SPYCHALSKI, Jan, MUSIAŁ, Mikołaj, SPYCHALSKA, Maria, DYLIK, Adrianna, GRYCZYŃSKA, Weronika, GROCHOWSKA, Wiktoria, KACZMAREK, Mikołaj, KRAWCZAK, Łukasz and GULACZYK, Hanna. The Impact of Childhood Obesity on Mental Health: A Comprehensive Review. Quality in Sport. 2024;36:56639. eISSN 2450-3118.
https://dx.doi.org/10.12775/QS.2024.36.56639
https://apcz.umk.pl/QS/article/view/56639

The journal has been 20 points in the Ministry of Higher Education and Science of Poland parametric evaluation. Annex to the announcement of the Minister of Higher Education and Science of 05.01.2024. No. 32553.
Has a Journal's Unique Identifier: 201398. Scientific disciplines assigned: Economics and finance (Field of social sciences); Management and Quality Sciences (Field of social sciences).
Punkty Ministerialne z 2019 - aktualny rok 20 punktów. Załącznik do komunikatu Ministra Szkolnictwa Wyższego i Nauki z dnia 05.01.2024 r. Lp. 32553. Posiada Unikatowy Identyfikator Czasopisma: 201398.
Przypisane dyscypliny naukowe: Ekonomia i finanse (Dziedzina nauk społecznych); Nauki o zarządzaniu i jakości (Dziedzina nauk społecznych).

The authors declare that there is no conflict of interests regarding the publication of this paper.
Received: 04.12.2024. Revised: 19.12.2024. Accepted: 19.12.2024. Published: 20.12.2024.

The Impact of Childhood Obesity on Mental Health: A Comprehensive Review

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Abstract

Introduction: Obesity and overweight are among the main health issues affecting the child population in developed countries today. Excess body weight is observed in 29.7% of boys and 14.3% of girls aged 11 to 16 years. Studies reveal that childhood overweight increases the odds of having mental disorders in adolescence compared to children with a normal body weight.
Aim of the study: The aim of this study is to analyse the available literature in order to examine the impact of childhood obesity on mental disorders such as depression, anxiety, ADHD, eating disorders and schizophrenia,
Materials and methods: Comprehensive review of the literature available on PubMed, Google Scholar, Scopus database by searching the keywords “obesity”, “overweight”, “ mental health”, “childhood”, “mood disorders” “psychiatric disorders”, “anxiety”, “depression”, “eating disorders”, “ADHD”
Results and conclusion: Childhood obesity is a growing global problem with physical and health consequences. It is associated with various factors such as social stigma, neurological imbalances or malfunction and other environmental factors related to obesity. It contributes to the growth of depression, ADHD, anxiety, eating disorders, OCD and even schizophrenia. Preventing and treating obese or overweight children have to be done, by affecting both physical and mental health.

Keywords: obesity, overweight, mental health, childhood, mood disorders, psychiatric disorders, anxiety, depression, eating disorders, ADHD

Introduction

Obesity is one of the most serious health problems among children. Various literature show that childhood obesity has consequences, including an increased risk of diabetes, hypertension, hyperandrogenism, menstrual abnormalities, and sleep disorders. In the long term it is noted to significantly increase the chances of emerging cardiovascular risk factors, chronic diseases, and early death in adulthood [1]. The consequences of overweight and obesity in childhood can last a lifetime, which is why it is crucial to prevent and treat it as early as possible. Children with genetic and endocrine diseases are at risk of obesity, and the risk is also increased in children whose parents are obese or whose mothers had gestational diabetes [2,3]. The ubiquitous digitalization increases the time spent in front of the screen and promotes a sedentary lifestyle. The Covid 19 pandemic has caused a decrease in physical activity among children and adolescents, which results in an increase in body weight [4]. Nowadays, the consumption of highly processed food is rising, which applies to products with added sugar, excessive consumption of energy-dense and micronutrient-poor foods. Another problem is bad dietary habits, such as frequent snacking or skipping breakfast [5]. The primary prevention of obesity is physical activity and a well-balanced diet. Public health prescriptions recommend at least one hour of physical activity per day of age-appropriate aerobic exercise and three times a week of muscle-strengthening exercises [6]. In the process of treating obesity, it is necessary to manage obesity-associated complications. Additionally it is required to change the current diet, promote physical activity and, in some cases, plan pharmacotherapy or bariatric surgery [7].

