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The Relationship between Anxiety-Depression Levels in Children with Obesity: A Comprehensive Review

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ABSTRACT

Childhood obesity and internalizing disorders, particularly anxiety and depression, represent two pressing public health concerns with an increasingly recognized bidirectional relationship. This comprehensive review synthesizes current evidence to examine the complex interplay between anxiety-depression levels and obesity in children and adolescents. It explores the epidemiological landscape of both conditions and delves into the multifaceted biopsychosocial factors that underpin their comorbidity. The analysis encompasses the shared physiological pathways, such as chronic inflammation and HPA axis dysregulation, and the critical psychological and social mechanisms, including weight stigma, body dissatisfaction, bullying, and family dynamics. Furthermore, the review investigates the moderating role of socioeconomic status and family environment, highlighting them as common determinants influencing both physical and mental health outcomes. By integrating findings from epidemiological, clinical, and psychosocial research, this paper elucidates the vicious cycle wherein obesity exacerbates mental health symptoms, and poor mental health, in turn, promotes obesogenic behaviors. The conclusion underscores the necessity for integrated, multidisciplinary approaches in clinical practice that simultaneously address physical and psychological well-being, and calls for systemic interventions to reduce weight-based stigma and address socioeconomic disparities.

Keywords: Childhood Obesity; Adolescent Obesity; Anxiety; Depression; Comorbidity; Mental Health; Pediatrics.

INTRODUCTION

Childhood obesity represents one of the most critical public health challenges of the 21st century, having reached epidemic proportions globally[1]. Defined as a condition where excess body fat accumulates to an extent that may impair health, it is typically assessed using body mass index (BMI)-for-age growth charts[2].

According to the World Health Organization (WHO), the number of overweight or obese children under the age of five was estimated to be over 38 million globally in 2019, a figure that escalates dramatically in older age groups[3]. The epidemiological trajectory shows a relentless rise, with prevalence rates in many countries doubling or tripling over the past three decades, transitioning from a problem of affluent nations to a pervasive issue affecting low- and middle-income countries as well[4]. This shift is largely attributed to rapid urbanization, nutritional transitions towards energy-dense, nutrient-poor foods, and increasingly sedentary lifestyles[5]. The implications of this trend are profound, imposing a substantial long-term burden on public health trajectories.

The health consequences of childhood obesity are severe and multifaceted, extending far beyond physical appearance[6]. In the short term, obese children are at a

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significantly higher risk for a spectrum of medical comorbidities previously considered exclusive to adulthood.[7] These include insulin resistance and type 2 diabetes, hypertension, dyslipidemia, non-alcoholic fatty liver disease (NAFLD), and sleep apnea.[8] Furthermore, musculoskeletal problems such as slipped capital femoral epiphysis and increased fracture risk, alongside dermatological conditions like acanthosis nigricans, are commonly observed.[9] The long-term prognosis is equally concerning, as childhood obesity strongly tracks into adulthood, substantially elevating the lifetime risk for cardiovascular diseases, stroke, certain cancers, and premature mortality.[10] However, the burden of obesity is not confined to the physical domain; it permeates the psychological and social fabric of a child's life. The pervasive stigma, discrimination, and bullying experienced by many obese children create a toxic psychosocial environment that can undermine mental well-being, setting the stage for internalizing disorders such as anxiety and depression[11].

METHODOLOGY

This comprehensive review was conducted to identify, evaluate, and synthesize the existing scholarly literature on the relationship between anxiety, depression, and obesity in children and adolescents. A thorough search strategy was designed and executed across multiple electronic databases, including PubMed/MEDLINE, PsycINFO, Scopus, and Web of Science. The search employed a combination of keywords and Medical Subject Headings (MeSH) terms related to the core concepts: ("child*" OR "adolescent*" OR "pediatric*" OR "youth") AND ("obes*" OR "overweight" OR "body mass index") AND ("anxi*" OR "depress*" OR "internalizing disorder*" OR "mood disorder*" OR "mental health"). The search was limited to articles published in English from January 2000 to March 2024 to capture contemporary research, though seminal older works were included where foundational.

The study selection process involved a two-stage screening. Initially, titles and abstracts were reviewed for relevance. Subsequently, full-text articles of potentially eligible studies were assessed against predefined inclusion criteria: (1) primary research studies, meta-analyses, or systematic reviews; (2) focus on children or adolescents (ages 2-18 years); (3) measurement of both weight status (e.g., BMI percentile, clinical diagnosis of obesity) and symptoms or diagnoses of anxiety or depression; and (4) investigation of the association, mechanisms, or moderators linking the conditions. Exclusion criteria included studies focused solely on adults, those on eating disorders without a primary anxiety/depression focus, and non-peer-reviewed commentaries. Data from included studies were extracted and synthesized narratively. The synthesis was organized thematically according to the predetermined subheadings (e.g., biopsychosocial factors, prevalence, mechanisms), allowing for an integrated analysis of epidemiological patterns, theoretical models, and empirical findings to construct a coherent overview of the comorbidity.

