Behavioral nutrition applied to the treatment of obesity

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ABSTRACT
Obesity is a chronic disease, difficult to control. Even with traditional treatments, such as diet prescription, physical exercise, psychological and drug therapy, the obesity prevalence still continues to increase in worldwide. Thus, behavioral nutrition emerges as a possibility in the control of this disease. This study aimed to understand the role of behavioral nutrition in the treatment of obesity. This is a literature review, conducted through online research in Pubmed, Scielo and Lilacs. Publications from the last ten years in Portuguese and English were included. Reference books in the area were also consulted. The keywords used in the search were: obesity, feeding behavior, mildfulness eating, and intuitive eating. The Boolean AND and OR techniques were used to combine the keywords. Behavioral nutrition is a psychological method, which aims to understand food as a whole, and its main objective is to change negative relationships with food. Thus, the application of behavioral nutrition in obesity treatment can favor the individual to see food as a source of both nutrition and pleasure, but not as an "enemy". It is known that obesity is directly associated with eating-related behavior patterns and changes of satiety recognition. In this sense, behavioral nutrition techniques broaden the range of interventionist possibilities to rescue the recognition of the hunger and satiety cycle and the factors that interferes in this process. Strategies of behavioral nutrition applied in the treatment of obesity include nutritional counseling, intuitive eating, cognitive-behavioral therapy, motivational interviewing, and mindful eating tactics. It is concluded that the application of behavioral nutrition promotes recognition of hunger and satiety signals, and may generate even greater benefits in the treatment of obesity.

Keywords: Obesity, Eating behavior, Mindfulness, Intuitive eating.

1 INTRODUCTION

According to the WHO, obesity is defined as an accumulation of abnormal fat that can harm health. Obesity has numerous causes, being considered a disease of multifactorial origin, dependent on the interaction of genetic, metabolic, social, behavioral and cultural factors, causing a strong impact both on physical health and psychological well-being and, mainly, on quality of life (NISSEN; SCALLOP; BOZZA, 2012).

In recent decades, with the increasing prevalence of obesity worldwide, it has become a public health problem, constituting an epidemic responsible for the substantial increase in morbidity and mortality. The increase in body mass index (BMI), especially in severely obese patients (BMI >40.0 kg/m2), causes serious health problems, such as increased risk factors for cardiovascular, metabolic, neoplastic and orthopedic diseases. Chronic non-communicable diseases, associated with obesity, entail high costs to health systems and the national economy, through mortality and early retirement (SILVA et al., 2020).

Obesity also causes infertility, cholelithiasis, non-alcoholic fatty liver disease, gastroesophageal reflux, depressive symptoms, psychosocial disorders, systemic arterial hypertension and breathing difficulties, such as chronic hypoventilation and obstructive sleep apnea (BRASIL, 2020).

Overweight and obesity are closely linked to eating behavior, and these are affected by several factors, the so-called food determinants that are categorized into three types: those related to food, such as taste, appearance and nutritional value; those related to the eater: anthropological, psychological and socioeconomic biological; and factors related to the environment: physical and sociocultural; these affect food choice through effects on individual thoughts and feelings (NUNES; GARRIDO, 2018).

Emotions are directly related to the principle and individual behavioral aspects, which can cause risks for emotional disorders such as depression, anxiety, eating disorders, and image distortion body and low self-esteem, which are intrinsically linked to inappropriate food behavior and consumption (LIMA; OLIVEIRA, 2016; MOURA; NAVA, 2020).

The incorporation of behavioral nutrition in the context of eating behaviors in the face of obesity has become an extremely important approach, since it values the relationship of human beings with food and all behavioral aspects related to food. This new concept disassociates the negative aspects attributed to food, in addition to worrying about the emotional, physiological and social factors involved in eating behavior, also relating pleasure to the act of eating without guilt and the change in the vision of food from enemy to ally (CARVALHO, 2012).

The present work is justified by the growing epidemic of obesity and consequently the need to study and apply new approaches that will combat the problem more effectively. There is an increase in the prevalence of obesity, making it a major public health problem. In addition, obesity is a risk factor for other serious diseases, which compromise quality of life and cause an increase in the use of health resources. For this reason, intervention studies for the treatment of obesity (NISSEN; LEONARDO, 2012).

Our motivation came from the fact that there is an increasing need to value and rescue the bonds with eating without guilt, to share a good meal with natural foods in its majority, and to emphasize that by taking such attitudes the body system self-regulates itself naturally, both physically and

psychologically, since healthy eating favors the proper functioning of the various body systems. We hope to contribute in this work, to demonstrate that the human being is unique and must be treated in an integral way and not only under the biological approach, but also human.

2 GOALS

2.1 GENERAL OBJECTIVE

Understand how behavioral nutrition can contribute to the treatment of obesity.

2.2 SPECIFIC OBJECTIVES

1. Analyze the fundamentals of behavioral nutrition;
2. Review the behavioral determinants related to the etiology of obesity;
3. To associate the applicability of behavioral nutrition in the treatment of obesity.

3 MATERIALS AND METHODS

A bibliographic review was carried out by consulting scientific articles published in the databases Scielo, PubMed and Lilacs in the last ten years, as well as specific academic books in the area. We conducted research through the combination of keywords registered in the Health Sciences Descriptors (DECS): Obesity, Obesity Management, Mindfulness, Eating Behavior and Eating Habits. The English terms used were: Obesity, Obesity Management, Mindfulness Feeding behavior, Mindful eating and Comfort food. The Boolean technique AND and OR were applied to combine the keywords.

4 DEVELOPMENTS

4.1 OBESITY

4.1.1 Definition and prevalence

Obesity, according to the WHO, is a chronic condition of excess body fat in amounts that determines damage to health, categorized in the 10th revision of the International Classification of Diseases (ICD-10), being considered a manifestation of food and nutritional insecurity and risk for the development of other chronic non-communicable diseases (DIAS et al., 2017).

It is diagnosed through body mass index (BMI), which is calculated by the ratio of weight to height squared (BMI = weight (kg) / height (m)2) (SBEM, 2020). BMI does not measure body composition; however, it has high specificity and low sensitivity, suitable for its use as a criterion to identify overweight/obesity as a risk factor for chronic non-communicable diseases (NCDs) in population groups, but not to make nutritional diagnosis (ABESO, 2016; DIAS et al., 2017).

Combining BMI with measures of body fat distribution can help solve some problems of using BMI alone. The cutoff point for adults is based on the association between BMI and chronic disease

or mortality. Those with BMI between 30 and 34.9 kg/m2 are classified as Obesity I and at high risk for diseases; BMI between 30 and 39.9 kg/m2 is classified as Obesity II and very high risk for diseases; and BMI ≥40.0 kg/m2 is classified as severe obesity III and very high risk for diseases (ABESO, 2016).

In the human body there are two types of adipose tissue, the white adipose tissue that stores fat in a large drop, mostly in the form of triglycerides. It is considered the most comprehensive and is located mainly in the visceral and subcutaneous compartments, with functions of energy storage, mechanical protection against shocks and traumas, adequate sliding between viscera and muscle bundles. It is considered thermal insulator and maintains body temperature, still provides raw material for the synthesis of some vitamins, lipoproteins and hormones (BONFANTE et al, 2015).

It is the white adipose tissue that produces and secretes a large amount of adipokines, which are stimulated by monocytes, macrophages and infiltrated lymphocytes, and which influence appetite regulation, energy balance, insulin sensitivity and angiogenesis. Its excess causes hypoxia, cell death and remodeling of adipose tissue, causing greater secretion of adipokines and induction of a chronic low-grade inflammatory state, which will influence the emergence of NCDs (BONFANTE et al, 2015).

On the other hand, brown adipose tissue has a greater number of mitochondria and the ability to metabolize energy substrates to produce heat and consequently burns a large number of calories (BONFANTE et al, 2015; SBD, 2019).

Obesity considered exogenous results from external factors, such as the imbalance between caloric expenditure and food intake. Endogenous obesity is characterized by weight gain as a result of hormonal imbalance factors resulting from changes in thyroid, gonadal, hypothalamic-pituitary metabolism, tumors and genetic syndromes (GOIS; BAGNARA, 2011).

Obesity can still be classified into four types according to the distribution of fat deposits: type I, characterized by excess total body fat mass without particular concentration; type II, excess subcutaneous fat in the abdominal region and trunk, also known as android-type or "apple" type obesity; type III, excess abdominal visceral fat, associated with cardiovascular problems and resistance to the action of insulin; type IV, excess gluteofemoral fat, also known as gynoid type or "pear" type obesity (GOIS; BAGNARA, 2011).

To store more fat in the adipose tissue, it is necessary that it increases its storage capacity, increasing the size of the adipocyte by the process of hypertrophy, which has a more pathological character due to the inadequate and disproportionate increase in vascularization. The process of hyperplasia is characterized by the increase in the number of adipocytes, and occurs by adipogenesis, in which there is the recruitment of more cells of the stromal vascular fraction and increase in vascularization proportionally (MOURA et al., 2019).

There is also the possibility of accumulation of ectopic fat, characterized by the deposition of triglycerides in other non-adipose tissues, such as the liver, brain, heart and skeletal muscle, either by

an inability of cells to hydrolyze triglycerides, or by increased uptake of triglycerides by non-adipose tissues. These phenomena cause the reduction of energy expenditure in brown adipose tissue, impairment of bone marrow stem cells, decrease in muscle strength, appearance of chronic diseases, in addition to contributing to systemic inflammation, due to increased secretion of pro-inflammatory cytokines. Already in the process of weight loss, these cells decrease in size, but not in number, in this sense, obesity is considered a disease that has no cure, but rather control (MOURA et al., 2019).