The aim of this paper is to look at the connection between obesity in children and adolescents and their mental health. Studies confirm the impact of obesity on the development of such conditions as depression, anxiety disorders, eating disorders (binge eating, loss of control over eating, eating without feeling hungry), hyperactivity and aggression. In addition, body image is disturbed, which is associated with lower self-esteem, social stigmatization, impaired social relationships and even bullying related to weight [8].

Epidemiology of childhood Obesity Worldwide

Recent estimates show that worldwide, over 390 million children and adolescents aged 5–19 years were overweight in 2022. This number includes 160 million living with obesity. The percentage of overweight people (including obesity) in this age group has risen dramatically from just 8% in 1990 to 20% in 2022. This increase has affected both boys and girls: in 2022, 19% of girls and 21% of boys were overweight. In 1990, only 31 million children and adolescents aged 5–19 were affected by obesity, representing 2% of young people. By 2022, this number had increased to 160 million (8% of young people) [9]. In Europe, the number of overweight or obese children is rising. Data show that this problem affects 1 out of 5 children [10]. In the United States, children of Hispanic, Black, and Native American ethnicity, as well as those living in poverty, are disproportionately affected by obesity [3].

Childhood Obesity Statistics in Poland

Data from 2014, 2018, and 2022 shows a consistent upward trend in the number of overweight or obese children in Poland. The tendencies observed in Poland reflect the general trend all over the world [11]. One of the reasons for this increase is the COVID-19 pandemic, during which the highest rise in childhood obesity was observed. In 2022, compared to 2018, boys had a 5% higher chance and girls a 2% higher chance of being overweight or obese (higher chance of excess weight). Recent data shows that 1 in 3 elementary school students is overweight or obese. Excess body weight is significantly more common among boys than girls [12].

Obesity and depression

Depression is a common chronic medical condition that impacts thoughts, emotions, and physical well-being. It is marked by persistent low mood, fatigue, feelings of sadness, difficulty sleeping, and a diminished capacity to find pleasure in life [13]. In the past, the idea of child's depression was largely dismissed. Before the 1970s, it was predominantly considered an adult condition, as children were thought to be too developmentally immature

to experience it. The American Psychiatric Association's *Diagnostic and Statistical Manual of Mental Disorders (DSM)* did not include diagnostic criteria for children until its third edition in 1980. Since then, research has established that children can meet the DSM's criteria for major depressive disorder (MDD) typically applied to adults. Early onset of the condition has been linked to a higher frequency and severity of depressive episodes with increased co-occurrence of medical and psychiatric conditions and increased suicidality. Moreover there is greater social, educational, and quality-of-life impairment [14].

Obesity can predispose children to depression, low self-esteem, social discomfort, and even social isolation [15]. It is estimated that around 19.44–36.5 million overweight and 12.52–33.11 million obese children are diagnosed with MDD worldwide [16]. In a systematic review from 2020 Wen-Wang Rao et al. it has been proven that as many as 1.7% to 26.7% of obese children and adolescents suffer from depression, while among overweight individuals, the figure ranges from 4.0% to 16.9%. Most of the included studies did not demonstrate an increased risk of clinical depression in overweight children and adolescents, although a significantly increased risk of MDD was noted in the samples with obesity [17]. Risk factors for obesity (lack of physical activity, sedentary lifestyle, unhealthy diet, and excessive screen time) are also linked to the onset of depressive symptoms in adolescents [16]. The impact of obesity on depression is still not fully understood; however, one hypothesis links it to neurobiological mechanisms—an imbalance in the hypothalamic-pituitary-adrenal (HPA) axis and altered cortisol levels. Inflammation, reduced leptin receptor activity, and metabolic disorders may also play a role in the pathogenesis. Excess body weight can lead to low self-esteem and a negative self-image, which decreases life satisfaction and may contribute to depression. Moreover, maternal depression increases the likelihood of both overweight/obesity and depression in children [17,18]. Many studies indicate a bidirectional effect of depression and obesity: obesity increases the risk of depression and vice versa. Additionally, their simultaneous presence is associated with a significant deterioration of the individual patient's condition and has important clinical implications. The coexistence of these two significantly complicates their treatment process, as it reduces the response to standard antidepressant therapy and lowers adherence to obesity treatment and its complications. This is associated with a longer course of illness and poorer prognosis [19]. Furthermore, stress levels are increased affecting eating behavior and leading to increased food consumption. This can trigger a cycle of overeating and may cause weight gain together with psychological distress, which exacerbates mood disorders and obesity [20].