Anxiety and Depression in Pediatric Populations

To comprehend the comorbidity with obesity, a clear understanding of anxiety and depression as they manifest in children is essential. In pediatric psychiatry, anxiety disorders encompass a group of conditions characterized by excessive fear, worry, and behavioral disturbances.[12] Fear is an emotional response to a real or perceived imminent threat, while anxiety is the anticipation of future threat.[13] Common disorders include Generalized Anxiety Disorder (GAD), marked by persistent and excessive worry about various domains; Separation Anxiety Disorder; Social Anxiety Disorder (Social Phobia); and Panic Disorder.[14] Diagnosing anxiety in children requires careful clinical evaluation, as symptoms may present differently than in adults. Children may not articulate worry but instead exhibit somatic complaints (e.g., headaches, stomachaches), irritability, restlessness, fatigue, concentration difficulties, and sleep disturbances.[15] Diagnostic criteria, as outlined in the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5), require symptoms to be developmentally inappropriate, persistent (typically lasting six months or more), and cause significant impairment in social, academic, or other important areas of functioning[16].

Depression in childhood, formally referred to as Major Depressive Disorder (MDD), is a serious mood disorder that goes beyond transient sadness.[17] It involves a persistent state of depressed mood or loss of interest or pleasure (anhedonia) in almost all activities.[18] In children and adolescents, the mood can often be irritable rather than sad.[19] Other diagnostic criteria include significant weight change or appetite disturbance, insomnia or hypersomnia, psychomotor agitation or retardation, fatigue or loss of energy, feelings of worthlessness or excessive guilt, diminished ability to think or concentrate, and recurrent thoughts of death or suicide.[20] For a diagnosis, five or more of these symptoms must be present during the same two-week period and represent a change from previous functioning, with at least one symptom being either depressed/irritable mood or anhedonia.[21] Assessment in pediatrics is challenging and relies on multi-informant reports (child, parent, teacher) and standardized tools, as children may lack the cognitive or linguistic maturity to describe their emotional state.[22] The manifestation can also be "masked" by acting-out, behavioral problems, or academic decline.[23] Recognizing these disorders in the context of obesity is particularly complex, as symptoms like fatigue, sleep changes, and

appetite disturbances can be misattributed to the obesity itself, leading to underdiagnosis and undertreatment.[24]

Factors Linking Obesity to Mental Health in Children

The connection between childhood obesity and internalizing disorders like anxiety and depression is not linear but is mediated by a dense network of interrelated biological, psychological, and social factors. The biopsychosocial model provides an integrative framework for understanding this complex relationship.[25] From a biological perspective, shared pathophysiological pathways are increasingly recognized. Obesity is a state of chronic low-grade inflammation, characterized by elevated levels of pro-inflammatory cytokines such as interleukin-6 (IL-6) and tumor necrosis factor-alpha (TNF-α).[26] These inflammatory markers can cross the blood-brain barrier and affect neuroendocrine systems, including the hypothalamic-pituitary-adrenal (HPA) axis, which regulates stress response.[27] Dysregulation of the HPA axis, leading to abnormal cortisol secretion, is a common feature in both obesity and mood/anxiety disorders.[28] Furthermore, obesity can disrupt neurocircuitry involved in reward and emotion regulation. Diets high in fat and sugar may alter dopamine signaling, potentially reducing sensitivity to natural rewards and contributing to anhedonia—a core symptom of depression.[29] Additionally, sleep disturbances, particularly obstructive sleep apnea common in obesity, lead to sleep fragmentation and hypoxia, which exacerbate daytime fatigue, cognitive impairment, and emotional dysregulation.[30]

Psychologically, the experience of obesity in a weight-conscious society inflicts significant distress. Body dissatisfaction, low self-esteem, and a negative body image are almost ubiquitous among obese children and are potent risk factors for developing anxiety and depression.[31] The internalization of weight-based stigma—whereby the child comes to believe the negative stereotypes about obesity are true of themselves—leads to self-devaluation, shame, and social withdrawal.[32] This is compounded by maladaptive coping strategies; emotional eating, defined as eating in response to negative emotional states rather than hunger, serves as a short-term regulatory strategy but reinforces both weight gain and a cycle of guilt and further negative affect.[33] Learned helplessness may develop when repeated efforts at weight management fail, fostering a sense of hopelessness and low self-efficacy that mirrors depressive cognitions.[34]

