectrum; second, an exploration of the relationships between eating disorders and obesity risk; third, new and integrated approaches in the treatment of obesity and eating disorders; and fourth, evaluation in clinical and research domains.

Longer electroencephalographic reaction times (EEG) were found associated with eating disorder symptoms in individuals with high BMI (Edwards et al., 2018). A preliminary study reported associations between weight status and changes in EEG patterns, which correlated with general impulsivity and eating behavior (Schmidt et al., 2018). Furthermore, the differential neuronal regulation of binge eating by a new mechanism, The Neuromedina U Receptor 2 (NMUR2), which points to future treatment research. Other studies support a neural and biofeedback-based approach to disordered eating behaviors, such as food craving or rumination, with a neurocognitive logic (modulation of brain reward mechanisms) supported by empirical research (Smith et al., 2019).

## VII. EPIDEMIOLOGY

Eating disorders can affect individuals of all ages, genders, sexual orientations, ethnicities, and geographies. Adolescents and young adults are particularly at risk, with anorexia nervosa starting earlier than bulimia nervosa or binge eating disorder. Onset after 30 years of age is rare and the age of onset of anorexia nervosa seems to be decreasing dramatically, leading to it being a health problem still in childhood (Jensen & Steinhausen, 2016; Litmanen et al., 2017).

In adult populations, the clinical profile is dominated by disorders of the eating compulsion spectrum with fewer gender differences between sexes than in adolescents and an above-average risk in ethnic minorities and overweight individuals. At the primary care level, incidence rates have remained stable in recent decades for anorexia nervosa, stable or declining for bulimia nervosa and increased binge eating disorder and unspecified eating disorders (Litmanen et al., 2017).

Overall, the prevalence of eating disorders increased by 25%, but only about 20% of affected individuals are treated. Duration of untreated eating disorders before the start of the first treatment is variable, but shorter for anorexia nervosa than for bulimia nervosa or binge eating disorder (i.e., 29.9 months for anorexia nervosa, 53.0 months for bulimia nervosa and 43.8 months for binge eating) and shorter for children than for adolescents or adults (i.e., 9.8 months for children and 34.7 months for children) adolescents or adults (Treasure et al., 2020).

Long-term follow-up studies (> 20 years) of patients with anorexia nervosa or bulimia nervosa show that about one third of these patients have a persistent eating disorder, with a median disease duration of about 10 years for anorexia nervosa. The standardized mortality rate for anorexia nervosa is 5.9%, for bulimia 1.9% and for binge eating disorder 2% (G. L. de Oliveira, de Oliveira, de Pinho Gonçalves, et al., 2017; Radici et al., 2020; Treasure et al., 2020).

## VIII. BODY IMAGE AND EATING DISORDERS

Dissatisfaction with body image and shape resulting from the attempt to adjust to establish standards can lead an increasing number of people to adopt extreme and harmful measures to health with the aim of controlling their body mass. Without professional guidance, people tend to adopt inadequate eating practices, such as severe dietary restriction (diets), extreme compulsion to physical exercises associated or not with the indiscriminate use of laxative and diuretic, which are considered precursor behaviors of eating disorders (AD) (Gonçalves et al., 2017).

Studs affirm that the multifactorial model is the most accepted etiological model today to explain the genesis of AD. This model is based on the hypothesis that biological, genetic, psychological, sociocultural and family factors contribute to the development and maintenance of AD. Although there is interaction between these factors, some authors have highlighted sociocultural factors such as those that exert greater influence on the etiogenesis of this syndrome (Towne et al., 2017).

## **IX. MEDICAL COMPLICATIONS ASSOCIATED WITH EATING DISORDERS (ADS)**

The medical complications of ADs have been well described. In general, medical complications are the result of physiological adaptations to the effects of malnutrition or a consequence of behaviors harmful to weight control. Young people who have lost large amounts of weight or lost weight very quickly may develop hypothermia, bradycardia, hypotension and excess body weight and obesity in orthostasis eating disorders, even if their current weight is in the normal range. Rapid weight loss may be associated with acute pancreatitis and the formation of gallstones (M. et al., 2020).

Electrolyte disturbances can occur secondarily to self-induced vomiting or the use of laxatives or diuretics, or they can occur when food is reintroduced after prolonged periods of food restriction (the so-called feedback syndrome). Dietary restriction can lead to primary or secondary amenorrhea in adolescent girls, even with normal weight, as a result of suppression of the hypothalamic-pituitary-ovary axis, which is partly mediated by leptin (Chou & Mantzoros, 2014). Prolonged amenorrhea results in a low estrogen state, which can contribute to osteoporosis (Golden et al., 2015).