Obesity and anxiety

Anxiety disorder is one of the most common mental disorders in children. Its occurrence is estimated at approximately 2-10% of juveniles [21]. It is a commonly underdiagnosed and undertreated problem [22]. Anxiety disorder most often is defined as worry that is inappropriate to the situation, which may manifest itself in digestive system problems, crying, irritation, and outbursts of anger [21]. It disrupts the child's functioning, leading to avoidance behavior [23]. Untreated anxiety in childhood may influence the emergence of mental illnesses in adolescence and adulthood, including panic attacks, depression, substance addiction, and suicidal tendencies [21].

Swedish research involving children aged 6 to 17 years that in the group of girls with obesity, almost 9% of them experience anxiety and in the group of overweight boys it is 5%. In the control group of children with normal body mass index, the incidence of this disease was 5% in girls and 3% in boys, respectively [24]. Similar conclusions were presented by a study conducted in China. Meta-analysis included almost 18,000 participants showed that symptoms of anxiety disorder appeared in 22% of obese children, while in children of normal weight this percentage was 18% [25]. Factors contributing to the more common occurrence of anxiety disorders in obese children are not yet fully specified [26]. One of the reasons may be malfunction of the hypothalamic-pituitary-adrenal (HPA) axis, same as in depressive disorders [18]. What's more, constant inflammation impairs the functioning of dopaminergic and serotonergic pathways, resulting in inadequate control of emotions [27]. The human factor also plays a role - the widespread stigmatization of obesity and children's exposure to indiscriminate comments from peers and adults make obese children susceptible to symptoms of anxiety disorders [28]. Low self-esteem and poor quality of life due to obesity are also one of the main causes of mental disorders such as anxiety and depression [26]. It is important to emphasize, that children with obesity and anxiety disorder feel reduction of quality of life (HRQOL – Health Related Quality of Life), comparable to children suffering from cancer [28]. Interestingly, research has shown that lifestyle changes - introducing physical activity, changing diet, increasing the amount of sleep and limiting time in front of screens - reduce anxiety symptoms, even without correlation with a decrease in BMI [29].

Obesity and ADHD

Attention deficit hyperactivity disorder (ADHD) is one of the most common complex, chronic and neurodevelopmental disorders. It' s defined by three core characteristics: hyperactivity, impulsivity and attention deficit. ADHD etiology is complex and multifactorial, it includes both genetic and environmental factors [28]. ADHD is associated with a deficit in dopamine receptors. Genetic factors play a major role, although impact of the environment is essential in developing ADHD. These encompass viral infections, maternal smoking during pregnancy, prematurity, alcohol exposure, nutritional deficiencies, and endocrine disorders [30]. Recent data indicate that 7.6% of children (aged 3 to 12 years) and 5.6% of teenagers (aged 12 to 18 years) are diagnosed with ADHD [31].

Recent literature points to a bidirectional association between ADHD and obesity. Children with ADHD have a higher BMI than average and in that case more of them are overweight or obese. Impulsivity of children with attention disorders causes problems in sticking to a healthy diet. Children with ADHD eat more unhealthy foods, which are high in sugar and fat. These children can have trouble focusing, resulting in difficulty in engaging and maintaining physical activity. Lower self- esteem can lead to emotional eating and gaining weight [32]. On the other hand, obese people show a higher occurrence of ADHD. Obesity may lead to a reduction in dopamine receptors, causing dysfunction in their activity in the brain. This is one of the valid pathophysiological mechanisms of ADHD [33]. Recent studies using summary data from consortia of genome-wide association suggest that higher BMI increases the risk of developing ADHD. However no consistent evidence was found in the reverse direction [34]. The frequency of ADHD in children with obesity is five times higher than in children with a healthy weight (RR 4.80, 95% CI 2.2–10.4, $P < 0.001$). This suggests that childhood obesity is independently associated with ADHD. Implementation of strategies, including behavioral interventions and pharmacological treatments, aimed at reducing childhood obesity, may contribute to a reduction in the prevalence of ADHD in pediatric populations [35].

