DERLEME/REVIEW

RELATIONSHIP BETWEEN OBESITY AND FOOD ADDICTION

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ABSTRACT

Obesity is a worldwide epidemic and a major health risk impacting millions of individuals globally. Despite current treatments, the effective management of obesity remains a challenging process. Therefore, research on the origins of obesity and treatment options is of great importance. The primary cause of obesity is irregular eating habits. This condition not only has negative effects on physical health but also contributes to mental health issues. One of these health issues is food addiction. Food addiction has neurobiological, psychological, and behavioral characteristics. Research indicates that individuals who fulfill the criteria for food addiction are frequently obese or overweight. Food addiction can be a significant trigger for obesity in some individuals. Therefore, obese individuals should be evaluated for food addiction, and those diagnosed with food addiction should be provided with psychosocial support. Limiting high-carbohydrate foods in obese individuals may help reduce food addiction.

Keywords: Obesity, Food addiction, Psychosocial support

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ÖZET

Obezite, küresel bir salgın ve ciddi bir sağlık riski oluşturan, dünya üzerinde milyonlarca insanı etkileyen bir durumdur. Mevcut tedavilere rağmen, obezitenin etkili bir şekilde yönetimi hala zorlu bir süreçtir. Bu nedenle obezitenin kökenleri ve tedavi seçenekleri üzerindeki araştırmalar büyük önem taşımaktadır. Obezitenin temel nedeni düzensiz beslenme alışkanlıklarıdır. Bu durum, yalnızca fiziksel sağlık üzerinde olumsuz etkiler yaratmakla kalmaz, aynı zamanda zihinsel sağlık sorunlarına da yol açabilir. Yeme bağımlılığı bu sağlık sorunlarından biri olarak karşımıza çıkmaktadır. Yeme bağımlılığı, nörobiyolojik, psikolojik ve davranışsal özelliklere sahiptir. Yapılan araştırmalar, yeme bağımlılığı kriterlerine uyan bireylerin genellikle obez veya fazla kilolu olduğunu ortaya koymaktadır. Yeme bağımlılığı, bazı bireylerde obezitenin tetikleyicisi olarak önemli bir faktör olabilir. Bu sebeple, obez bireyler yeme bağımlılığı açısından değerlendirilerek, yeme bağımlılığı tespit edilen kişilere psikoosyal destek sunulmalıdır. Obez bireylerde özellikle karbonhidrat içeriği yüksek besinlerin kısıtlanması, yeme bağımlılığını azaltmaya katkıda bulunabilir.

Anahtar Kelimeler: Obezite, Yeme bağımlılığı, Psikososyal destek

INTRODUCTION

Obesity is a global epidemic affecting millions of people and represents a significant risk factor for health. Despite numerous treatment options available today, finding a solution to this condition remains challenging. Therefore, it is crucial to investigate the underlying causes of obesity and focus on treatment options accordingly. The primary determinant of obesity is irregular eating habits. Under normal physiological conditions, energy balance is maintained, but when this balance is disrupted, obesity may develop. Hormones such as ghrelin, leptin, and insulin regulate this balance. Factors referred to as "hedonic factors" can influence overeating and obesity, particularly due to the easy access to high-calorie and palatable foods. The appealing taste properties of these foods activate the brain's reward regions, and increased dopaminergic release enhances cravings for these foods. Food addiction (FA) involves the uncontrolled consumption of tasty foods that exceed energy needs, and this condition has been reported to be associated with obesity (1). This study employs a methodological approach based on a comprehensive literature review, aiming to explore the connection between FA and obesity. A systematic search was conducted across multiple databases, such as PubMed and Scopus, using key terms like "food addiction," "obesity," and "eating behaviors." The search was focused on studies published in the last ten years, including clinical trials, reviews, and meta-analyses. This approach ensures that the most relevant and up-to-date research is included, providing a clear understanding of how FA contributes to obesity and how it can be addressed in treatment strategies.