## **X. THE INTERACTION BETWEEN EATING DISORDERS, OBESITY, AND CONSIDERATIONS ABOUT EXERCISE**

Most people who develop AD are not overweight. However, it is not uncommon for a DA start with a teenager "trying to eat healthily" (Schreiner, 2018; Treasure et al., 2020). Some adolescents and their parents misinterpret obesity prevention messages and begin to eliminate foods they consider "bad" or "unhealthy" (Smink et al., 2016). The nutritional data required by the US Food and Drug Administration (FDA) on food labels list daily percentage values based on a 2000 kcal diet. Moderately active adolescent girls require approximately 2200 kcal/day, and moderately active adolescent boys require 2,800 kcal/day for normal growth and development. Adolescent athletes require even higher caloric intake (Le et al., 2017; World Health Organization, 2015).

Strict adherence to a 2000 kcal/day diet can lead to an energy deficit and weight loss for many growing teens. Overweight people may adopt disordered eating behaviors when trying to lose weight. In cross-sectional studies, it demonstrated that overweight people practice self-induced vomiting or laxative use more often than their normal weight peers (Mitchison et al., 2019).

People who were overweight or obese may develop AD. In a study conducted seeking treatment for AD, 36.7% had a previous weight higher than the 85th percentile for age and (Lebow et al., 2015). Initial attempts to lose weight by eating healthily can progress to severe dietary restrictions, skipping meals, prolonged periods of freshening, or the use of self-induced vomiting, diet pills, or laxatives. Initial attempts to increase physical activity can progress to compulsive and excessive exercise, to the point of waking up at night to exercise or continuing to over-exercise despite injuries. People with AD who develop in the context of previous obesity may present challenges that delay treatment (Koo et al., 2016). The onset of weight loss is praised and reinforced by family, friends and health professionals, but excessive and continuous concern with weight loss can lead to social isolation, irritability, difficulty concentrating, deep fear of regaining lost weight and distortion of body image (G. L. de Oliveira, de Oliveira, Gonçalves, et al., 2017; Gonçalves et al., 2017).

## **XI. NON-DRUG TREATMENTS AGAINST EATING DISORDERS**

### **11.1 Psychological treatments for eating binge spectrum disorders**

In adolescents with bulimia nervosa, family-based therapy is one of the first-line recommended treatments National Institute of Excellence in Health and Care of the United States (INESC) (NICE, 2017). Cognitive behavioral therapy (CBT) is an alternative therapy and, given in the form of guided self-care produces an improvement in binge eating than family therapy, and has the advantage that the manual can be shared with parents (Agras, 2019).

In adults with bulimia nervosa, INESC guidelines recommend guided self-help or therapist administering CBT as the treatment of choice. A meta-analysis found that more than 60% of patients were unable to fully abstain from the central symptoms of bulimia nervosa, even after receiving the best available treatments. In binge eating disorder, a comprehensive meta-analysis found great effects for abstinence from binge eating in CBT trials compared to a waiting list, while structured self-help treatment produced sizes of medium to large (NICE, 2017).

A reference study made a direct comparison of CBT with self-help guidance. In this large study, it was found that CBT is more effective and more expensive than guided self-help (König et al., 2018). Several behavioral therapies have been adapted for eating disorders, such as acceptance commitment therapy, dialectical behavioral therapy, compassion-focused therapy, mindfulness-based interventions, and schema therapy. Several small trials, mainly in binge eating disorder, were done to examine efficacy in terms of remission. A meta-analytical review showed that these treatments were not superior to comparison treatments (such as CBT) in terms of reduction of binge eating (Linardon et al., 2017). Other promising treatments include integrative cognitive-affective therapy for bulimia nervosa (Wonderlich et al., 2014).

### 11.2 Physical exercise as medicine in eating disorders

The suggestion to include exercise in the treatment of AD can be seen as provocative and controversial. However, there is a growing body of evidence suggesting that monitored exercise and nutrition are safe and can bring multiple benefits to individuals with AD. For example, previous research showed that the exercise has had an effect on attitudes and behaviors like symptoms reduction of the extreme thinness, and decrease body dissatisfaction (Cook et al., 2016; T. A. P. de Oliveira et al., 2018; Gonçalves et al., 2017), facilitate weight gain in anorexia nervosa, increase strength (Fernandez-Del-Valle et al., 2014) among other benefits to physical and mental health. This area of research suggests that substantial help may be possible with an appropriate exercise protocol as part of the treatment of people with AD.