Obesity rates have almost tripled since 1975, affecting people of all ages, social groups in developed and developing countries, reaching 650 million people worldwide (BRAZIL, 2020). By 2025, an estimated 700 million adults will be obese. Currently, 55.7% of Brazil's adult population is overweight and 19.8% is obese, according to the Surveillance Survey of Risk and Protective Factors for Chronic Diseases by Telephone Survey (BRASIL, 2019). Between 2015 and 2017, the country had the highest growth rate of obesity among adults aged 25 to 34 years (84.2%) and 35 to 44 years (81.1%) (ABESO, 2020). The National Health Survey (PNS), of 2013, indicates that, among adults with diabetes mellitus, 75.2% are overweight and, among adults with hypertension, 74.4%, which demonstrates the relationship between overweight and comorbidities (BRASIL, 2020).

4.1.2 Etiology and consequences

Obesity is considered a multifactorial disease, in which several biopsychosocial factors are involved in its development. In this way, the political, economic, social and cultural environment assumes a strategic place, as well as biological and environmental determinants (SBEM, 2020).

As an etiology for obesity, one should consider the historical and ecological influences of the nutritional transition, where there was a reduction in the prevalence of diseases attributed to underdevelopment and the increase in diseases linked to modernity, correlating with economic, social and demographic changes. In this scenario, it was observed the adoption of a diet rich infats, sugars and refined foods, and reduction in the consumption of fiber and complex carbohydrates, accompanied by reduced physical activity and adherence to a sedentary lifestyle (DIAS et al., 2017).

Leptin, a hormone secreted by adipose tissue in response to fat storage or excess food intake is considered the most important hormone for homeostasis of energy balance. It acts on the hypothalamus decreasing energy consumption and carrying signals from energy stores in the body for the brain to be able to balance energy expenditure and consumption (MACHADO; MARTIN; PINTO, 2015; MANCINI et al., 2015).

Food intake generates responses to reduce food consumption, and stimulates the secretion of leptin, which acts on the central nervous system and potentiates the effect of reducing food consumption, from the inhibition of the synthesis of neuropeptides related to appetite, along with

increased expression of anorectic neuropeptides, such as α-melanocyte stimulating hormone and corticotropin-releasing hormone (MACHADO; MARTIN; PINTO, 2015).

When there is central activation of leptin receptors, there is an increase in the activity of the sympathetic nervous system, which stimulates energy expenditure in adipose tissue. In addition, it acts in the control of glucose and lipid metabolism (MACHADO; MARTIN; PINTO, 2015).

Leptin has already been observed in other organs and tissues, with direct action on the regulation of immune cells, pancreatic beta cells, adipocytes, muscle and blood cells. It acts as an endocrine and paracrine factor, in the regulation of puberty and reproduction, modifying insulin sensitivity in muscle and liver, preventing ectopic lipid deposition, in the association of endocrine and immune systems, skin repair and glucose metabolism (SILVA; CASTRO, 2019).

It is observed that serum leptin concentrations in obese individuals are higher compared to lean individuals, directly correlating to body fat percentage. However, when it occurs in high plasma concentrations, leptin resistance may occur, which is usually associated with a hypercaloric diet for a long period, and this becomes unable to act effectively in the control of the energy balance, leading to excessive weight gain and the difficulty of treating obesity (SALDANHA, 2019).

The hormone ghrelin, in turn, is secreted mainly in the mucosa of the stomach, and stimulates food intake and reduces energy expenditure. It has potent properties of release and effect of growth hormone, is an important regulator of food intake and satiety, which is reduced in obese individuals and in response to high food intakes (VILANDRE JUNIOR et al., 2012).

The feeding impulse induced by ghrelin is partly mediated by the hypothalamic arcuate nucleus, implying the secretion of neuropeptide Y (NPY) and agouti-related peptide (AgRP). The alteration of leptin and ghrelin levels is capable of altering the pattern of food intake and leading to nutritional maladjustments, and the synchronism in the secretion of these hormones is important for the daily pattern of meals, and there is a reciprocal rhythmic pattern between the secretion of leptin and ghrelin. Ghrelin also inhibits the expression of adiponectin, a hormone that modulates the regulation of glycemia and the catabolism of fatty acids, where its reduction implies insulin resistance and obesity (VILANDE JÚNIOR, 2012).

Adiponectin also has potent anti-inflammatory properties, being able to influence the proliferation and balance of anti- and pro-inflammatory cells and molecules, such as Tumor Necrosis Factor (TNF-α), IL-10, macrophages, T cells and NK cells (SILVA; CASTRO, 2019). Such adipokine has the potential to activate the expression of molecules that increase the oxidation of fatty acids in skeletal muscle, reduce insulin resistance in this tissue, and may activate the enzyme adenine monophosphate kinase (AMPK), which results in decreased hepatic glucose production (PENNA; HERMSDORFF; SARON, 2020).

Interleukin-6 (IL-6) has inflammatory functions, and the greater the amount of adipose tissue, the greater the secretion of it and adipokines with immune function, such as TNF-α (SIPPEL et al., 2014).

TNF-α, a pro-inflammatory cytokine, synthesized as a transmembrane protein, causes decreased expression on the cell surface of glucose transporters (GLUT-4), phosphorylation of the substrate of the insulin (IRS-1) and specific phosphorylation of the insulin receptor, also reduces the oxidation of fatty acids in hepatocytes and skeletal muscle, implying accumulation of bioactive lipids, such as triacylglycerols (SPERETTA; MILK; Duarte, 2014).

Obesity today is characterized by a state of chronic inflammation, characterized by increased concentration of pro-inflammatory adipokines, which have a great impact on various bodily functions that are strongly correlated with cardiovascular diseases (SIPPEL et al, 2014).

Still as determinants of obesity, we have the influence of sleep and melatonin production, where the number of hours of sleep per night is inversely related to BMI and obesity. Sleep deprivation causes decreased leptin and TSH secretion, increased ghrelin levels, decreased glucose tolerance, increased hunger and appetite. Melatonin secreted in the pineal gland functions as a chronobiotic hormone, regulating circadian temporal order, GLUT4 expression, insulin receptor phosphorylation, and intracellular substrates of the insulin signaling pathway. The reduction in its production induces insulin resistance, glucose intolerance, sleep disturbances, and metabolic circadian disorganization, characterizes a state that leads to obesity (ABESO, 2016).

Serotonin is the neurotransmitter responsible for regulating functions such as mood, sleep, and appetite. Its reduced production is related to depression, associated with increased desire to consume sweets and refined carbohydrates, as well as lower satiety, which is potentially related to excessive weight gain and development of obesity (AZEVEDO; BRITO, 2012).

Exposure to chronic stress influences the temporal pattern of peripheral biomarkers that can have behavioral impacts and metabolic repercussions, leading to obesity. The neurobiological mechanisms of stress affect reward pathways to enhance motivation and consumption of highly palatable foods. The stress response is characterized by: acute behavioral and physical adaptations, such as gluconeogenesis, lipolysis, and reproduction inhibition (BITTENCOURT; VAZ; ZANIN, 2015).

The Hypothalamic-Pituitary-Adrenal (HPA) axis is one of the two main neuroendocrine systems associated with stress. Activation of the HPA axis occurs when the hypothalamus secretes a corticotropin-releasing factor (FLC) hormone, which stimulates the pituitary to release adrenocorticotropic hormone (ACTH) into the bloodstream, which acts on the cortex of the adrenal gland, stimulating the release of glucocorticoids (cortisol), with bodily effects of stress response. Constant activation of the HPA axis is associated with eating disorders such as binge eating, as well

as alters glucose metabolism and promotes insulin resistance, with changes in appetite hormones and feeding neuropeptides (e.g., Neuropeptide Y). Cortisol helps in the control of biorhythm, acts in the process of controlling inflammation, allergic reactions, stress, immune responses, emotional stability and also stimulates the increase of glucose in the blood. When their levels are high, weight gain, learning disability, low growth, decreased testosterone and memory lapses occur (TOFOLI, 2012).

When there is exposure to environments characterized by chronic psychosocial stressors, this chronic stress overloads the mechanisms of body homeostasis, causing the release of glucocorticoids, which causes an anomalous distribution of fat, especially in the abdominal region, associated with insulin resistance, hypertriglyceridemia and systemic arterial hypertension. Situations considered as desynchronizing biological rhythms, which induce the release of glucocorticoids, are associated with eating disorders that can lead to obesity (BITTENCOURT; VAZ; ZANIN, 2015).

Stress can modify eating behavior, as the hormone cortisol stimulates food intake. Compulsive behavior facilitates obesity, just as the severity of binge eating may be related to the degree of obesity. Thus, compulsive individuals may represent a subcategory of the obese population, who present high levels of psychopathology, and greater severity of obesity (LIMA; OLIVEIRA, 2016).

There are psychological variables involved in the development and maintenance of obesity, which are related to some type of psychological suffering, such as anxiety, anger, sadness, guilt, worry, experience of psychosocial stressors, as well as a loss of self-image and self-esteem (STAR; MENDES, 2017).

Emotional problems are a serious risk for these patients, as they tend to present an increase in emotional symptoms when dieting, in addition to being constantly exposed to intrinsic psychological suffering, resulting from social prejudice regarding their obesity in conjunction with the eating behavior presented (CUNHA et al., 2020).

