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Research Progress on Depression in Obese Children and Adolescents

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Abstract: *With rapid socio-economic development and substantial lifestyle changes, the prevalence of overweight and obesity among children and adolescents has continued to increase, while mental health problems—particularly depression—have become increasingly prominent. Evidence suggests a significant bidirectional relationship between obesity and depression, forming a self-reinforcing cycle. Therefore, this study aims to review the current status of depression among obese children and adolescents, as well as its influencing factors and intervention strategies. The objective is to provide a comprehensive overview of existing research and to offer a reference for improving prevention and management approaches for depression in this population.*

Keywords: *Obesity; depression; children; adolescents*

1. Introduction

With rapid socioeconomic development and evolving lifestyles, the prevalence of overweight and obesity among children and adolescents in China has continued to increase. The 2021 Global Burden of Disease Study predicts that by 2050[1], approximately one in three individuals aged 5–24 years worldwide will be overweight or obese, corresponding to about 746 million people, including 360 million classified as obese. Furthermore, between 1990 and 2021, the global prevalence of obesity in this age group more than doubled. According to the *Report on the Nutritional Status and Chronic Diseases of the Chinese Population (2020)*, 34.3% of adults in China are overweight and 16.4% are obese. Among adolescents aged 6–17 years, 11.1% are overweight and 7.9% are obese, while among children under 6 years of age, 6.8% are overweight and 3.6% are obese[2].Evidence further suggests that the prevalence of depression among obese children and adolescents in China is as high as 24.02%[3].

Rising obesity rates pose a significant threat to the health of children and adolescents and are associated with an increased risk of chronic conditions, including diabetes, hypertension, and cardiovascular disease[4].Evidence indicates that children with obesity are more likely to experience peer rejection and bullying and tend to demonstrate poorer academic and social performance. These challenges further elevate their risk of developing low self-esteem, anxiety, and depression, with such psychological effects potentially persisting into adulthood[5].Adolescent depression can adversely affect sleep patterns and psychosocial functioning, leading to declines in academic achievement. In severe cases, it may result in self-harm, suicidal behavior, or even engagement in criminal activities, thereby posing a serious threat to the well-being of individuals, families, and society [6].Despite these concerns, research on depression among obese children and adolescents remains limited. Therefore, this study aims to review the risk factors and intervention strategies associated with depression in this population, with the goal of providing a comprehensive overview of current research and informing improvements in prevention and intervention efforts.

2. Factors influencing Depression in Obese Children and Adolescents

2.1 Physiological Factors

Current research indicates that depressive symptoms in obese children and adolescents are significantly associated with a range of physiological indicators, including salivary cortisol levels, inflammatory cytokines, metabolic markers, and gut microbiota composition.

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Pervanidou et al. [7]reported that obese children exhibiting symptoms of anxiety or depression have higher salivary cortisol levels compared with those without such emotional symptoms. McLachlan et al.[8]reported that adolescents with major depressive disorder (MDD) exhibit significantly elevated levels of inflammatory markers, including C-reactive protein and tumour necrosis factor-α, as well as altered lipid profiles. Moreover, the severity of depression was found to be positively correlated with indicators such as visceral adipose tissue. Christaki et al. [9] further demonstrated that overweight and obese girls have significantly higher serum fibroblast growth factor 21 (FGF21) levels, which are associated with depressive symptoms, externalising behavioural problems and metabolic parameters such as insulin levels. In addition, Hannon [10]identified a significant association between depressive symptoms and insulin resistance. After adjusting for potential confounding factors, including gender, ethnicity, age, and body mass index (BMI), the Children's Depression Inventory (CDI) T-score remained positively associated with the homeostatic model assessment of insulin resistance (HOMA-IR). This finding suggests that greater severity of depressive symptoms in obese adolescents is linked to a higher risk of insulin resistance.