Obesity and obsessive-compulsive disorder

Obsessive-Compulsive Disorder (OCD) is a chronic condition that may start from early childhood. The main symptoms of OCD are obsessions defined by repetitive, intrusive thoughts or images and compulsions,which manifest themselves through time-demanding behaviors or mental acts. Repeating a certain pattern of behavior is intended to reduce anxiety caused by irrational fear. It has been also suggested that compulsions are the core feature of OCD, and they may lead to the development of various obsessions [36]. In up-to-date knowledge, OCD expression is influenced largely due to genetic factors, but the environmental aspects also have an impact. [37, 38]. The incidence of OCD is estimated to be 2-3% in the general population [39]. OCD is more commonly diagnosed in boys than in girls and most often appears between 10 and 14 years of age [40].

The connection between OCD and childhood obesity is still under research, and the evidence remains unclear. MRI scans of the brains of obese children, with a BMI percentile of 95th or higher, show similar differences in the orbitofrontal cortex as observed in typical OCD. This area exhibits reduced local functional connectivity and includes the anterior hippocampus, parahippocampal gyrus, and part of the amygdala. This pathological pattern in the orbitofrontal cortex of obese children may obscure major disorders characterized by compulsive tendencies. In other words, the reward system in the brains of obese children does not function properly and exhibits the same dysfunctions as seen in typical OCD [41]. The available data is insufficient to determine a link between childhood obesity and OCD. Furthermore, a recent study did not observe either a positive or negative correlation [42]. However, in adult populations, there is evidence that a higher BMI is associated with a decreased risk of OCD. This association is not observed in individuals who also suffer from depression [43].

Obesity and eating disorders

Eating disorders are illnesses characterized by abnormal eating behaviors. Most individuals with these disorders exhibit an obsessive focus on body image and dissatisfaction with their weight. Such conditions affect biopsychosocial health and can lead to perilous eating routines, causing developmental and growth problems in affected children. The most common eating disorders include anorexia nervosa, bulimia nervosa, and binge eating disorder. [44,45]

Anorexia nervosa is characterized by an abnormal drive to lose weight, achieved through restrictive eating and/or excessive exercise. It is caused by an intense fear of weight gain, even in those who are already underweight, and can result in severe medical consequences.

Bulimia nervosa is a condition characterized by recurrent episodes of binge eating, during which a person consumes an unusually large amount of food and experiences a lack of control over this behavior. After overeating, comes a feeling of guilt that often leads to compensatory actions such as vomiting, misusing laxatives, or performing excessive exercise in order to prevent weight gain. The reason for these unhealthy behaviors is excessive self-criticism associated with their body image, size, and weight.

Binge eating disorder is a serious mental illness that manifests by eating large portions of food all at once until in a short period of time. People eat without feeling like they're in control of what they're doing until they feel uncomfortably full. These repeating behaviors recur at least once a week within three months and are often followed by feelings of guilt or distress. Unlike bulimia nervosa, binge eating disorder is not associated with inappropriate compensatory behaviors and does not occur exclusively within the context of bulimia nervosa or anorexia nervosa [46]. The global rate of eating disorders is increasing. Recent systematic review reports that 22.36% of children and adolescents showed signs of disordered eating [47]. Current literature reveals a significant rise in eating disorders and eating behaviors during the COVID-19 pandemic, with children and adolescents recognized as especially vulnerable groups [48].

Obesity during childhood is a significant risk factor for developing eating disorders such as binge eating disorder, bulimia nervosa, and anorexia nervosa. These disorders can develop in childhood or adulthood as a consequence of obesity. Approximately 29% of adults with binge eating disorder, 13% of adults with bulimia, and 4% of adults with anorexia have experienced childhood obesity according to data [49].

Binge eating disorder is the most common eating disorder associated with childhood obesity, often increases the risk of obesity complications, regardless of the BMI value of a child [50]. Above that obese children often have to face mental challenges connected with their condition. Children with obesity have a low self-esteem and symptoms of depression related to their body dissatisfaction. These psychosocial factors may have a direct impact on eating behaviour that takes the form of restrained eating and compensatory behaviours. In an attempt

to cope with the negative emotions connected with their condition, children could find a way to relieve them in the way of binge eating or restrictive eating behaviors [51].

Furthermore, binge eating disorder and bulimia nervosa, are associated with the same genetic factors, as overweight and obesity. Genome-wide association studies proved that they share the same genomic variants [52].

The management of obesity in the young population can accidentally increase the risk of developing anorexia nervosa. The overemphasis placed on calorie count. and rapid weight loss according to the weight loss plan can lead to the promotion of unhealthy dietary habits. Providing not enough appropriate attention to process and methods of reducing weight in some young patients may lead to disordered eating behaviors, finally leading to diseases such as anorexia nervosa [53].