There is also the influence of pharmaceutical iatrogeny on the development of obesity, where many drugs used to treat other conditions contribute to weight gain or exacerbation of weight gain in susceptible individuals (ABESO, 2016).

Endocrine disruptors are environmentally stable and industrially produced lipophilic substances, which include dichlorodiphenyltrichloroethane, some polychlorinated biphenols and alkylphenols, and can affect endocrine function, disrupting endogenous hormone regulation, promoting weight gain through multiple pathways (GORE et al., 2019).

Obesity would also have a cause compatible with the infectious origin, since it was found that the human adenovirus, adenovirus (Ad)-36, Ad-37 and Ad-5 directly affect adipocytes, stimulating enzymes and transcription factors that cause triglyceride accumulation and the differentiation of pre-adipocytes into mature adipocytes. The data reveal that Ad-36 is present in 30% of obese humans and 11% of non-obese humans (ABESO, 2016).

In addition, it is believed that the altered intestinal microbial composition can lead to obesity, increasing energy uptake in both the large and small intestines. The gut microbiota is made up of approximately 100 trillion bacteria, and they are also responsible for converting food into nutrients and energy. Its composition interferes with gene expression, immune system, risk of chronic and serious diseases, immunological, metabolic and structural function. The imbalance of this microbiota, or gut dysbiosis, generates bacterial overgrowth, toxin production and increased intestinal permeability, causing immunological and hormonal changes. In addition, microbial signals regulate the release of fasting-induced adipose factor (Fiaf) from epithelial cells of the intestine, inhibiting lipoprotein lipase (LPL) that regulates peripheral fat storage (ANDRADE et al., 2015).

In a study, consequences were found in the health status of obese individuals, and a positive association was found between self-rated health and diagnoses of hypertension, diabetes mellitus, angina and depression, related to obesity (FERREIRA; SZWARCWALD; DAMACEN, 2019).

According to the Brazilian Society of Bariatric and Metabolic Surgery (SBCBM, 2016), comorbidity is the pathological state caused, aggravated or hindered by the presence of excess weight or that presents control or cure with weight loss, such as metabolic diseases, some respiratory diseases, joint diseases, arterial diseases, liver diseases, male and female infertility.

At the present time, SARS-CoV-2 has shown worse outcomes for obese people regardless of age. This is due to the cardiac overload and immune dysregulation presented in obese individuals, being proportional to the increase in BMI, so obesity is an important comorbidity for the severity in cases of COVID 19 (BRANDÃO et al., 2020).

A sedentary lifestyle emerges as a major public health problem and there is evidence to support the detrimental effects on health and well-being in individuals of all ages in the long term, associated with increased risk for a range of health problems, including, obesity, cardiovascular disease, mood disorders and mortality. It is defined as "any waking behavior." It is different from physical inactivity, which is defined as physical activity at a level insufficient to meet current recommendations (150 min of moderate or vigorous physical activity per week) (RAWLINGS et al., 2019).

A sedentary lifestyle is a risk factor for obesity and comorbidities that is easily circumvented. It is worth emphasizing that the practice of physical exercises in conjunction with healthy eating, are factors that produce important improvements in the general health status, including prevention and treatment of obesity (PORTO et al., 2019).

The reasons for remaining in a sedentary lifestyle come from childhood, where the parenteral environment, interests and capacities of the individual, social and physical, influence the levels of sedentary lifestyle. In adulthood, social roles, family, employment and economy, can act as facilitators or barriers to sedentary lifestyle. By ceasing to be sedentary, the individual experiences various benefits such as increased stamina, balance, weight loss, psychological and physical well-being,

improved mood, better sleep quality, cognitive benefits, quality of life and mental health (RAWLINGS et al., 2019).

The relationship between eating habits and NCDs, such as obesity, has been extensively investigated. Data from the Global Burden of Disease Study, conducted in 195 countries between 1990 and 2017, indicated that global consumption of healthy foods and key nutrients were suboptimal, with the largest differences between recommendation and consumption for nuts and seeds, milk, and whole grains. In parallel, it was noted that the daily consumption of unhealthy foods, such as sugar-sweetened beverages, was much higher than the optimal intake, as was processed meat that exceeded 90% of the ideal amount and sodium per day, and red meat exceeded the ideal intake by 18% (GBD, 2017 DIET COLLABORATORS, 2019).

This analysis provides a comprehensive picture of the effects of poor eating habits on health at the population level. It is believed that improved diet could potentially prevent one in five deaths globally. This study showed that the main dietary risk factors for mortality are diets high in sodium and low in whole grains, fruits, nuts and seeds, vegetables, and omega-3s (GBD 2017 DIET COLLABORATORS, 2019).

Body weight tends to increase from 20 to 50 years of age, worsening with the reduction in the levels of physical activity, resulting in an increase of 600g in average weight per year and reducing 200g of muscles. After menopause, there is a frequent increase in body weight, as well as changes in the distribution of body fat. The weight gain from the fourth decade onwards is due to the reduction of the basal metabolism, positive caloric balance and accumulation of body fat, being observed that there is a progressive increase in the waist-hip ratio with advancing age, which is due to elevation of abdominal fat of menopausal women (DIAS et al., 2017).

4.1.3 Obesity and eating behavior

Obesity presents as one of the main causes the food consumption above the daily needs. In this sense, it is necessary to elucidate the behavioral factors related to diet and overweight. Eating behavior involves methods, reactions, and ways of proceeding with food and is directly related to the control of food intake. It is configured as the system that conducts the choices, requiring specialized mechanisms to balance physiological information from the internal environment, affected by psychosocial factors, with nutritional information from the external environment (ARAÚJO; MAYNARD, 2019).

According to the literature, there are three types of determinants of eating behavior (ARAÚJO; MAYNARD, 2019):

1. Food-related: such as taste, appearance, nutritional value;

2. Related to the eater: biological, anthropological, psychological and socioeconomic;

3. Environmentally-related: physical and sociocultural, reflecting interactions between the physiological state, the psychological state, and the environmental conditions of the individual.

Although not considered a mental disorder, obesity involves behavioral and emotional disturbances related to eating and there may be comorbidities with psychological disorders such as depression, anxiety, eating disorders, as well as body image distortion and low self-esteem. These emotional and psychological changes are intrinsically related to the behavior and food consumption that can lead to excess weight (LIMA; OLIVEIRA, 2016).

Individuals with obesity who seek specialized treatment for weight loss may have a higher prevalence of symptoms of anxiety, depression, impulsivity traits, and eating behavior disorders (BIAGIO; MOREIRA; AMARAL, 2020)

Depression alters the eating and social behavior of individuals, and they may present difficulties in relating, and anxious symptoms may arise, increased sense of social inadequacy and decreased sense of well-being and, as a consequence, decreased interpersonal relationships (STAR; MENDES, 2017).

Chronic stress is associated with metabolic disorders and changes in energy homeostasis that can induce pleasurable and compulsive behaviors such as eating sweet and fatty foods. There seems to be a bidirectional relationship between psychiatric disorders, overweight and obesity, which is a predictor of depression, which has a bidirectional association with obesity (STAR; MENDES, 2017).

Studies state that the quality of the diet is related to mood disorders, and that some nutrients can contribute to depression and other pathologies associated with mood. Weight gain distorts body self-image, which can lead to a devaluation of self-concept, decreasing self-esteem and potentiating depressive symptoms, decreased sense of well-being and feeling of social inadequacy (CUNHA et al., 2020).

Several patterns of eating behaviors have been identified and they include: Eating Uncontrollability (AD), Emotional Eating (EA), and Cognitive Restriction (CR). Cognitive Restriction consists of adopting a mental position in relation to food in order to reduce caloric intake. Emotional Eating is characterized by the impulse to eat in response to emotions, and changes in mood are triggers for the disinhibition of food control. And finally, food uncontrol is the loss of self-control and excessive consumption of food, with or without the presence of hunger. Therefore, it is important to understand the patterns of eating behaviors for the proper management of obesity, and to build a nutritional approach multidimensional that may result in greater adherence to treatment (BIAGIO; MOREIRA; AMARAL, 2020).

Binge Eating Disorder (BED) falls among eating disorders. Its diagnostic criteria are recurrent binge eating episodes, such as eating alone out of shame about how much one is eating; feeling disgusted with yourself, depressed, or very guilty afterwards; and having marked suffering due to binge

eating. These episodes are accompanied by feelings of subjective distress, involving shame, disgust and/or guilt (LIMA; OLIVEIRA, 2016).

Patients who have concomitant eating disorders such as Binge Eating Disorder and do not treat with obesity, tend in the long term, remain with a high rate of caloric intake, usually have a higher BMI, more severe levels of depression and obsessive-compulsive symptoms. Thus, it is essential to carry out nutritional and/or behavioral interventions that simultaneously address weight control and the reduction of eating disorder behaviors in individuals with obesity, in order to improve treatment adherence and promote greater benefits to physical and mental health, than treatments focused on only one or another condition (FLORIDO et al., 2019).