OBESITY

Definition

The term "obesity" has Latin origins, derived from the word “obedere”. The prefix "ob" signifies excess, while "edere" means to eat. When combined, the term refers to a state of

overeating. The World Health Organization (WHO) defines obesity as "an abnormal or excessive accumulation of fat that presents a health risk." (2,3). The World Obesity Federation describes obesity as a long-term, progressive, and recurring health condition. In essence, obesity involves a state of positive energy balance (4). Obesity is described as a condition where body fat makes up more than 25% of total body weight in men and more than 30% in women. Historically, the emergence of obesity can be traced back to the late 16th century. Methods of weight control have been in practice since the time of Hippocrates. Stone carvings from the Roman period also depict figures associated with obesity. During these times, certain dietary restrictions and weight control strategies gained importance. Throughout history, obesity has been described in various ways, often symbolizing not only excessive weight but also health, wealth, and sometimes fertility. In the face of challenges such as famine, scarcity, and deprivation throughout human history, being overweight became associated with strength, power, and grandeur (5).

Classification

Obesity is typically classified based on Body Mass Index (BMI). BMI is an index expressed in kg/m^2, calculated by dividing an individual's weight (in kilograms) by the square of their height (in meters). The WHO classifies BMI as follows: a BMI of less than 18.5 kg/m^2 is considered underweight, between 18.5 and 24.9 kg/m^2 is normal, between 25.0 and 29.9 kg/m^2 is overweight, between 30.0 and 34.9 kg/m^2 is classified as Class 1 obesity, between 35.0 and 39.9 kg/m^2 as Class 2 obesity, and greater than 40.0 kg/m^2 as Class 3 obesity (6).

Epidemiology

Obesity is a prevalent health issue across societies, and WHO has listed obesity among the top 10 most high-risk diseases (5). Obesity, once primarily observed in developed countries, has now become an issue across all economic levels. According to WHO, the global number of individuals diagnosed with obesity is 400 million. The prevalence of obesity has notably

increased in the United States, rising by 50-70% between 1991 and 1999. Studies suggest that by 2030, obesity rates in many countries could reach 50%. The WHO conducted a 12-year research project named Monitoring Trends and Determinants in Cardiovascular Disease (MONICA) in six regions across Asia, Africa, and Europe. The study found a 10-30% increase in obesity prevalence. In Turkey, the prevalence of obesity is similar to that of Western countries, with obesity being more common among women in the adult population (7). According to the findings of the Turkey Nutrition and Health Survey (TBSA) 2010, the prevalence of obesity (BMI ≥30 kg/m²) among individuals aged 19 years and older was determined to be 30.3%. This prevalence was 20.5% in males and 41.0% in females. The prevalence of overweight individuals (BMI: 25.0-29.9 kg/m²) was reported as 34.6%, with 39.1% in males and 29.7% in females. Additionally, the prevalence of morbid obesity (BMI ≥40 kg/m²) was recorded at 2.9%, with rates of 0.7% in males and 5.3% in females. According to the results of TBSA-2017, the prevalence of overweight individuals aged 15 years and older was determined to be 34%. This rate was 39.9% among males and 27.6% among females. The prevalence of obesity was identified as 31.5%, with rates of 24.6% in males and 39.1% in females (8). Based on data from the Turkish Statistical Institute (TIK), obesity rates decreased from 21.1% in 2019 to 20.2% in 2022. When examined by gender, 23.6% of women and 30.9% were classified as pre-obese in 2022. During the same period, the obesity rate among men was 16.8%, while 40.4% were classified as pre-obese (9).

Etiology

Obesity is a multifactorial condition influenced by both internal and external influences. Internal causes include the brain, adipose tissue, and genetic factors, while external causes involve dietary habits, physical activity level, and environmental factors (10). The internal causes of obesity stem from complex interactions that make it difficult for the body to regulate energy balance. Adipose tissue secretes hormone leptin, which sends satiety signals to the brain.