Socially, the environment plays a decisive role. Weight-based victimization, including bullying, teasing, and social exclusion, is tragically common and has a devastating impact on mental health.[35] Victims of bullying are at a markedly increased risk for anxiety, depression, and suicidality.[36] The social isolation that often results from stigma limits opportunities for positive peer interactions and social skill development, further entrenching feelings of loneliness and difference.[37] The family system is also critical; parenting styles, family functioning, and parental mental health are significant moderators. For instance, an overprotective or controlling parenting style may limit a child's autonomy and coping skills, while family conflict or parental criticism about weight can directly contribute to anxiety and depressive symptoms.[38] These biopsychosocial factors do not operate in isolation but interact dynamically, creating a vicious cycle where obesity worsens mental health, and poor mental health, through behavioral and physiological mechanisms, exacerbates obesity.[39]

Prevalence of Anxiety and Depression Among Obese Children: Quantifying the co-occurrence of obesity and internalizing disorders is crucial for understanding the scope of the problem. A growing body of epidemiological and clinical research consistently demonstrates that children and adolescents with obesity are at a significantly elevated risk for symptoms and diagnoses of anxiety and depression compared to their normal-weight peers.[40] A meta-analytic review provides compelling evidence for this association, though exact prevalence rates vary across studies due to differences in sample characteristics, assessment methods (clinical interview vs. self-report), and cultural contexts.[41]

The link appears to be particularly strong for specific anxiety disorders. Social Anxiety Disorder (SAD) shows one of the most robust associations, likely driven by the intense fear of negative evaluation in social situations related to one's physical appearance.[42] Similarly, symptoms of Generalized Anxiety Disorder (GAD), particularly excessive worry about health, social acceptance, and performance, are highly prevalent.[43] The relationship with depression is equally pronounced. Longitudinal studies indicate that obesity in childhood predicts the onset of depressive symptoms later in adolescence, and conversely, depressive symptoms in childhood can predict increases in BMI over time, suggesting a bidirectional relationship.[44] The severity of obesity also appears to be a factor, with children in the severely obese category (BMI ≥99th percentile) demonstrating even higher rates of psychological distress.[45] It is critical to note, however, that not every child with obesity develops a mental health disorder. Resilience factors, such as strong social support, positive family relationships, and high self-esteem in non-weight-related domains, can provide protection.[46] Furthermore, the association is often moderated by gender and pubertal stage. Adolescent girls with obesity seem to be at a disproportionately higher risk for depression, potentially due to greater societal pressure regarding body image.[47] The developmental timing of obesity onset may also be important, with earlier onset linked to more severe psychosocial sequelae.[48]

Socioeconomic Status and Family Environment

The socioeconomic context and family environment are fundamental, upstream determinants that shape both the risk for childhood obesity and the development of anxiety and depression, often serving as common causal ground for their comorbidity. Socioeconomic Status (SES), typically measured by parental education, income, and occupation, exerts a profound influence.[49]

Lower SES is consistently associated with higher rates of obesity in children, a disparity linked to the "obesogenic" environment characterized by limited access to affordable healthy foods (food deserts), greater exposure to marketing of unhealthy products, fewer opportunities for safe physical activity, and higher levels of chronic family stress.[50] This same environment is a potent incubator for poor mental health. Economic hardship, parental stress, and neighborhood disadvantage are significant risk factors for childhood anxiety and depression.[51] Therefore, children from lower SES backgrounds face a double jeopardy, experiencing a convergence of risk factors that predispose them to both conditions simultaneously.[52] The chronic stress of poverty can lead to allostatic load—the cumulative wear and tear on the body's stress response systems—which biologically embeds the risk for both metabolic dysfunction (obesity) and HPA axis dysregulation (anxiety/depression).[53]

Within the family unit, dynamics play a critical mediating and moderating role. Parental mental health is a powerful predictor; children of parents with depression or anxiety are at a genetically and environmentally increased risk for these disorders themselves.[54] Furthermore, a parent struggling with their own mental health may have difficulty modeling healthy coping strategies, providing consistent emotional support, or maintaining structured routines around meals and physical activity.[55] Family functioning styles are pivotal. Authoritative parenting, characterized by warmth combined with appropriate structure and expectations, is generally protective against both obesity and internalizing problems.[56] In contrast, dysfunctional patterns can be detrimental. For example, an "enmeshed" or overprotective style may limit a child's autonomy and problem-solving skills, fostering anxiety.[57]