In a study by França et al. (2012), the psychoeducational techniques applied in two focus groups were described, in order to contribute to the change of eating behavior:

1) Psychological factors, which address the perception of the group about interferences of psychological aspects in the maintenance of adequate eating habits, making it possible to identify feelings such as: sadness, anger, depression, anxiety, difficulties in family relationships, low self-esteem, negative evaluation of body image, motivation and joy, with prevalence of depression and anxiety;
2) Intervention strategies, in order to investigate how participants behave in the face of psychological symptoms that negatively influence the change in eating habits. From this angle, the principles of cognitive behavioral therapy helped in the construction of this category, through the technique of distraction, which works by shifting attention from the internal world (thoughts, bodily sensations) to the external world. Thus, participants learn how to change their inaccurate and dysfunctional thoughts so that they feel better emotionally and behave more productively in the pursuit of their goals; and the modification of dysfunctional beliefs, such as going to church, reading, working, using the computer, meditating, performing physical activity, going to the mall, and doing manual labor. These strategies help them to control psychological problems and deal with impulses regarding food cravings;
3) Effectiveness of the psychoeducational group in changing eating behavior, which provided improved self-esteem, changing habits, performing physical activity more frequently, changing thinking, valuing food, weight loss, improving biochemical indicators such as cholesterol, triglycerides and blood glucose and healthy food choice. Finally, feelings evaluated by the group as negative allowed a lower adherence to the diet and the practice of healthy habits, as well as positive feelings were evaluated, as a driving force to change eating behavior and the practice of healthy habits, being paramount for adherence to changes in lifestyle.

There is a trend in the relationship between emotional eating and eating disorders, associated with obesity in conjunction with depression, comfort food consumption, inflammatory markers, menstrual cycle, neurotransmitters, violence and neglect. Regarding depression, it is suggested that emotional eating is a mediator between obesity and depression, in the subtype that generates increased appetite (FRANCE et al., 2012).

Both emotional eating and routine restriction are associated with differential neural activity in regions of the brain related to self-control, impulse, and reward. Emotional eating was positively associated with general eating psychopathology and binge eating, and negatively with body image flexibility and mindfulness. Body image flexibility moderated the association between emotional eating and binge eating. In women, emotional eating may be related to hormonal changes arising from the menstrual cycle, higher levels are found in the luteal phase (BETTIN, 2017).

4.2 BEHAVIORAL NUTRITION

4.2.1 Eating behavior

Behavior and habit are confused in their uses and definitions, where the term behavior is linked to behavioral theories. In food and nutrition, the terms "eating behavior" and "eating habits" are empirical categories that express a reality. Elements such as objectivity, permanence, individual and collectivity can contribute to the understanding of eating habits, because when inserted in the culture, the individual is significantly influenced (KLOTZ-SILVA; MEADOW; SEIXAS, 2016).

Several authors have definitions of Eating Behavior and all converge on the following factors: the way of behaving and living with food, involving eating practices, the meaning given to food and sociocultural factors. They are the actions of the individual based on the information received and from these, the changes or reactions in the way he deals with food. In addition to being associated with sociocultural factors, it is also related to intrinsic factors of the individual and the collectivity in which he lives at the time of the act of eating, and with the food itself. They are all forms of conviviality with food from the values or meanings, to the preparation and choice of consuming or not what is being arranged at the table (VAZ; BENNEMANN, 2014).

The term behavior has as a synonym the action or act of eating, so the term eating behavior is everything that refers to the coexistence with food, related to the social and cultural food actions of an individual or in a group, from the food choice to the swallowing of food (CAVALCANTI, 2019).

Food is multifaceted, so there are several determinants, such as nutritional, demographic, social, cultural, environmental and psychological determinants. The search for identity, with the role of social integration, satisfaction of desires and sensory pleasure present a different symbolic meaning for each individual, and for the construction of a meaning to the act of eating. Thus, the need to better understand the determinants of eating behavior, of the individual or the group, is reinforced, in order

to increase the effectiveness of interventions nutritional and promotion of healthy eating practices, especially in conditions of obesity (NASCIMENTO, 2016).

Usually food choices occur distractedly, or automatically, but the act of eating is determined by thoughts and emotions, and can represent the power to calm, reward, numb, distract, procrastinate, entertain, seduce and even punish (RODRIGUES, 2019).

Hunger is related to different elements, nine types of hunger can be mentioned, as listed in chart 1. In the performance of behavioral nutrition in the treatment of obesity, it is essential to understand the types of hunger determinants in each individual, because there are deep hungers that have nothing to do with food and that have the ability to mask several other more complex and obscure "hungers" (RODRIGUES, 2019).

Table 1 - Types of hunger and related sensations.

Type of hunger	Related sensation
Hunger of the eyes	An organized meal
Hunger for smell and Hunger for the mouth	Are the flavors, textures and temperatures in our mouth
Hunger for touch	Feel food with our hands
Ear hunger	The spoon stirring in the pan
Stomach hunger	Stomach noises
Cellular or body hunger	Our intuition, one of the most difficult to be perceiving because it requires greater self-perception of internal signals
Hunger of the mind	Influenced by our racing thoughts and concerns
Hunger of the heart	The taste of memory, Confort Food, is that food that often represents a caress hat we need at the moment

4.2.2 Definition of Behavioral Nutrition

The science of nutrition is a new science, and scientific results have shown that it can be articulated with several areas of knowledge and in different forms. Behavioral nutrition should be seen as a science that considers beyond nutrients and bioactive compounds, it integrates psychology to assist in the process of understanding the individual about the external and internal influences in relation to the pattern of food and nutritional consumption. It is constituted as a strategy to glimpse the human being from other perspectives from the relationships it establishes with food (FERNANDES; FERNANDES; BARBOSA, 2019).

Psychology and the field of food and nutrition have interests regarding the treatment of obesity, considering the multicausality and emotional aspects involved in this disease (KLOTZ-SILVA; MEADOW; SEIXAS, 2016).

In this sense, behavioral nutrition aims to present an innovative approach, without the practice of restrictive diets, focusing on stimulating the individual to feel pleasure when eating (CAVALCANTI, 2019).

The behavioral nutrition approach uses the focus of cognitive-behavioral theory, which is based on theories and principles of learning to explain the emergence, maintenance and elimination of

symptoms, with a focus on problem solving, merging assessment and intervention to generate progress (TRAJANO; ALVARENGA, 2019).

Based on the statement that there is a relationship between eating disorders and psychological conflicts, the nutritionist who works the behavioral approach is called a nutritional therapist (TN). The purpose of this approach is to help the individual in relation to the structure and what he should consume, in the understanding of how emotions influence behavior and eating attitudes. It is responsible for helping the patient to build a gradual course, making feasible the execution of food planning (FERNANDES; FERNANDES; BARBOSA, 2019).

4.2.3 Approaches and Techniques of Behavioral Nutrition

Behavioral nutrition encourages, through different initiatives, to understand why and how one eats, through various tools to motivate the patient during the process of changing eating behavior. Through messages that bring back the pleasure in eating, using responsible and positive communication to induce and provide the individual to adopt a healthy eating behavior. Behavioral nutrition believes that all foods can have a place in a healthy diet, respecting the laws of food, social and emotional aspects that involve eating. In this concept, a communication and nutritional guidance that is not based exclusively on diets and nutrients is advocated (ALVARENGA et al., 2019; CATO; Tavares, 2017).

Behavioral nutrition approaches are considered, recognizing the context of each individual, validating emotions related to the act of eating, understanding beliefs, to establish the positive relationship between food, respecting their subjectivities, with long-term interventions recognized by both actors (FAUSTINO-SILVA; JUNG; LA PORTA, 2019).

4.2.3.1 Cognitive-Behavioral Therapy

The Cognitive-Behavioral Therapy (CBT) presents itself as the main cognitive approach of today, is the integration of different cognitive-behavioral concepts and techniques. It is a system of psychotherapy based on the way each human being structures their experiences and the way they feel and behave (REYES; FERMANN, 2017).

It argues that feelings are determined by the way people interpret situations, where psychological disorders proceed in a distorted way from the perception of events, influencing affects and behaviors (REYES; FERMANN, 2017).

The objective is the construction of different hypotheses, for the different areas of life, attributing meanings to situations; in addition to describing the results of cognitive processes characterized as maladaptive or dysfunctional (CONCEIÇÃO; BUENO, 2020).

Nutritional treatment, applied in conjunction with cognitive behavioral therapy (CBT), is one of the auxiliary therapeutic techniques for weight control. It is based on the analysis and modification of behavioral disorders associated with the patient's lifestyle, avoiding relapse and consequent weight regain. One of the objectives of the use of behavioral techniques is the possibility of the patient to identify the stimuli that precede the compulsive behavior, as well as the situations that facilitate non-adherence to treatment (ABESO, 2016).

Among the principles of Cognitive Behavioral Therapy are evidenced (ALVARENGA; Trajan, 2019):

1. Respondent conditioning (Pavlov's), where neutral stimuli, paired with an unconditioned stimulus, provoke the same response;
2. Operant conditioning (Skinner's), in which the effects of a behavior can determine the increase or decrease of its frequency;
3. Social learning or social cognitive theory, where behavior can be learned and acquired by observation (or imitation)
4. Habituation, a natural phenomenon in which sensations such as anxiety and discomfort decrease according to the time spent in contact with the stimulus;

Therefore, current CBT is a combination of action procedures by multidimensional techniques and methods to modify dysfunctional behaviors and/or thoughts (ALVARENGA; Trajan, 2019).

4.2.3.2 Motivational Interviewing

Motivational interviewing (MI) is a patient-centered communication style that uses specific strategies and principles, such as reflective listening, that bring up questions about behavior, autonomy, shared decision-making, and proposes to help people in their conflicts (CATÃO; Tavares, 2017).