Ercan [11] found that adipokines and genetic polymorphisms may contribute to the comorbidity of obesity and depression by influencing the hypothalamic–pituitary–adrenal (HPA) axis, neurotransmitter regulation, and inflammatory responses. Furthermore, emerging evidence highlights the role of gut microbiota in this relationship. Furthermore, growing evidence suggests that obesity and depression are linked through alterations in the gut microbiota. Obesity-induced changes in gut microbial composition may contribute to the onset and progression of depression via multiple mechanisms, including the promotion of neuroinflammation, modulation of intestinal metabolism, and alterations in brain structure, thereby playing a significant role in the comorbidity of obesity and depression[12].

2.2 Cognitive Factors

The association between childhood obesity and mental health may be mediated by individual cognitive and behavioural factors, including executive function, body image, and emotional regulation.

Wang Mingyi[13]conducted a study involving 408 fourth- and fifth-grade primary school students in Beijing. The findings indicated that overweight and obese children exhibited significantly lower levels of executive function than their normal-weight peers and experienced more pronounced negative emotions. Moradi [14] reported that obesity in children and adolescents is significantly positively associated with body dissatisfaction and low self-esteem. In addition, being overweight was found to increase the risk of developing low self-esteem. A case–control study conducted in Turkey found that obese children and adolescents exhibit significantly higher levels of anxiety and depression than their normal-weight counterparts, along with lower self-esteem and pronounced impairments in emotional regulation. These psychological factors were found to be closely interrelated[15].Aparicio[16] further identified emotional regulation as a key mechanism linking stress and obesity in children. Effective emotional regulation may mitigate obesity-related risk behaviours, such as emotional eating and sedentary lifestyles. Conversely, stress combined with poor emotional regulation may contribute to the onset and progression of obesity through multiple pathways, including dysregulated cortisol secretion, emotional eating, physical inactivity, and sleep disturbances.

2.3 Behavioural Factors

Existing research indicates that lifestyle factors, including dietary habits, physical activity, sleep patterns, and substance use (e.g., smoking and alcohol consumption), are closely associated with obesity and depression in children and adolescents. Calcaterra et al. [17]highlighted the complex interplay among dietary behaviours, depression, and obesity, noting that these factors share common biological pathways, such as inflammatory responses, neuroendocrine regulation, and the gut–brain axis. Stress may further exacerbate this relationship by prompting individuals to cope with negative emotions through the consumption of high-calorie foods, thereby creating a vicious cycle of "overeating → weight gain → psychological distress," which intensifies both depressive symptoms and obesity severity. Wenqi Gao et al. [18]found that emotional eating and restrictive eating behaviours in obese children are associated with depressive symptoms and insulin resistance, suggesting that maladaptive eating patterns may indirectly influence emotional states through metabolic pathways.

In addition, several studies have demonstrated that higher levels of physical activity combined with adequate fruit and vegetable intake are associated with a significantly reduced risk of depression and poor well-being among obese children, with a synergistic effect observed when these factors are

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combined [19].Conversely, insufficient physical activity has been shown to significantly increase the risk of comorbid depressive symptoms in overweight and obese children [20].Sleep patterns also play a critical role. Previous research indicates that sleep deprivation in adolescents is associated with a higher prevalence of depressive symptoms, potentially due to mood instability, daytime fatigue, and physical discomfort resulting from circadian rhythm disruption. Moreover, such disruptions may also contribute to dysregulation of appetite and body weight [21]。Furthermore, research indicates that smoking and alcohol consumption are significant risk factors for the co-occurrence of overweight/obesity and depression[22].

2.4 Family Factors

As the primary developmental context for obese children and adolescents, the family environment encompasses multiple factors that are closely associated with depressive symptoms in this population. Kanellopoulou et al. [23]found that parental dietary habits, attitudes towards food, and emotional coping strategies—such as using food to soothe children—can influence children's eating behaviours and weight status, thereby contributing to the development of obesity.