However, in some cases, these signals may not be processed correctly, leading to overeating (11). The external causes of obesity arise from factors that encourage individuals to overeat and avoid physical activity. Fast-food chains and high-calorie foods have a substantial impact on the rising prevalence of obesity. Additionally, technological advancements and the rise in sedentary employment rates have resulted in reduced of physical activity level among individuals (12). Over the past two decades, several studies on genetic obesity have shown that genetic mutations, polymorphisms, and alterations in gene expression contribute to individuals' vulnerability to obesity. At first, candidate gene studies identified specific genes as responsible for severe early-onset obesity or monogenic obesity, which is rarely observed. Later on, additional genes have been discovered. Epigenetic changes are modifications that influence gene expression without changing the DNA sequence and are acquired through environmental factors (13). Certain obesity syndromes, such as Prader-Willi syndrome, are associated with genetic defects. Research has shown that these genetic factors raise the likelihood of obesity, but do not guarantee its occurrence (14). Maternal obesity is a major risk factor for the development of obesity in children. Postnatal factors play a significant role in weight gain and the risk of obesity during the early years of life (15). Sleep is a crucial factor that contributes to an increased risk of obesity. Insufficient sleep can lead to obesity (16). Some therapeutic medications can cause significant weight gain in certain individuals (17). Medical conditions can contribute to weight gain through various mechanisms (18). These include hormonal disorders (such as ghrelin and leptin), insulin resistance, hypertension, endocrine tumors, elevated triglyceride levels, and heart failure (19). Socioeconomic status affects the risk of obesity in both children and adults. In low-income countries, improvements in socioeconomic status can lead to increased obesity rates (20,21). Certain ethnic groups may be more predisposed to weight gain compared to others. Stress increases chronic exposure to glucocorticoids, which contributes to overeating (22). The gut microbiome may be associated

with obesity. Microorganism belonging to the *Firmicutes* and *Bacteroides* phyla are more abundant in obese individuals. Factors that affect the gut microbiome include the method of delivery, length of breastfeeding, timing of solid food introduction, diet, and lifelong antibiotic use (23). One of the main causes of obesity is irregular eating patterns. This condition can lead to various issues, including overeating, eating disorders, and FA. This irregular eating factor also contributes to a state known as hedonic hunger, in which individuals are drawn to palatable foods (24).

Other health problems it causes

Obesity is a complex disease that affects multiple organs and systems when left untreated. The increase in body fat and the excess of adipokine secretion are the primary causes of obesity-related complications. Adipokines can harm the endothelial lining of blood vessels, contributing to cardiovascular conditions like heart disease and stroke, while also promoting inflammation, which raises the likelihood of diseases such as cancer, arthritis and asthma. Adipokines that induce insulin resistance also contribute to a higher risk of developing type 2 diabetes. Additionally, the sympathetic nervous system is activated, raising blood pressure. Obesity contributes to metabolic syndrome by leading to elevated LDL cholesterol levels and dyslipidemia. Abdominal fat accumulation triggers metabolic syndrome through factors such as insulin resistance, high blood sugar, and hypertension. Furthermore, obesity is associated with respiratory problems, strokes, gastroesophageal reflux disease, and in women, conditions such as gestational diabetes, anovulation, and polycystic ovary syndrome. It also has negative effects on the musculoskeletal system, causing joint issues and increasing the risk of psychological stress and depression (25,26).

Treatment

There are four primary approaches to obesity treatment: lifestyle changes, medications, bariatric surgery, and nutritional therapy. Lifestyle interventions focus on weight loss by decreasing

energy intake and increasing physical activity level, with a target daily energy deficit of about 500 kcal. Pharmacological treatment is used to suppress appetite, control gastric emptying, and reduce nutrient absorption. Bariatric surgery is preferred in cases of severe obesity, facilitating weight loss by restricting food intake or decreasing absorption. Poor dietary habits are among the main triggers of obesity (27). Nutritional therapy aims to reduce body weight through a personalized program, promote healthy eating habits, and maintain weight loss. The diet should be simple, practical, and suitable for the individual's food preferences and social circumstances. A weight loss target of 500 grams to 1 kilogram per week and a 5-10% reduction in weight within the first six months are recommended. Daily energy intake should consist of 15-20% from protein, 50-55% from carbohydrates, and 25-30% from fat. Fluid intake should be at least 2 liters per day, and salt consumption should be kept below 5 grams. Attention should also be paid to the intake of minerals, vitamins, and dietary fiber (28).

FOOD ADDICTION (FA)

Definition

FA is characterized by a hedonic eating behavior where individuals consume highly palatable but unhealthy foods in amounts that surpass homeostatic energy needs. FA exhibits symptoms similar to those of binge eating disorders. Neuroimaging studies in individuals with FA have shown distinct activation patterns and connectivity within brain reward circuits. Areas like the striatum, orbitofrontal cortex, insula, nucleus accumbens and amygdala are involved in this process. The hypothalamus is a region that regulates eating behaviors and satiety networks, and additional effects have been observed in this area among individuals with FA. FA is influenced by impulsivity and mood, with chronic stress potentially disrupting the hypothalamic-pituitary-adrenal axis, which in turn affects eating behaviors (29,30). Recently, there has been growing interest in FA, leading to more refined definitions and assessment methods within this field of

research. Notably, the Yale Food Addiction Scale (YFAS) was developed to assess eating behaviors resembling addiction, using the criteria for substance use disorders as defined in the fourth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM)-IV. With the addition of new criteria for substance use disorders (SUD) in DSM-V, uncertainty remains regarding how these criteria can be adapted for FA. The YFAS can identify food addiction when there is noticeable impairment or distress, and at least three out of the seven symptoms are present (31).