Its purpose is to help people identify their problems and consolidate the importance of change. Used in an initial stage of treatment, focused on the problem and has a brief duration. Its application should be based on five principles (BAZZI, 2019):

1. express empathy: through listening, understanding and accepting the patient's feelings and beliefs;
2. develop discrepancy: assess the current situation and finish line of the patient, showing discrepancies in behavior, through their personal goals and values;
3. avoid argumentation: which can generate defensive attitudes;
4. accompany resistance: act in conjunction with the client's priorities, through guiding reflections;
5. Promotion of self-efficacy: develop confidence in the patient, so that he is able to make changes.

Motivational interviewing is currently described in four processes in the form of steps:

1. engagement: it is the construction of a positive therapeutic alliance with the patient, resulting in more engagement and adherence;
2. focus: it is the development and maintenance of the specific direction of conversation for change, which helps in the elaboration of meaning, and in the process of building a direction for change;
3. evocation: it is the extraction of the patient's feelings concerning the purpose of change;
4. Planning: define when and how to change, have a specific action plan. The 4 steps are represented in Figure 1 (FIGLIE; GUIMARAES, 2014).

Figure 1. Motivational coaching in the company. Source: GARRIDO, 2017.

The first step in this approach is to talk about change, about the desire to change, and then about the patient's ability to do so. The reasons and the need to modify some behavior can be addressed. It is necessary to ask open-ended questions in order to let the patient express himself freely, understanding, supporting and giving praise. A summary of the conversation, punctuating the patient's reports, allows him to listen again to his conflicts and positive affirmations, which can have a motivating effect. It is this motivation that probably causes the person to start, continue and stay on a specific change plan, it is intrinsic, but it can be influenced by external factors (BAZZI, 2019).

There are guiding principles of the conversation to stimulate behavioral changes (SANTINI, 2019):

1. Capacity: these are the easy attitudes, which are within the reach of the patient to be fulfilled. An example would be the elaboration of a strategy capable of being executed,

such as buying fewer sweets throughout the week, and that can be suggested by the patient himself, thus having greater chances of success and adherence;

2. Reasons: may be the purposes for initiating the change and vary according to the patient's expectation. It is usually expressed in the form of desires, thoughts such as "practicing physical exercises would make me more willing";
3. Needs: something urgent and fundamental, here there is a higher level of commitment, for example, make use of words such as "need or must", or words of commitments such as "I will organize my schedules".
4. Commitment: the patient already demonstrates that he has started the process of change.

4.2.3.3 Transtheoretical Model

The motivation for behavior change can be identified through the Transtheoretical Model of Motivation for Behavioral Change (MTT) (CATÃO; Tavares, 2017). The transtheoretical model was initially proposed by James Prochaska and Carlo DiClemente, American researchers. It is considered an approach that advocates that behavior change occurs in five stages plus relapse:

1. Pre-contemplation: where the individual still has no intention of change;
2. Contemplation: the individual begins to consider the change, but does not yet have a deadline to begin;
3. Decision or preparation: foresees a change in behavior for the near future;
4. Action: corresponds to the change of behavior, requiring dedication on the part of the individual to avoid relapses;
5 Maintenance: in which the individual changed the behavior and was able to maintain it for more than six months;
6. Relapse: there is a resumption of the previous behavior, a failure in maintenance, and the individual can regress to any of the stages of change. Many need to start the whole process again, however the reason for understanding the process must be identified (SANTINI, 2019).

It is believed that people modify their behaviors intentionally, assuming commitment and collaboration of the subject. By going through these stages of the change process, individuals understand the different patterns involved in each stage, in addition to experiencing each moment, generating modifications or ceasing certain behavioral patterns. It is a process with different levels of motivation and readiness for change (BAZZI, 2019).

For the analysis of the options and elaboration of an action plan for the stages of change, it is necessary to follow some steps, such as:

1. Goal setting: it is necessary to define clear, acceptable and feasible goals, which should come from the patient himself, through key questions;
2. Analysis of options: it is the analysis of how to achieve them, which may be the first choice or not, it is important to prepare the patient for the possibility of changes or adaptations;
3. elaboration of a change plan: it can be a summary form with the change plan or a question such as, "is this what you want?", and it can be disclosed to someone important to him (FIGLIE; GUIMARAES, 2014).

Another component, in addition to the stages of change, are the processes of conduct modifications, which allow the understanding of the modification of recurrent conducts that occurs between the stages. From the moment the individual changes his behavior, it is possible to identify ten steps applied most frequently in treatment adherence, they are (SOUSA; NUNES, 2014):

1. increase awareness and information about adherence;
2. dramatic relief associated with non-adherence;
3. environmental reassessment, which consists of the perception of the effectiveness of the treatment in other people;
4. emotional and cognitive self-reassessment related to adherence;
5. self-liberation, which makes a commitment to the individual for adherence;
6. reinforcement management, with the application of intrinsic and extrinsic rewards for treatment;
7. help in relationships, through incentives and social support;
8. "counterconditioning," which is the replacement of the old behavior by the new behavior;
9. stimulus control, presenting suggestions and reminders for adherence;
10. social liberation, showing that society is changing to support you in joining

4.2.3.4 Comer Intuitivo ou Intuitive Eating

Intuitive Eating (IC) or Intuitive Eating (IE) is an approach that is based on evidence, teaching people to have a good relationship with food, knowing their own body, so that the individual gets in tune with food, mind and body through three pillars: unconditional permission to eat; eating to understand physiological and non-emotional needs and lean on internal hunger and satiety signals to determine what, how much, and when to eat. Intuitive eaters have greater intuitive awareness, perceive the physical sensations that arise from within the body, mediated directly by the brain, its internal hunger signals and eat what it chooses, without feeling guilt, without judgments and without living an ethical problem (ALVARENGA et al., 2019).

Eating intuitively is associated with high levels of psychological well-being and happens gradually, while internalized beliefs about food, nutrition and food are unleashed and replaced by new ideas (NOGUEIRA, 2019).

The Intuitive Eating technique is composed of ten principles (ALVARENGA et al., 2019).

1. Reject the diet mentality, excluding everything that contains information about diet and measures that promise rapid weight loss;
2. Honor hunger, being necessary to perceive signs of hunger and standardize schedules;
3. Making peace with food, through questions such as "do I really want to eat this?", "do I need to eat this now?";
4. Challenge the food policeman: the sensations of stealing or lying about the diet generate a feeling of guilt, and it is necessary to change this thought, and give space to other inner voices that do not judge;
5. Feeling satiety: to feel satiated, it is necessary to learn to listen and understand the internal signals, through self-assessment exercises that can help in this process of better understanding the body;
6. Discover the satisfaction factor, know how to identify when you are satisfied and eat less;
7. Dealing with emotions without using food: cognitive behavioral therapy exercises can be quite helpful in dealing with these emotions without using food;
8. Respect one's own body: encourage the patient to perceive his body with compassion, without evidencing the dissatisfactions;
9. Exercise: so that one feels the positive impacts on health, it should be daily practice and with activities in which one feels pleasure when performing it;
10. Honoring health: Practicing "gentle nutrition" consists of making people feel good about eating, but respecting nutritional guidelines.

There is an Intuitive Eating Scale (IES2), which can be applied during the consultation. The original American version consists of 23 items, adapted for the Portuguese, and has four dimensions (DA SILVA et al, 2018):

1. "Unconditional permission to eat": is the permission to eat food, without classifications and restrictions;
2. "Eating for physical rather than emotional reasons": investigates how much choices are tied to tuning in to internal hunger and satiety signals;
3. "Trust in hunger and satiety signals": investigates the level of trust the individual has with internal signals to guide their choices.

4. "Food choices made in congruence with the state of the body": evaluates the tendency of the individual to make choices according to the functioning and state of the body (BARBOSA; PENAFORTE; Smith, 2020).

4.2.3.5 Mindfulness

Mindfulness has been practiced for centuries, and it is a time of concentration, without making judgments. It means not being involved with memories, and rationalizations are suspended. It is an interaction between nature and the mind, releasing potential emotions or feelings. Through systematic training, aspects of the mind and heart are cultivated through mindfulness, which has no correlation with religious activities (MARTINS et al., 2018).

The practice is multimodal, presenting itself as a psychological state, acting in the self-regulation of attention and attitude of openness and curiosity towards the experience; as a psychological trait; as a practice and as an intervention program (MARTINS et al., 2018).

In general, mindfulness programs are applied to groups for eight weeks, with one face-to-face session per week lasting 2 hours. In addition to preventive or therapeutic applications, mindfulness programs have an impact on all aspects of health promotion, developing autonomy, self-efficacy and empowerment of people (DEMARZO; GARCIA-CAMPAYO, 2017).

The effectiveness of mindfulness-based interventions has been highlighted in the management of chronic stress, anxiety disorders, depressive disorders; in chronic clinical conditions (physical symptoms), treatment of arterial hypertension, diabetes mellitus and multimorbidity. A mindfulness-based technique used in behavioral nutrition is mindful eating (DEMARZO; GARCIA-CAMPAYO, 2017).

4.2.3.6 Comer Consciente ou Mindful Eating

The mindful eating technique engages all parts of the body, mind and heart in the choice and preparation of food, as well as in the act of eating it, involving all the senses. It involves the systematic formation of a focused state of awareness through repeated participation in sensory experiences, thoughts, and emotions, as well as the development of a non-judgmental attitude. It allows the individual to focus on the present moment without the interference of aspects of the past, It must be directed by the individual's internal experience, which is unique. This technique is much broader than simply eating slowly, paying attention to what you are eating (SILVA; Martins, 2017).