A highly critical or coercive family climate, especially regarding the child's weight, is strongly associated with body dissatisfaction, low self-esteem, binge eating, and depressive symptoms.[58] This is often termed "weight talk" or "weight teasing," and its effects are profoundly damaging, sometimes more so than teasing from peers.[59] Conversely, a supportive family environment that emphasizes health rather than weight, encourages open communication, and fosters self-worth based on intrinsic qualities can buffer the child against the psychological impacts of obesity and stigma.[60]

Mechanisms of Comorbidity:

Biological/Physiological Mechanisms

As previously mentioned, the inflammatory state associated with obesity is a primary biological pathway. Adipose tissue, particularly visceral fat, acts as an endocrine organ secreting adipokines (e.g., leptin, adiponectin) and inflammatory cytokines.[61, 62]

Elevated cytokines like IL-6 and TNF-α can access the brain and influence neurotransmitter systems involved in mood regulation, such as serotonin and dopamine, contributing to symptoms of depression and anxiety.[63]

Neuroendocrine dysregulation is another core mechanism. Chronic stress and obesity can lead to HPA axis hyperactivity or, eventually, burnout, resulting in abnormal cortisol rhythms.[64] This dysregulation impairs the body's ability to manage stress effectively, lowering the threshold for anxiety responses and contributing to mood instability.[65] Additionally, structural and functional brain changes have been observed in obese youth, including alterations in the prefrontal cortex (involved in executive function and emotion regulation) and the amygdala (key in fear and anxiety processing), which may underlie common emotional and cognitive symptoms.[66]

Cognitive and Behavioral Mechanisms: The cognitive appraisal of one's weight and the resulting behaviors form a critical pathway. The internalization of societal weight stigma leads to a core schema of being "defective" or "less worthy," which fuels automatic negative thoughts in social and performance situations, characteristic of social anxiety and depression.[67]

This cognitive distortion is maintained through avoidance behaviors (e.g., avoiding gym class, social events) that provide temporary relief from anxiety but reinforce the fear and prevent disconfirming experiences, in a classic cycle seen in anxiety disorders.[68] Behavioral mechanisms also include activity withdrawal. Due to physical discomfort, poor fitness, or fear of ridicule, obese children often reduce physical activity.[69]

This withdrawal eliminates a potent natural antidepressant and anxiolytic—exercise, which boosts endorphins, reduces inflammation, and enhances self-efficacy.[70] Sleep disruption, from conditions like sleep apnea, impairs emotional regulation and cognitive function the next day, increasing irritability and vulnerability to stress.[71]

Social and Interpersonal Mechanisms

The social consequences of obesity directly feed into psychopathology. Chronic exposure to weight-based victimization is a severe psychosocial stressor that can lead to Post-Traumatic Stress symptoms, chronic hypervigilance (anxiety), and profound sadness and hopelessness (depression).[72] Social isolation and peer rejection deprive the child of essential sources of support,

positive feedback, and the development of social competencies, leading to loneliness—a well-established risk factor for depression.[73]

Table 1: Summary of Key Comorbidity Mechanisms

Mechanism Domain	Specific Pathway	Potential Outcome on Mental Health
Biological	Chronic Inflammation (Cytokine release)	Alters neurotransmitter function, contributing to depressed mood & anhedonia [62],[63]
Biological	HPA Axis Dysregulation (Cortisol)	Reduces stress resilience, increases anxiety & emotional lability [64],[65]
Cognitive	Weight Stigma Internalization & Negative Self-Schema	Fuels core beliefs of worthlessness (depression) and fear of evaluation (anxiety) [67]
Behavioral	Activity Withdrawal & Reduced Exercise	Removes natural mood stabilizer, reduces self-efficacy, worsens physical health [69],[70]
Social	Victimization (Bullying) & Social Rejection	Acts as chronic trauma, leading to hypervigilance, sadness, and isolation [42]

CONCLUSION

The relationship between childhood obesity and anxiety-depression is not coincidental but causal and reciprocal, forged through intricate biopsychosocial mechanisms. The evidence underscores that these conditions feed into each other, creating a vicious cycle that can trap a child in a compounded deterioration of metabolic and psychological outcomes. This comprehensive review highlights the imperative for a paradigm shift in clinical and public health approaches. Screening for anxiety and depression should be a standard component in the management of pediatric obesity, just as assessing weight and metabolic health should be considered in children presenting with internalizing disorders. Future interventions must be integrated, simultaneously addressing the physical, emotional, and social dimensions of this complex comorbidity. Breaking the cycle requires not only individual-level support but also a concerted effort to combat weight stigma at the societal level, creating environments that support the holistic well-being of all children, irrespective of body size.

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Consent for Publication

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Authors' Contributions

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