Symptoms

Although a definitive diagnosis of FA may not be established, several symptoms exist, and the presence of 4 to 5 of these symptoms is sufficient for diagnosis. These symptoms include the inability to control oneself when consuming foods despite knowing that they cause physical harm, hiding the consumption of unhealthy foods from those around them, the inability to reduce eating behaviors despite the desire to do so, making excuses when discussing cravings for specific foods, the inability to refrain from consumption despite feeling guilty after eating certain foods, experiencing significant obstruction after consuming foods, consuming excessive amounts after starting to eat certain foods, and continuing to eat a desired food despite feeling excessively full (32).

Epidemiology

A meta-analysis conducted in 2014 examined studies utilizing YFAS. This analysis revealed that the prevalence of FA was 19.9%. When the studies were generalized, it was found that women had higher YFAS scores than men (33). In a study conducted in Germany, the prevalence of FA was found to be 7.9%. Other studies have also shown that FA is less prevalent in individuals who are not obese, while it is more common in those who are obese (34). According to the validity and reliability study conducted in Turkey, the prevalence of FA, as measured by YFAS 2.0, was found to be 7.8% among the participants. The research also

revealed that individuals who identified as overweight or obese had higher food addiction scores (35).

Etiology

Impaired control: Impaired control emerges as a frequently observed symptom in individuals with FA. Excessive and uncontrolled eating constitutes a part of the binge eating episodes defined in the Diagnostic Criteria for Eating Disorders. Planned episodes of excessive eating may result in consumption that exceeds the initial plan (36). Impulsivity is generally defined as a tendency to think and act without adequate foresight. This condition can lead to behaviors that are inconsistent with an individual's long-term goals. Numerous studies (37,38) related to substance use disorders have demonstrated the significant role of impulsivity. Additionally, impulsivity is also associated with binge eating and obesity (39). Reward sensitivity refers to the response exhibited toward rewarding stimuli. Individuals who are sensitive to rewards tend to respond more vigorously to rewarding cues. This heightened sensitivity can increase the risk of binge eating and obesity (40).

Craving: The term "food craving" is commonly used to describe a strong desire to eat a particular food. This craving is quite widespread, as a report reveals that 100% of young women and 70% of young men experience cravings for at least one type of food. While chocolate is the most frequently craved item, there is also a notable prevalence of cravings for carbohydrates and salty snacks (39,41).

Social impairment: Excessive eating and obesity can negatively affect social interactions, particularly in younger populations. These adverse effects can be explained through bullying and victimization, weight stigmatization, and a bidirectional relationship. Overweight children may experience more bullying and victimization compared to their healthy-weight peers, leading to issues such as loneliness, isolation, and avoidance of social activities (42,43). Weight stigmatization can have a detrimental effect on the interpersonal friendships and romantic

relationships of overweight individuals, leading to encounters with discriminatory attitudes and behaviors that contribute to social isolation and interpersonal problems (44).

Repeated use despite negative consequences: Excess weight and obesity have both physical and psychological effects, including depression, an elevated risk of diabetes, hypertension, cardiovascular disease, and some cancers. Despite the increasing awareness of these health concerns in society, individuals who have received weight management treatments frequently fail to achieve or sustain weight loss. Even among individuals who have undergone bariatric surgery, persistent patterns of excessive eating and poor food choices can still be observed. This indicates that there is substantial evidence supporting the continuation of overeating despite the negative consequences associated with it (45,46).

Physiological criteria: Tolerance to a substance is defined as the reduced effect that occurs when the same amount is consumed over time. In animal models of sugar addiction, excessive sugar consumption leads to neurochemical changes and increased intake, resembling the patterns observed in drug addiction (47). It has also been suggested that sugar tolerance may develop early in life in humans (48). Withdrawal refers to the symptoms that arise from the cessation of substance use during addiction. In animal models, sugar withdrawal has been observed to produce physical symptoms and aggression. Similar withdrawal symptoms have been reported in humans as well (49,50). These findings indicate that sugar addiction might be similar to substance use disorders (47).