Thus, individuals are able to make positive criticisms about their food, without judgments or criticism of the sensations during the act of eating. Mindfulness is an innate ability, but it can also be developed through meditation, sharpening attention and focus (FAUSTINO-SILVA; JUNG; LA PORTA, 2019).

Meditation consists of the ability to focus attention on something, when based on mindfulness, it can be performed by anyone, it only needs a quiet environment where one can remain seated comfortably for the release of thoughts, and one must remain in this state of mindfulness for a minute. Its frequent practice is positive for health, by bringing greater recognition of feelings, and boosting positive feelings (FAUSTINO- SILVA; JUNG; LA PORTA, 2019).

In the state of mindfulness, the individual should focus only on the facts perceived by the five senses or the mind, without criticism about it. It should be behaved as an external observer, and accept what goes on in your body, remembering that the thoughts or feelings observed by the individual himself represents something momentary, not necessarily what the person is (RODRIGUES, 2018).

The definition of Mindfulness, basically part of four components (RODRIGUES, 2018):

1. uncentered consciousness;
2. sustaining action, allowing attention to rest through difficult cognitive situations or situations that generate suffering;
3. acceptance of difficult thoughts and images;
4. possibility that cognitive aspects of difficult management pass without reaction on the part of the person.

Thus, in food, mindful eating involves (NOGUEIRA, 2019):

- The slowing of the rhythm when eating: take breaks during each bite, chew more slowly, take breaks to breathe and feel the moment;
- Eating away from distractions: television or computer;
- Become aware of the hunger and satiety signals that the body provides, and decide whether or not to continue eating;
- Recognize responses to food without judgment: (liking, disliking, indifference), rather than following a strict diet;
- Choose to eat pleasant and nutritious foods, using all the senses while eating;
- Be aware: reflect on the effects of eating unconsciously, out of boredom, sadness, or eating until you feel uncomfortable.

There are no restrictions on what is ingested, adopting an intuitive diet is a process that is acquired over time. For people with a history of dieting, dietary restrictions, or body image concerns, it may be difficult to abandon old habits and attitudes, and try new ways of relating to food (NOGUEIRA, 2019).

Among the suggested practices of mindful eating are (RODRIGUES, 2018):

- Hunger Odometer: stimulates the person to "honor their hunger" by understanding the differences between hunger and satiety. On a scale from 0 (zero) to 10 (ten), when one is 0 (zero) from hunger to satiety it is 10 (ten). The application of this instrument can

be used as training to perceive the best time to feed, understanding the proper functioning of the body; according to the hunger scale represented by Figure 2.

Figure 1. Learn to use the hunger scale.

Source: NUTRITOTAL, 2019.

Some examples below of how to apply the mindful eating technique:

- Practice of raisins: by directing the mind to something it is possible to prevent thoughts from oscillating from one to another;
- Practice of chocolate and feelings: with the aim of changing the focus of attention in a conscious way. It can be performed with any food, preferably with those considered "forbidden". It is intended to make the person pay attention to some roles that food plays in our lives. Bring to mind some stressful event and assign a score from 0 to 10, corresponding to the intensity of stress. It proposes the attempt to understand why a particular food is eaten and its quantity;
- Practice of satiety: exercises respect for the body and satiety. If you fill the stomach with water, you score the size of the hunger and how much you can feel the full stomach, from 0 to 10;
- Food awareness questionnaire, investigates mindful eating. It is divided into 28 items with 5 subscales. Each item has a score from 1 to 4, the higher the score, the higher the awareness in the act of eating, which favors weight maintenance (RODRIGUES, 2018). The subscales are:

1. Awareness (awareness of what food looks like, and aware of its taste)
2. Distraction (when not focusing attention on food);
3. Disinhibition (eats even when full);
4. Emotional response (eating in response to sadness or stress)
5. External influences (eats in response to external suggestions, such as advertisements).

Some tips applied to eating mindfully include (RODRIGUES, 2018):

- To improve the eating experience, one should eat in a relaxing environment;
- Recognize and express emotions instead of eating at emotional times
- Try eating all colors of food, red, orange, yellow, green and purple, to ensure the consumption of important phytochemicals beneficial to health;
- Eating is a social occasion, it can help to focus more on people and not on the need to eat large quantities;
- Experiment with various flavors in a meal, salty, sweet, bitter, astringent, obtaining small amounts of all flavors of the food;
- Chewing a lot, because the act of eating allows you to be conscious and in the present moment, in addition to making you realize the exchange of energy with food.

4.2.3.7 Self-monitoring

Self-monitoring is part of a broader, multifaceted construct called metacognition, which comprises beliefs, processes, and strategies that identify, monitor, or control cognitions. It is the process of identifying and observing oneself in relation to one's own cognitions. There are two aspects of metacognition, metacognitive knowledge, which is the information that the individual has of his own cognition; and metacognitive regulation, through which information is monitored and controlled (MELO et al., 2014).

The individual perceives his actions and the effect caused, from there, seeks to change behaviors and thoughts. It allows the recognition of cognitive tendencies and emotional reactions to self-correction. The most used form is to fill out a checklist with date, time, situations, triggered behaviors and responses. Thus, it is possible to map dysfunctional thoughts, emotions and behaviors (CONCEIÇÃO; BUENO, 2020).

Self-monitoring is the process of identifying and observing one's own cognitions and monitoring them with a specific therapeutic goal. It involves, for its proper functioning, resources of executive functioning capable of allocating attention, monitoring, checking, planning and detecting performance dysfunctions (MELO et. al., 2014)

It is performed by the patient himself, through records of food intake, binge eating episodes and triggering events. These diaries are useful in order to assist in the elaboration of planning and therapeutic adjustments (ABESO, 2016).

Combined with cognitive techniques, self-monitoring can document misguided thoughts regarding eating, weight, and appearance bodily.

In problem solving, therapist and patient identify problems related to excess weight, and seek possible solutions and strategies, applying them, testing them and rediscussing them in order to select those that are definitely effective in modifying individual behavior, helping the patient to lose and maintain weight. In cognitive restructuring, there is the modification of the belief system, alteration of the patients' thoughts, proposing a cognitive restructuring in relation to selective abstraction, which consists of paying attention and giving more value to information that confirms their negative assumptions; such as "all or nothing" thinking, permitted foods and forbidden foods; superstitious thinking, which consists of believing that there is a relationship of cause and effect (ABESO, 2016).

There are several self-monitoring techniques for various purposes. Among the techniques that can be useful in nutritional care are (MELO et al., 2014):

- Recording of Dysfunctional Thoughts (DPR): There must be the assumption that there is the election of thought over emotion. It is based on the principles of conventional cognitive therapy, and establishes a sequential relationship between activating situations, beliefs and emotional, physiological and behavioral consequences. It is the process of realizing your thoughts and associated emotional, physiological, and behavioral reactions;
- Intrapersonal Thought Record: relates to emotional, physiological and behavioral response;
- Daily Record of Food Intake: adapted from the conventional Record of Dysfunctional Thoughts, for the work with other specific disorders related to eating behavior;
- Coping Cards: simple technique of cognitive therapy, consists of writing on a card reminders or motivational elements, which can be photos, phrases or words, which serve as an external monitor to help the patient remember the topics addressed in session, functioning as triggers that provoke metacognition, increasing the level of control;
- Techniques for decision making: The Decision Scale is a very simple and useful tool for working with many of the problems faced in clinical practice in cognitive therapy. Used when the issue is decision-making in situations of impasse, caused by the uncertainty between advantages and disadvantages, wanting and not wanting. In a form are placed two exactly opposite situations and below each of them are placed the advantages and disadvantages of the decision for each situation;
- Consensual Emotive Rational: another technique for decision making. It systematizes the decision-making process in seven stages, where a consensus between reason and emotion is sought. 1) establishes the desired or feared action; 2) it separates how much reason and emotion each of the extremities presents, so as to clearly visualize the impasse; 3) point and counterpoint, the individual performs a dialogue aloud,

representing the roles of emotion and reason at different times; 4) the therapist asks the patient to make an evaluation of their decision-making process, giving feedback in relation to the work done so far; 5) then, the patient can assess how ready he is to make his decision at that moment; 6) one should not pressure the patient, so that he does not feel compelled to decide without being prepared, or frustrated by not being totally sure of what he will do at the end of the technique; 7) action plan, the last stage of the technique, establishes a step by step consistent with the decision made by the patient throughout the consultation, so that the resolution of the problem can be implemented (MELO et. al, 2014).

4.2.3.8 Food Autobiography

Autobiography is one of the techniques that are based on narratives, it constitutes a personal narrative not limited to the individual perspective, relating the individual with the collective in the construction of its history. A characteristic of autobiography is the concern with the temporal sequence (OLIVEIRA; SILVA; PEREIRA-CASTRO, 2020).

In the food autobiography it is the narrator who decides what to narrate, it can be life itself, or fragments of it, in person, and in the present moment as well in virtual environments, such as in digital social media, in timelines or in closed groups, texts in blogs, or even in videos. Configuring the characteristic of a public food diary, with records of their feelings, relationships, events and opinions around eating practices (OLIVEIRA; SILVA; PEREIRA-CASTRO, 2020).