Bulimia nervosa has strong links with childhood obesity. People experiencing bulimia often reported greater exposure to stressful factors from their childhood. They indicated variables such as obesity, overweight, criticism about weight and appearance from family and others belonging to the inner circle. Childhood obesity is closely associated with body dissatisfaction and negative self- image. High social pressure on obese children to meet the ideal body image results in weight-related distress, which further increases the risk of developing eating disorders such as bulimia nervosa [54].

Childhood obesity and schizofrenia

Schizophrenia is severe and chronic mental illness with positive symptoms (hallucinations, delusions, disorganized speech, and behavior), negative symptoms (blunted affect, alogia, apathy, asociality, and anhedonia), and cognitive impairments. The prevalence is approximately 1% worldwide, with a male:female ratio of 1.4:1. Its etiology is multifactorial, including a combination of genetic, biochemical, and environmental factors. [55]. Early childhood adversities, including trauma, abuse, or neglect, can disrupt normal brain development. These disruptions increase the vulnerability to mental health disorders, including schizophrenia, later in life.[56] Recent study shows that childhood obesity is significantly associated with increased risk of schizophrenia in contrast to adulthood BMI was linked to decreased risk of schizophrenia. Multivariable mendelian randomization framework

analyzes illustrate a direct impact of childhood BMI on schizophrenia, unrelated to lifestyle factor of adulthood BMI [42].

Weight-related stigma and the importance of comprehensive prevention and treatment of childhood obesity

Weight related disorders are consistently reported as the most common reason for bullying and teasing in children and adolescents. Approximately one-quarter to half of young people report being bullied due to their weight, which makes them more likely to exhibit suicidal behaviors and thoughts compared to peers of the same weight who do not feel stigmatized [5]. Furthermore, studies show that children with overweight and obesity are more likely to miss school, with increased absenteeism being associated with poorer psychosocial development as well as weaker academic performance [57]. Weight-related stigma causes social isolation and limits social contacts. Moreover, children do not want to participate in sports activities and avoid healthcare services, which is associated with a further deterioration of their physical and mental health [58]. Therefore, comprehensive prevention and treatment should involve the family, school, and healthcare system. Schools should promote interventions focused on dietary changes, healthy eating, and physical activity. Parents play a crucial role by participating in the implementation of dietary changes and encouraging an active lifestyle, significantly contributing to the improvement of their children's health [59]. Primary care physicians are also extremely needed, as they often care for patients from birth, allowing them to influence their dietary habits and physical activity levels of families. Annual check-ups that measure height and weight enable monitoring BMI trends before a child becomes obese. In cases where overweight or obesity is detected, it is the physician's responsibility to provide guidance and suggest interventions aimed at reducing body weight [60].

Conclusion

Childhood obesity is a global problem and challenger that requires urgent attention. In last decades there’s an alarming rise in the number of overweight and obese children. We have been witnessing widespread consequences affecting both physical and mental health. Recent studies show a close correlation between childhood obesity and mental health disorders such as depression, anxiety, ADHD, eating disorders and suggest that it may increase the chance of

developing schizophrenia. Social stigma and imbalance in the neurobiological mechanism in the hypothalamic-pituitary-adrenal (HPA) axis often increases the risk of childhood obesity. It’s also linked to the development of anxiety where inflammation and malfunction of the HPA axis can be observed.

There's a bidirectional link between childhood obesity and ADHD. ADHD symptoms such as impulsivity and lack of focus can result in increased BMI by struggle in the physical exercises and poor diet. At the same time dopamine dysfunction observed in obese children may exacerbate ADHD symptoms. Childhood obesity increases the risk of developing eating disorders such as binge eating, bulimia nervosa, and anorexia nervosa. Its development depends on body dissatisfaction, social pressure and genetic predispositions. The dysfunction of the reward system in obese children is very similar to malfunction observed in obsessive compulsive disorder. Childhood obesity can impact on early brain development and in the long term increases the risk of developing schizophrenia.

Preventing and treating obese or overweight children have to be done, by affecting both physical and mental health. This integrated approach can help mitigate the long term consequences of child obesity by decreasing the risk of developing chronic diseases and mental disorders.

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All authors have read and agreed with the published version of the manuscript.

Disclosure:

No disclosures.

Funding statement:

This research did not receive special funding.

Institutional Review Board Statement

Not applicable.

Informed Consent Statement

Not applicable

Data availability statement

Not applicable.

Conflict of Interests Statement

The authors declare no conflict of interest.

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