Research also indicates a significant bidirectional association between family conflict and depressive symptoms in adolescents: family conflict can exacerbate adolescent depression, while adolescent depression may, in turn, intensify family conflict. Moreover, depression demonstrates intergenerational transmission effects, whereby maternal depression can influence adolescents, and adolescent depression may subsequently affect paternal mental health[24].Using linear regression analysis, Michal et al.[25] confirmed that obesity, lower parental income, and reduced self-esteem are all significantly associated with higher depression scores among adolescents. Notably, depression levels were particularly elevated among obese adolescents from families with both low household income and low maternal educational attainment. This may be attributable to a greater likelihood of negative parenting practices in such contexts, which can lead to poor parent–child interactions and subsequently undermine adolescents' self-confidence and psychological resilience.

2.5 School-related Factors

As peer interactions predominantly occur within the school environment, and adolescents' social development and self-identity formation are highly dependent on this context, peer discrimination represents a critical indirect factor influencing the mental health of obese adolescents. Overweight and obese children and adolescents frequently experience weight-related stigma and peer discrimination; such adverse experiences can undermine self-esteem and, in turn, significantly increase the risk of depression[26].Kang Li[27] found that overweight and obese adolescents are significantly more likely to experience bullying at school than their normal-weight peers. Moreover, the combined effect of overweight/obesity and bullying substantially increases the risk of depression, with both verbal and physical bullying showing additive effects on depressive symptoms. Tas et al. [28], in a case–control study, further reported that obese or overweight adolescents who are victims of bullying exhibit significantly higher levels of psychotic symptoms. Furthermore, Stephen et al.[29] found that teachers may hold implicit weight bias toward obese students. Such bias can be conveyed through classroom interactions and feedback, contributing to a cycle of self-doubt among obese students and indirectly triggering or exacerbating depressive symptoms. Given these findings, schools should implement targeted interventions, including strengthening education on obesity-related issues, promoting resilience among obese students, and fostering an inclusive and supportive school environment. These measures may help mitigate the impact of school-related factors on depression in obese children and adolescents.

3. Interventions for Depression in Obese Children and Adolescents

3.1 Psychotherapy

3.1.1 Cognitive Behavioural Therapy

Cognitive behavioral therapy (CBT) is a structured form of psychotherapy that integrates principles from cognitive and behavioral psychology, with the aim of helping individuals identify and modify maladaptive thought patterns and behaviors, thereby improving emotional and psychological well-being[30].Evidence suggests that CBT can not only alleviate depressive symptoms but also

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contribute to weight management in obese individuals[31].Guelly et al.[32]conducted a randomized controlled trial involving overweight or obese adolescent girls aged 12–17 years who had a family history of type 2 diabetes and presented with mild to moderate depressive symptoms. The findings demonstrated that CBT significantly reduced depressive symptoms. Although no direct reduction in overall BMI was observed, improvements in depressive symptoms were associated with greater decreases in BMI. Additionally, favorable changes in fasting insulin levels were reported. Ramalho et al.[33]further explored the application of CBT delivered through digital platforms, such as social media. Their findings indicated that this form of intervention effectively reduced symptoms of depression and anxiety, as well as binge-eating behaviors, while also contributing to weight loss in obese adolescents. These results suggest that e-CBT is both feasible and effective, representing a promising approach for addressing adolescent obesity and its associated mental health comorbidities.

3.1.2 Mindfulness-based Intervention Therapy

Research indicates that mindfulness-based interventions (MBIs) demonstrate moderate effectiveness in alleviating depressive symptoms in adolescents [34].Dalager et al.[35] conducted a case study involving a 16-year-old adolescent girl presenting with moderate depressive symptoms, obesity, insulin resistance, and a family history of type 2 diabetes. Following a six-week mindfulness group intervention, with assessments conducted immediately post-intervention and at a one-year follow-up, significant improvements were observed. Trait mindfulness increased markedly, while depressive symptoms decreased by 56% relative to baseline and remained in remission at follow-up. Perceived stress levels were also reduced.In addition, metabolic outcomes improved, with insulin resistance decreasing from severe levels to within the normal range, and the cortisol awakening response showing a sustained decline. Emotional overeating behavior was eliminated entirely. However, no significant changes were observed in BMI or body fat percentage, which remained stable throughout the follow-up period.