Neurobiology

Food reward and motivation: FA primarily affects the brain's reward system, sharing mechanisms similar to alcohol and substance addictions. The dopaminergic mesolimbic pathway is involved in these addictions. Sugary foods can influence dopamine levels, producing effects like those seen in other types of addiction. Prolonged exposure to addictive substances

can lead to reward deficiency syndrome. Additionally, food consumption and brain activation can vary from person to person (51).

Energy homeostasis and regulatory mechanisms: The body regulates appetite through feedback mechanisms, signaling to the brain about energy reserves. Hormones like leptin, insulin, and ghrelin influence appetite by affecting neurons in the hypothalamus (52). Gut peptides also signal satiety. While homeostatic mechanisms balance energy intake and metabolism, palatable foods can disrupt this balance and promote overeating. Conditions like Prader-Willi syndrome can impair appetite regulation, leading to overeating tendencies (53).

The effect of stress on hypothalamic functioning: Both acute and chronic stress affect eating behaviors. Acute stress activates the Hypothalamic-Pituitary-Adrenal (HPA) axis, releasing cortisol, which typically reduces appetite. However, chronic stress can disrupt this system, leading to insulin resistance and abdominal fat accumulation. Increased insulin and fat levels may drive the consumption of high-calorie foods. The hormonal effects of stress contribute to overeating and fat storage (54).

Cognitive control and addictive eating: Cognitive control areas in the brain regulate attention, decision-making, and motivation for eating. In obesity, consuming palatable foods can disrupt reward systems and reduce cortical regulation. In FA, inhibitory control in areas like the orbitofrontal and prefrontal cortices is weakened, while food cravings intensify in the mesolimbic pathway. This can impair appetite regulation and contribute to addiction-like behaviors in brain regions such as the amygdala and hippocampus (29).

Treatment

FA is a complex condition influenced by biological, psychological, and social factors, requiring a comprehensive treatment approach. This includes pharmacotherapy, psychotherapy, social support and lifestyle changes. Medications targeting neurotransmitter imbalances, such as SSRIs, duloxetine, topiramate, and lamotrigine, are effective in controlling binge-eating

episodes. The combination of naltrexone and bupropion can reduce food cravings and assist in obesity treatment. Psychotherapy, especially cognitive-behavioral therapy, helps modify negative thought patterns, while interpersonal and dialectical behavior therapies address psychological issues. Social support groups, like Overeaters Anonymous, offer shared experiences and support. Technological interventions, such as transcranial direct current stimulation and repetitive transcranial magnetic stimulation, target brain regions involved in food cravings. On a societal level, restricting unhealthy food advertising and promoting healthier alternatives are recommended. Individually, strategies include avoiding triggers, eating when truly hungry, managing emotions, and maintaining regular physical activity. When combined, these methods can effectively manage food addiction and foster healthier lifestyles (55).

RELATIONSHIP BETWEEN OBESITY AND FA

Obesity has become a major global health issue in recent years, affecting not only physical health but also mental well-being. Individuals with FA are often obese or overweight, and FA can be a significant factor in the development of obesity. This condition is generally linked to increased body weight and is associated with issues such as impulsivity, low self-esteem, high psychological distress, and a reduced quality of life. FA presents with neurobiological, psychological, and behavioral traits, which may contribute to obesity by diminishing interest in healthier food options. The brain's reward pathways are activated by palatable foods containing fat, sugar, or salt, intensifying the pleasure and positive feelings associated with consuming these foods. The enticing taste and sensory experience of such foods are key reasons why individuals often choose unhealthy options. Addictive substances, particularly those that affect dopamine receptors in the brain, lead to neurological chemical changes. Dopamine is a crucial neurotransmitter involved in reward pathways, and as addiction develops, the modified brain

amplifies the effects of these substances, creating a greater need. While the hippocampus encodes this pleasure experience into memory, the amygdala forms conditioned responses to specific stimuli. It is hypothesized that food cravings may increase when dopamine levels are low. Functional magnetic resonance imaging (fMRI) and neuropsychological studies have revealed similar effects between food consumption and drug addiction. For example, in obese individuals, activation has been observed in the ventral striatum when exposed to visual cues of calorie-dense foods. Dopamine and glutamate transmission within the nucleus accumbens (NAc) mediates motivational responses triggered by cues. It has been emphasized that the magnitude of activations in the NAc in response to food cues may predict future body weight gain. Additionally, it is known that sugar activates endorphins and dopamine in the nucleus accumbens, leading to an extremely hedonistic and satisfying response (56-58). Preclinical studies have shown that rats prone to obesity gained more weight when given a high-fat and high-sugar diet. In summary, the overconsumption of unhealthy foods may contribute to both obesity and addiction-like behaviors by influencing the neurobiological processes in the brain's reward systems (59).