Literature overviews concluded that exercise is safe for all variants of AD, if nutritional needs are met. In addition, the carefully performed therapeutic exercise may reflect the initiative of the American College of Sports Medicine "Exercise as Medicine" in patients with AD. However, the lack of a comprehensive list of guidelines that can explain how to effectively use exercises during a part of AD treatment demonstrates the need for additional review and synthesis of the literature, which may imply clinical considerations (Holland & Tiggemann, 2017; Moola et al., 2013).

Based on this, the following main strategies on exercise efficacy were identified as part of a treatment of AD (Cook et al., 2016). The team's approach, including an exercise program in the treatment of AD requires specific knowledge related to exercise prescription, physiology, and nutrition, as well as medical and psychological factors relevant to the treatment. Therefore, a multidisciplinary team of specialists in exercise, nutrition and mental health, medicine and physiotherapy should work collaboratively

to develop individualized exercise programs, with participation dependent on adherence to AD therapy.

It is recommended to start with mild intensity with a slow transition to moderate intensity. A primary objective should be to limit individuals with AD to small periods of light intensity activities that will allow the gradual conditioning of physiological systems. Aerobic and resistance exercises included in an exercise program should be adapted to the physiological and psychological needs of the patient. For example, successful programs have described resistance training for weight restoration in individuals with anorexia (Muñoz et al., 2018) and aerobic activity for weight loss, reductions in movement and bulimic symptoms and body dissatisfaction in individuals with bulimia nervosa (Ayuzo-Del Valle & Covarrubias-Esquer, 2019).

In addition, exercise should not be performed until the individual with AD has made sufficient progress in weight stabilization (for those with bulimia nervosa) and in caloric and nutritional intake to support the chosen activities (S. Bratland-Sanda & Vrabel, 2018; Solfrid Bratland-Sanda et al., 2010). Analyzing, preferably during the exercise session, but certainly after, the individual should be 'analyzed' in relation to sensations, emotions and thoughts evoked by the exercise. Here will be presented principles of the use of exercise as a treatment modality, they are:

1. Include a team approach with rigorous monitoring.
2. Ensure that adequate knowledge is available to oversee the nuances of proper delivery of exercise therapy and distinction when exercise needs to be modified or interrupted if the patient's medical or psychological status deteriorates.
3. Shall provide a set of rules, program goals, written in conjunction with results, expectations and contingencies for the progression and regression of exercise activity and provide a transparent example of treatment and exercise goals.
4. Help clinicians challenge the distorted beliefs and gears about exercise that are commonly observed in individuals with AD. For example, potential areas of content that are related to exercise in AD and therefore can be emphasized include the following: a. appropriate use of exercise for health benefits, b. recognize when exercise is becoming problematic, c. develop healthy attitudes and exercise behaviors, d. promote body awareness (i.e., understanding physiological states, injuries, and pain) , e. learn to enjoy exercise and exercise for fun, instead of having a functional role attached, f. identify factors related to overtraining or Burnout, e.g. focus on positive reinforcement;
5. Help change the exercise function in the AD. Specifically, exercise is a highly reinforcing activity for



some individuals, and the strength of this reinforcing value may be the reason for overuse or excessive exercise patterns associated with the severity of AD, and consequently the emphasis should be placed on making exercise appropriate to treatment compliance and success, rather than leaving exercise monitored and up to the individual with AD;

6. Start with moderate intensity and developing slowly to moderate intensity.

7. Emphasize the proper use of exercise, understanding body responses to exercise, and "listening to one's own body" when physiological resources are being exhausted. Therefore, exercise treatment should emphasize slow progression, so as not to leave exercise uncontrollable. A physiotherapist can provide the necessary knowledge to provide this guideline. So starting with small amounts of low intensity exercises, for example, starting with stretching or a half mile walk at a slow pace. The amount and intensity of exercise can be gradually increased as the patient demonstrates progress with standard Treatment of AD, weight restoration and any other predetermined therapeutic outcome. The recognition of body states related to physical exercise may continue to impair, even after weight restoration, because impairment in the recognition of other sources of pain (e.g., hunger, fullness, and exercise) often occurs during the development and maintenance of DA.

These guidelines correspond to the recommendations for the use of exercise as a complement to treatment for other mental health conditions and the beginning of activity in an individual without much knowledge of healthy exercise routines (Garber et al., 2011; Hayashi, 2016; Polman et al., 2018). In summary, the physical exercise effects is displayed in figure 1.