The food history is a great source of data during the service, but it is subject to some difficulties either by the time of data collection, or the need of the client to talk about the current moment, not finding relevant the relationship of some information of the past with the now. The client is asked to write about his story, from a pre-established script, addressing aspects from birth to the present, highlighting striking facts, his way of reacting to them and the people involved in the situations reported. In addition to these fields, the client should mention what emotion was felt at the time and what emotion was experienced when recalling the situation in the preparation of the autobiography. This information is important because it signals the relationship with current issues, because it is from the past that the future is understood and possible dysfunctional connections are found today and that were lived long ago (NEURACI, 2017).

4.2.3.9 Competency Model

The Food Competence Model is defined as a relationship between eating attitude and behavior, which is based on biopsychosocial processes, such as hunger and the will to survive; the appetite and the need for reward; the ability to stay satiated and the maintenance of body weight. It addresses aspects

related to the behavior and attitudes of food acceptance, such as eating in variable and adequate amounts. Food competence consists of four basic components (SOUSA; NUNES, 2014):

1. the attitude about food and food;
2. the ability to accept food;
3. the competence of internal regulation related to food; the positive attitudes supported by the acceptance of food;
4. management capacity in the context of eating, including the family meal

The eating attitude can be reinforced by creating bonds with food, through experiences in preparation and through tasting. Effective behaviors in regulating food is able to control the signals of hunger and satiety. The food competence model works on the changes, favoring the adoption of good eating habits (SOUSA; NUNES, 2014).

4.2.3.10 Food Education and Nutritional Counseling

Food and Nutrition Education (NEC) is defined as a set of learned experiences that facilitate the voluntary action of eating and other eating behaviors that are favorable to the health and well-being of the individual. Its goal, as well as nutritional counseling, is to provide support and guidance to individuals on how to make appropriate food choices that meet their needs (SOUSA; NUNES, 2014)

In the educational and pedagogical approaches of Food and Nutrition Education, attention should be paid to active processes, integration between theory and practice, using strategies to develop the autonomy of the individual and stimulate critical thinking about food choices (SELMY, 2018).

Food and Nutrition Education must turn to the formation of values, to pleasure, to responsibility, but also to the playful and freedom. Interdisciplinary approaches emerge as options that can offer alternative paths to this practice. Among the strategies used in food and nutrition education, nutritional counseling has been gaining prominence, since it is characterized by being centered on the patient and not only in the collection of information and strict protocols (SELMY, 2018).

The main objective of Nutritional Counseling is to promote healthy eating and lifestyle, aiming to meet nutritional needs, in order to develop strategies that solve the problems that prevent change. The initial proposal is to encourage the individual to expose their problems, from this, to develop appropriate techniques for each case (SOUSA; NUNES, 2014).

Nutritional Counseling is recommended in the proposal of the expanded clinic and the singular therapeutic project (PTS), of the National Humanization Policy. It is a process of help, which has psychology as a pillar of support. The counselor transmits the necessary information for the process of changing eating behavior, passes positively the knowledge about healthy eating, and appropriate ways to add them to the diet and more appropriate forms of preparation (BRAZIL, 2007).

The nutritional counseling was structured based on some approaches of psychology; it is an educational tactic that resizes the performance of the nutritionist before the patient. The goal is to make the patient able to master situations in their life in order to achieve growth and effective decision-making. Nutritional counseling is structured in three stages (SELMY, 2018):

1. Initial discovery: bonding with the patient, understanding their needs, and their emotional state through their verbal and non-verbal interaction;
2. Exploration in depth: makes the patient understand their problems and know how to discuss them;
3. Preparation for action: tries to minimize the patient's anxiety, as he is not used to making his own choices and solving his own problems. This process takes time, discipline and patience, and positive feedback from the nutritionist is key.

The nutritionist is responsible for promoting, preserving and recovering human health, and must follow the parameters of Food and Nutrition Education and know behavioral tools to create a bond with his patient. Should have frequent meetings with the patient, for mutual evaluation on the strategies chosen for treatment (SELMY, 2018).

We can cite as Nutritional Counseling Strategies:

1. Action of listening: acts as an efficient guide in solving problems, is a prerequisite of other competencies. The result of listening carefully, capturing the message, will promote more effective interventions;
2. Openness: it is the availability to receive the information, both the nutritionist and the patient, and allow others to influence you in your perception of the world. It includes both physical and psychological openness, it is letting oneself be influenced by what comes from outside, it is opening oneself to receive messages, even if they come at odds with established beliefs and habits;
3. Concentration: is the ability to concentrate energy on the situation of the moment, the here and now, without letting the internal dialogue interfere with this concentration. It is the acceptance of feelings at the same time that the conversation is taking place;
4. Comprehension: is the ability to attain the meaning of communication. Some factors in understanding are interpretation tools such as a large vocabulary and attention to the meanings of the client's nonverbal behavior.
5. Language: it is an important tool of interpretation. A vast vocabulary helps the listener understand what is being said;
6. Nonverbal signals: they are more difficult to understand, because they can be related to subliminal messages that bring the truth into the dialogue that the one who speaks, consciously or unconsciously, prefers to hide.

Nutritional Education strategies should be used by both the patient and the nutritionist at the time of the consultation. Knowledge contributes to sustaining or developing new attitudes, being the rational component necessary to motivate a desired action, but providing information and educational materials does not necessarily lead to changes in behavior. The main thing is to learn to meet the patient and his problems, to the point of knowing the obstacles he faces when he tries to achieve his goals in the eating plan (SILVA et al., 2020).

4.2.3.11 Health at All Sizes or Healthy at Every Size (HAES) ®

Another approach that also includes strategies for changes in eating behavior is the HAES® – Healthy at Every Size approach, which deals with a multidisciplinary approach and focuses on promoting health behaviors for people of all sizes, without using body weight as a mediator or indicator of health improvements (TORRES, 2016).

A person can have health regardless of their weight, eating normally and practicing pleasurable physical activity. The HAES® technique is defined by 5 principles:

1. respect the different types and sizes of existing bodies;
2. understand health and well-being from a multidimensional perspective, considering physical, social, spiritual, occupational, emotional and intellectual aspects;
3. promote all aspects of health and well-being for people of all sizes;
4. promote eating in a way that balances individual nutritional needs, as well as promote society, appetite and pleasure;
5. stimulate pleasurable individual physical activity, and improve the quality of life, without the goal of weight loss.

This form of approach is still controversial, requiring discussions regarding fatphobia and stigmatization in relation to obesity. It is not complacent with obesity, nor against weight loss. This model of approach treats health in a global way, involving food, physical activity, mental health, spirituality and interpersonal relationships. In fact, it focuses on behavioral changes, without the excessive pursuit of weight loss at any cost, approaching weight in an inclusive way, focusing on improving health, caring with respect; in eating for well-being; and in promoting the movement to improve the quality of life (ALVARENGA, 2019).

It is considered an alternative to work on issues related to weight and eating, based on self-acceptance and stimulation of healthy behaviors that can be maintained in the long term, regardless of body weight. It includes the acceptance of the diversity of body shapes and sizes, highlights the importance of a relaxed eating environment that respects the sensations of hunger and satiety and seeks

to collaborate for research on the social, emotional, spiritual and physical factors that contribute to a happy and healthy life (TORRES, 2016).

4.3 BENEFITS OF BEHAVIORAL NUTRITION

In the view of Behavioral Nutrition, the individual has the power to alter their behavior when they are ready for it. Lifestyle and dietary change will only occur if it is compatible with personal values and desires. The process of change should be composed of simple steps, which should be valued. It is also emphasized the need for changes in environmental issues for advances to be achieved (ALVARENGA et al., 2019).

In a systematic review study coordinated by the American Dietetic Association (ADA), the combination of different theories of behavior change, such as Cognitive Behavioral Theory, Social Cognitive Theory and the Transtheoretical Model, applied in clinical practice in the area of nutrition is effective in interrupting undesirable eating patterns and replacing contemporary habits with healthier ones, with consequent weight reduction and reduction of the risks of chronic non-communicable diseases (RODRIGUES, 2019).

Behavioral nutrition comes to act in this intangible universe of choices in relation to the lifestyle that one is ready to live at that moment, in order to improve the adherence of individuals to health treatments, so that they empower themselves and achieve an active posture towards self-care. Table 2 lists the techniques already mentioned and their benefits ((RODRIGUES, 2019).

Table 2. Benefits of behavioral nutrition approaches.

Approach or Technique	Benefits
Cognitive Behavioral Therapy	- reduction of symptoms and recurrence rates in psychiatric disorders (FERMANN; REIS, 2017); - improves the effectiveness of therapy (CONCEPTION; BUENO, 2020); - Identifi,reestruturaecorrigepensamentos dysfunctional (CONCEPTION; BUENO, 2020); - effective in the treatment of hypertriglyceridemia (MARTINS et al., 2018).
Motivational Interviewing	- reinforces the importance of detecting incongruities in individuals - effective for behavior change; - helps professionals to improve their clinical approach (OLIVEIRA; WEDGE; FERREIRA, 2021).
Transtheoretical Model	- useful in changing eating behavior (NUNES; SOUSA, 2014); - melhor adodiálogoentreopacienteeoprofissional (MAGALHÃES, 2019).
Intuitive Eating	- harmonizes the patient's relationship with food; - intervenes on the stigma of the body in a positive way; - promotes physical, mental and emotional well-being; - the perception of the signs of hunger and satiety surfaces; - favors the control of emotional eating; - improves the relationship with physical exercise; - leads to pleasure in eating, and reduces negative feelings related to food (ALVARENGA et al., 2019).
Mindfulness	- effective in the management of chronic stress, anxiety and depressive disorders, chronic clinical conditions (DEMARZO; GARCIA-CAMPAYO, 2017); - decreased perception of pain and the ability to tolerate it; reduction of stress, anxiety or depression, reduction of consumption and adverse effect of drugs;

4.4 APPLICATION OF BEHAVIORAL NUTRITION IN THE TREATMENT OF OBESITY

Due to overweight and obesity being a public health problem that increasingly affects the world population, new means of treatment are being sought and researched to control and treat this disease. Thus, behavioral nutrition has been studied as one of the non-conventional methods. This strategy is becoming increasingly relevant, as it involves the analysis of the individual's behavior and the why or what led him to binge eat and adopt sedentary lifestyle (ABESO, 2016).