These findings suggest that, for obese adolescents at risk of type 2 diabetes and experiencing depressive symptoms, mindfulness-based interventions can produce substantial and sustained improvements in psychological outcomes and metabolic function, independent of weight loss. As such, MBIs represent an important complement to traditional diet- and exercise-based interventions. For effective implementation in clinical practice, it is essential to enhance group-based social support, simplify abstract mindfulness concepts, and promote adherence to home-based practice. Nevertheless, to achieve meaningful weight reduction, mindfulness-based interventions should be combined with lifestyle modification strategies.

3.2 Lifestyle Interventions

Lifestyle interventions constitute a core, comprehensive strategy for addressing obesity and its associated depressive symptoms. By promoting fundamental health behaviours—such as evidence-based dietary modification, regular physical activity, and adequate sleep—these interventions support both weight management and metabolic health.

Sepúlveda et al. [36]conducted a randomized controlled trial in a healthcare setting involving obese children and adolescents (mean age 10.3 ± 1.4 years), implementing a three-month, family systems–oriented, multi-component intervention. This approach not only targeted lifestyle modification but also emphasized emotional and social development, as well as family system adjustment, with the aim of enhancing the sustainability of behavioural change through coordinated family-level intervention. Following the intervention, participants demonstrated significant improvements in depressive and anxiety symptoms, alongside enhanced self-concept. Similarly, Vourdoumpa et al. [37] conducted a study involving 611 children and adolescents aged 6–18 years with varying weight statuses (normal weight, overweight, and obesity). Through a one-year, multidisciplinary, personalized lifestyle intervention combined with regular follow-up assessments, the study found significant reductions in anxiety symptoms, as well as improvements in depressive symptoms and markers of metabolic inflammation among obese participants. Overall, the intervention effectively improved weight status and metabolic health while simultaneously alleviating symptoms of anxiety and depression.

3.3 Pharmacological Treatment

Recent evidence suggests that the co-occurrence of obesity and depression necessitates a comprehensive management approach, as untreated depression may adversely affect weight loss

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outcomes. For patients with comorbid obesity and depression, combination pharmacotherapy—such as bupropion with escitalopram—has been shown to be more effective than monotherapy, while fluoxetine may also provide therapeutic benefits[38].However, the use of antidepressants in obese children and adolescents requires careful consideration. A retrospective cohort study indicated that certain antidepressants may be associated with increases in z-scores of body mass index (z-BMI) among overweight adolescents with depression [39].Moreover, given that children and adolescents are still undergoing physical and neurological development, and that many anti-obesity medications act on the central nervous system, there is potential for effects on the neuropsychiatric axis, cognition, and mood. Therefore, during treatment, it is essential to closely monitor academic performance, attention, memory, and any potential exacerbation of depressive or anxiety symptoms[40].

4. Conclusion

In summary, depression is highly prevalent among obese children and adolescents and is closely associated with multiple factors, including physiological, cognitive, behavioural, familial, and school-related influences. Comprehensive interventions—such as cognitive behavioral therapy, mindfulness-based approaches, and lifestyle modifications—have demonstrated effectiveness in alleviating depressive symptoms in this population.

Nevertheless, current research in this field, both domestically and internationally, remains at an exploratory stage and is subject to several limitations. The complex mechanisms underlying the interactions among contributing factors have not yet been fully elucidated, and systematic intervention models based on family and school contexts remain limited. Moreover, there is a pressing need for tailored interventions targeting specific subgroups, while many existing studies are constrained by small sample sizes and a lack of long-term follow-up. Future research should prioritize large-scale, context-specific studies with more rigorous designs and extended follow-up periods. In addition, the development of multi-level, personalized intervention frameworks integrating families, schools, communities, and healthcare systems is essential. Such efforts will provide a stronger evidence base and practical guidance for improving the prevention and management of depression among obese children and adolescents.

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