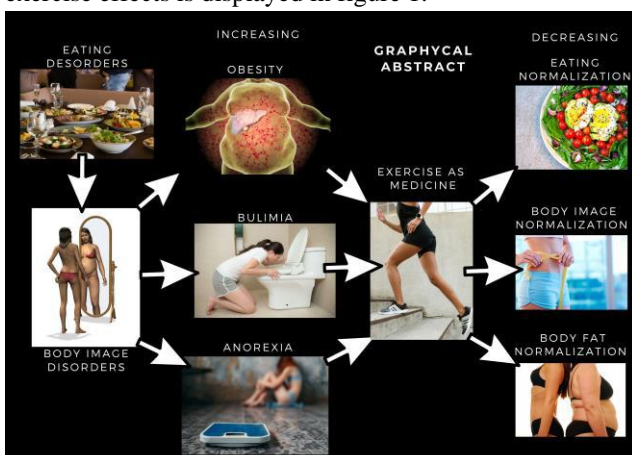


Fig.2: Summarized effects of physical exercise. After the installation of eating disorders, the body image are injured which can lead to obesity, bulimia, and anorexia, and after the physical exercise approach, all symptoms decrease in prevalence and severity.

## XII. CONCERNS AND AGAINST MEDICAL INDICATIONS

Although there is a critical mass that testifies in favor of exercise as part of the treatment of AD, not all whistles, that is, exercise is not appropriate for all individuals with AD. However, evidence can guide clinicians and researchers to adapt health benefits to the type of exercise, its amount and intensity to support physiological and psychological changes that can improve the effects of other AD treatments.

Safety is the main concern when adding exercise to AD therapy, and all precautions should be taken to prevent damage. The beginning of an exercise routine usually poses minimal health risks; however, patients with AD present additional psychological concerns in addition to an individual without AD (Holland & Tiggemann, 2017).

The identification of individuals who endorse pathological attitudes and behaviors in relation to exercise (e.g., exercise dependence, and compulsive exercise) may indicate the need for closer supervision. Creating a written contract detailing the program's rules, goals, outcomes, expectations, and contingencies for progression and regression of exercise activity should be agreed upon by all members of the treatment team and by the patient to promote an inclusive and collaborative exercise program that complements standard treatment for AD.

It is necessary to include a psych educational component that is the main component of cognitive behavioral therapy. In this sense, it is necessary to focus on positive reinforcement. However, unsupervised exercise can result in excessive behavior due to negative consequences of overtraining and exhaustion (Cook et al., 2016). Thus, programs need to identify and manage excessive or unhealthy exercise patterns, thus making exercise an available component for treatment adherence. Thus, the careful and incremental application of exercise is fundamental in the successful management of the exercise performed in therapy. Thus, graduate exercise programs that begin with small amounts of low intensity exercises should be emphasized (Ayuzo-Del Valle & Covarrubias-Esquer, 2019; Joy et al., 2016).

Therefore, it should be emphasized the understanding of physiological feedback and body states, distinguishing appropriate feelings of muscle effort from pain and/or injury, heart rate and respiratory rate, recovery, rest and body acceptance. To this end, additional time beyond what is necessary to obtain physical conditioning should appear at each level of exercise after the occurrence of physiological conditioning.

In summary, the figure 1 display the physical exercise effect on eating disorders, body image, obesity in a schematic overview.

### XIII. CONCLUSIONS

This literature review resulted in a comprehensive list of guidelines for the use of exercise in the treatment of ADs. These guidelines reflect the general objectives of an "exercise as medicine" approach, adapting exercise to maximize the health effects of a specific population. Of importance when applying these guidelines, the general objectives of an exercise program as adjuvant treatment of ADs should be developed "from the beginning" by a multidisciplinary team of specialists. The specific content should focus on safety by re-educating patients about the appropriate methods for performing exercises, motivation-related attitudes and transparency about health benefits and possible impairments resulting from increased exercise.

The approach advocated here begins with low intensity exercises (i.e., walking at a slow pace and stretching) for a short period. Progression to increased tension and amounts of exercise should occur only when the individual understands body sensations, psychological motivations and health outcomes related to exercise at low levels. The specific content of a therapeutic exercise program can also be adapted to amateur athletes and elite athletes with AD, focusing on the relationships between the athletes' body, exercise, psychological characteristics and foods (nutrition) used to promote athletic performance. Thus, our suggested approach to the inclusion of exercise in the treatment of AD is to empower the individual with exercise as a tool for a healthy life.

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