Behavioral nutrition explores in the background all the socioeconomic and sociocultural factors that circulate the daily life of the patient, understanding their feelings about food. The Brazilian Association for the Study of Obesity and Metabolic Syndrome (ABESO) itself recognizes the need to know the person and encourage their own self-reflection, as something fundamental to achieve success in the treatment of obesity (ABESO, 2016).

In any case, it can significantly reinforce the maintenance of lifestyle changes (diet therapy and physical activity) after a one-year follow-up. Controlled studies of up to six months and between

one and three years, obtained results of significant improvement in psychological well-being and quality of life, even associated with a small reduction in body weight (ABESO, 2016).

Below are some positive results found in scientific research regarding the applications of some behavioral nutrition techniques already mentioned, in the treatment of obesity.

A randomized clinical trial was conducted with 117 adults diagnosed with moderate to morbid obesity, binge eating disorder (CPAT), and subclinical eating problems. Participants were assessed in a number of areas, including issues related to eating and weight, emotional regulation, state of consciousness, and spiritual well-being. A food awareness training based on the mindfulness technique was proposed during 12 sessions, with 10 of these weekly group sessions lasting 2 hours and 2 reinforcement sessions of 2 hours. The techniques applied were sitting breathing, mindfulness at meals, body scanning and forgiveness practice. As results obtained, the factors of peace and faith increased significantly in the group of individuals who underwent the intervention, with decreased anxiety and depression (KRISTELLER; JORDAN, 2018).

In another randomized clinical study, in which individuals were divided into control and intervention groups, the target audience investigated was 152 adults, 65 women and 87 obese men, with a mean age of 22.9 years. Mindfulness-related meditation interventions were proposed for 6 weeks, testing the hypothesis that the group environment helps more than the individual environment. The sessions lasted about 20 minutes through sitting breathing practice. Then the meditators were encouraged to perceive and accept thoughts and experiences, without judgment. The results indicated that participants in the group environment lost more weight and reduced their levels of cognitive-behavioral avoidance, while impulsivity and attention remained stable. On the other hand, participants in the individual condition lost less weight, while there was an increase in cognitive-behavioral avoidance and attention scores full, but a decrease in impulsivity, but it was concluded that mindfulness meditation in individual settings should be used with caution (MANTZIONS; GIANNOU, 2014).

In a study conducted with 194 adults with obesity, BMI between 30 and 45.9 kg/m2, aged over 18 years, participants were randomized to a 5.5-month program with diet and exercise protocol, with or without mindfulness training. The effects observed after 12 months in the group receiving mindfulness training compared to the control group were weight loss by -1.9 kg, decreased fasting glucose, and decreased triglyceride ratio / HDL (DAUBENMIER et al., 2016).

In the study by Daubenmier et al (2011), the effects of mindfulness intervention under eating under stress were studied in overweight and obese women, without chronic diseases or who used medications, and aged over 40 years. An intervention was developed based on components of Mindfulness-Based Stress Reduction, Mindfulness-Based Cognitive Therapy, and Mindfulness-Based Food Awareness Training. The intervention program consisted of nine 2h30m classes and a quiet 7-hour day of guided meditation practice. The interventions were body scanning, mindful yoga stretches,

sitting meditation, introduction of mindful eating practices to the physical sensations of hunger, stomach fullness, taste satisfaction, identification of emotional and food triggers, self-acceptance and inner wisdom. The results in the intervention group were successful in increasing mindfulness and responsiveness to bodily sensations, reducing anxiety and eating in response to external food stimuli, as well as reducing eating in response to emotions. (DAUBENMIER et al., 2011).

In the randomized study conducted by Mason et al. (2016), the target audience investigated was 194 individuals who had a history of obesity, with a mean age of 47 years and mean BMI of 35.5 Kg/m2. The intervention was based on the principles of mindifulness in a group format in a medical center, lasting 5.5 months, through 12 weekly sessions lasting from 2h00 to 2h30m, being held 3 fortnightly sessions and 1 session 4 weeks later, in addition of a weekend session lasting 6h30m. The training involved guided meditations and discussion of mindful eating practices. As observed results, the group that received the mindfulness training showed an increase in conscious eating associated with a decrease in the intake of sweets and maintenance of fasting glucose up to 12 months after (MASON et al., 2016).

In the work of Albuquerque and Freitas (2019), a cross-sectional study with a quantitative approach, 26 women who had a history of restrictive diets for weight loss, aged 20 to 40 years, were investigated. The present study applied four distinct types of questionnaires to assess the interrelationships of intuitive eating. The scales were: the scale of intuitive feeding (IES-2), body appreciation (BAS-2), Flexible Control and Rigid Control. The study had as positive results the relationship between intuitive eating and greater body appreciation, BMI and greater confidence in hunger and satiety signals. It was also observed that flexible control was positively related to the construction of body-food compatibility, pointing to the fact that as a relationship of respect and love for the body is maintained, a greater body connection develops (ALBUQUERQUE; FREITAS, 2019).

In the study by Oliveira, Silva and Pereira-Castro (2020), workshops were held with undergraduate students from various courses, in which they were invited to write a narrative letter, describing a food autobiography addressed to themselves. In a second moment, they wrote the key words on cards and fixed them on posters, which were arranged so as to represent a timeline. In the workshops, the participants were divided into groups, and each group discussed one of the life phases (childhood, adolescence, adulthood). The use of autobiography as a pedagogical approach in groups provided the exchange and collective construction, allowing the discussion of elements and perceptions that permeate the food. Overweight and obesity carry strong social stigmas, fat or obese bodies are judged and socially, associated with the image of lack of control, thus, there is an exclusion of oneself, and an intense social guilt in relation to their prognoses. By narrating one's own history, a field of elaboration, resignification and reinvention of identity is established where.

The narrators see themselves from the cultural significance, and it is in the singularity that the fragilities and particularities of people who seek health care to treat obesity can feel more human and visible. The food autobiography seems to be a way to reveal multiple meanings of eating in society that, traditionally are little evidenced in the processes of health formation, the body is not separated from someone who counts it (OLIVEIRA; SILVA; PEREIRA-CASTRO, 2020).

In a cohort study conducted with patients treated at Basic Health Units in the city of São Luís, 523 individuals over 20 years of age were included, most of whom were female (88.52%), who were overweight. Participants underwent two sessions of nutritional counseling for weight loss. The results were positive in relation to weight loss for the vast majority (75.7%) (ALMEIDA, 2016).

In a prospective, quasi-experimental clinical trial lasting one year, 30 women participated in the intervention "Health and well-being in obesity", based on nutritional counseling, with the objective of enhancing their personal resources through individualized strategies that stimulated responsibility for self-care, without the prescription of diets. Conducted by a multidisciplinary group, the participants performed physical activity three times a week, individual nutritional care biweekly and five philosophical workshops. After the intervention, participants reported feeling more empowered to deal with expectations about their bodies and more comfortable with their current body condition. They also reported transitioning from negative experiences associated with body movement to positive experiences with them, motivating them to insert more physical activities into their routines (ULIAN, 2015).

In a prospective randomized controlled trial conducted with 58 obese women, it aimed to understand the effects of a Healty at Every Size (HAES)®-based approach. The intervention group consisted of receiving an approach based on HAES®, through the practice of physical activity three times a week, biweekly individual nutritional care and five philosophical workshops. The control group had a traditional intervention based on this approach through bimonthly lectures. The two groups did biochemical tests and body composition tests. The results showed that the intervention group showed more expressive improvements in food quality, related to greater engagement in culinary experiences and increased food planning. They also had a positive impact on food choices, eating mindfully, in adequate time and according to hunger and satiety signals. There were reports, by a large part of the intervention group, that despite the expectation of weight loss, they were satisfied with other gains and no longer placed weight loss as a central focus for their happiness and understood that the changes would occur in the long term (ULIAN, 2018).

5 FINAL CONSIDERATIONS

The techniques used in nutritional care with a focus on behavioral nutrition value the history of the individual and their relationships with food, in order to improve the entire process and the relationships that involve food.

The process of changing eating habits and beliefs is long and requires the individual and the nutritionist to get on the same page, so that everything occurs naturally and without guilt or judgment. The self-acceptance resulting from the treatment implies weight loss, but also in improved self-esteem, social relationships and relationships with food.

Behavioral nutrition has several techniques that can be applied to different audiences at different stages of life. Techniques that range from the most basic such as food education, to those that lead the individual to a deep reflection on themselves and their state of health, such as cognitive behavioral therapy. It can be seen in this work that considering other aspects of human life besides body weight brings benefits and helps in the treatment of obesity.

It is up to the nutritionist, at the time of nutritional treatment, to identify the best approach for each individual to relate in the best way with their body and mind, in order to maintain the balance between the two and their long-term state of health.

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