DISCUSSION

A cross-sectional study involving 1,432 Canadian adults explored the connection between FA and obesity using YFAS. The results indicated a FA prevalence of 9.3%, which was lower than the obesity rate of 32.7%. However, FA was more prevalent in obese individuals. Among those who were not obese, FA was also linked to a higher BMI (60). In an other study, 100 women aged 19 to 65, classified as mildly overweight or obese, were assessed. The study aimed to explore the connection between FA and depression in these women. The results indicated that 38% of the obese women exhibited FA. Furthermore, it was found that 52.6% of individuals with FA also suffered from depression (61). In a study, 202 individuals who presented to the

obesity clinic of a training and research hospital were evaluated. The study aimed to examine the relationship between FA and obesity. The results revealed that the group with FA had a higher BMI than the non-food addiction group (29). In a different study, the prevalence of FA was compared between 184 obese and non-obese individuals who visited a family medicine clinic, using YFAS. The findings revealed that FA was more common in the obese group (62). In a study conducted on 256 individuals at a private obesity clinic in Istanbul, YFAS and the Dutch Eating Behavior Questionnaire were used to assess the FA status of obese individuals. The results indicated a higher prevalence of FA in the obese group; however, this condition was also observed in the non-obese group (63). A meta-analysis was performed to assess the influence of FA on childhood obesity, including data from 13 studies. The findings suggested that FA in children contributes to obesity (64). Given the unclear connection between FA and obesity in children and adolescents, a study was conducted with 426 children and adolescents using YFAS for Children to explore the relationship between FA and weight. The results showed that FA rates were higher in children and adolescents with a greater BMI (65). A study involving 612 high school students aimed to explore the prevalence of FA and the factors influencing it. The results showed that 12.4% of the students displayed signs of FA, with a higher prevalence in girls compared to boys. Although no significant relationship was observed between FA and obesity, it was suggested that FA might play a role in the prevalence of obesity (66). A cross-sectional study involving 752 adolescents aimed to explore the impact of FA on obesity. The study found that 18.9% of the participants exhibited signs of FA, highlighting that FA significantly increases the risk of obesity (67). A study with 571 individuals aged 10-14 aimed to assess the relationship between FA and obesity. The results revealed that 37% of the participants showed signs of FA, with the highest prevalence found among obese individuals (68).

CONCLUSION

The global rise in obesity has been paralleled by an increase in mental health issues, and FA, as a form of behavioral addiction, has garnered significant attention in recent years. It is increasingly recognized as a key factor contributing to the loss of control over unhealthy eating behaviors, particularly in the context of obesity. Research indicates that individuals who meet the criteria for FA are often obese or overweight. Given this connection, screening for FA in obese individuals becomes essential, and those diagnosed should receive appropriate psychosocial support. Reducing the intake of carbohydrate-dense foods may help alleviate FA symptoms in obese individuals. However, future studies should focus on developing more effective and tailored treatment strategies for FA in the context of obesity. Furthermore, the relationship between food addiction and obesity should be explored in greater depth to enhance our understanding of how this interplay should be addressed in therapeutic interventions. More concrete recommendations for future research on effective prevention and treatment methods are needed to tackle both conditions comprehensively.

Abbreviations

BMI: Body Mass Index

DSM: the Diagnostic and Statistical Manual of Mental Disorders

FA: Food addiction

fMRI: Functional magnetic resonance imaging

HPA: the Hypothalamic-Pituitary-Adrenal

MONICA: Monitoring Trends and Determinants in Cardiovascular Disease

NAc: Nucleus accumbens

SUD: Substance use disorders

TBSA: Turkey Nutrition and Health Survey

TIK: Turkish Statistical Institute

WHO: World Health Organization

YFAS: the Yale Food Addiction Scale

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