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Mini review: Sleep and childhood obesity

Mini derleme: Uyku ve çocukluk çağı obezitesi

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ABSTRACT

Childhood obesity is a complex endocrine issue that is becoming more common and often leads to various social, physiological and psychological problems in children. There are many reasons why this problem is getting worse. It is estimated that in 2024, the global population of children under the age of five will reach 35 million, while in 2022, the number of children and adolescents between the ages of 5 and 19 who are categorised as overweight will exceed 390 million. The prevalence of childhood obesity in Türkiye has been increasing in recent years. Sleep has many functions, including infection control and healing, brain development and cognitive performance (such as alertness and memory), and mood, emotion, and behaviour regulation. The amount of sleep required changes with age. Children and adolescents who do not receive adequate sleep are known to experience difficulties in terms of attention, emotional regulation, and may display irritability, impulsivity, or mood instability. It is well-known that short sleep duration is associated with decreased leptin levels and increased ghrelin levels. These changes are linked to increased appetite, potentially leading to overeating and an elevated body mass index. Poor sleep timing, late bedtimes or not getting as much sleep as needed may indicate a 'slipped' or 'delayed' sleep phase. A lack of sleep can have a detrimental effect on the general long-term health of everyone, but especially children.

Keywords*:* childhood obesity; sleep; obesity

ÖZET

Çocukluk çağı obezitesi, giderek yaygınlaşan ve çocuklarda çeşitli sosyal, fizyolojik ve psikolojik sorunlara yol açabilen karmaşık bir endokrin sorundur. Bu sorunun giderek kötüleşmesinin birçok nedeni vardır. 2024 yılında, beş yaş altındaki çocukların küresel nüfusunun 35 milyona ulaşacağı; 2022 yılında ise 5–19 yaş arasındaki çocuk ve ergenler arasında fazla kilolu olarak sınıflandırılanların sayısının 390 milyonu aşacağı tahmin edilmektedir. Türkiye'de çocukluk çağı obezitesinin görülme sıklığı son yıllarda artış göstermektedir. Uyku; enfeksiyon kontrolü ve iyileşme, beyin gelişimi ve bilişsel performans (uyanıklık ve hafıza gibi) ile ruh hali, duygu ve davranışların düzenlenmesi dâhil olmak üzere birçok işleve sahiptir. Gereksinim olan uyku miktarı yaşa göre değişmektedir. Yeterli uyku alamayan çocuk ve ergenlerin dikkat, duygusal düzenleme konusunda zorluklar yaşadıkları; irritabilite, dürtüsellik veya duygu durum dengesizliği sergileyebildikleri bilinmektedir. Kısa uyku süresinin, leptin düzeylerinde azalma ve ghrelin düzeylerinde artış ile ilişkili olduğu iyi bilinmektedir. Bu değişiklikler iştah artışıyla ilişkilidir ve aşırı yeme ile vücut kitle indeksinin yükselmesine yol açabilmektedir. Uygun olmayan uyku zamanlaması, geç yatma ya da ihtiyaç duyulandan daha az uyuma, "kaymış" veya "gecikmiş" bir uyku fazına işaret edebilmektedir. Uyku yoksunluğu, uzun dönem sağlık üzerinde olumsuz etkilere sahip olabilmekte; ancak özellikle çocuklar için daha zararlı olabilmektedir.

Anahtar kelimeler*:* çocukluk çağı obezitesi; uyku; obezite

Introduction

Sleep plays a crucial role in numerous functions, including mood regulation and cognitive performance. Insufficient sleep and sleep disorders are highly prevalent among both adults and children, thereby constituting a significant public health burden (Johnson et al., 2018).

Obesity is an endocrine and chronic disorder characterised by fat accumulation that arises when the balance between energy intake and energy expenditure is disrupted, with energy intake exceeding energy expenditure (Baş & Aycan, 2020). Childhood obesity is considered a pandemic due to its increasing prevalence and poses a serious health problem worldwide (The Lancet Diabetes & Endocrinology, 2022). Kids who are obese or overweight during childhood and adolescence are more likely to have problems with their metabolism and heart health as they grow up. This can have a really negative impact on their quality of life and outlook on life, and it can even increase the risk of death in adulthood.

On a global scale, growing evidence suggests a correlation between reduced sleep duration in children and elevated body mass (Lancet, 2022). This review imply the importance of sleep effects on childhood obesity.

1. Circadian rhtym

The term "circadian" is derived from the Greek words "circa" (approximately) and "dies" (day). It describes the physiological, biochemical and behavioural effects of the light-dark cycle on living organisms. The suprachiasmatic nucleus (SCN) of the hypothalamus is home to a central clock. This clock is comprised of a series of peripheral clocks that are found in nearly all other tissues of the body (Baştürk & Koç Özerson, 2023). The central clock and peripheral clocks together structure an organism's circadian rhythms. However, the human body is constantly exposed to numerous environmental changes. Different mechanisms enable the organism to perceive these changes and adapt to them. External factors that influence circadian rhythms are called zeitgebers (Gombert et al., 2018). The circadian rhythm corresponds to insulin secretion, energy expenditure, the thermic effect of

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food, sleep regulation and hunger. The circadian clock is strongly associated with the sleep-wake cycle. However, it also plays a role in many other processes. These include hormone secretion, ardiovascular health, cancer and neurodegenerative disorders (Hunt et al., 2022).

Light is the central modulator that helps our bodies clock the time of day (Asher & Sassone-Corsi, 2015). Light is detected by photosensitive retinal ganglion cells containing melanopsin, which transmit the light stimulus to the SCN via the retinohypothalamic pathway. The light stimulus is transmitted to the pineal gland via the superior cervical ganglion via complex neural networks, and melatonin synthesis is suppressed by the influence of light. The cycle of light and darkness in the external environment is important in regulating the circadian rhythm. The production and release of melatonin are influenced by light and darkness, respectively. However, exposure to light at night has been shown to cause a decrease in plasma melatonin levels. Melatonin's effects go beyond its role as a chronobiotic; it also has hypnotic properties (Akıncı & Orhan, 2016).

a. Sleep

Sleep has many functions, including infection control and healing, brain development and cognitive performance (such as alertness and memory), and mood, emotion, and behaviour regulation (Johnson et al., 2018). The amount of sleep required changes with age. Children and adolescents who do not receive adequate sleep are known to experience difficulties in terms of attention, emotional regulation, and may display irritability, impulsivity, or mood instability (Sprajcer et al., 2023).

The National Sleep Foundation suggests that toddlers require between 11 and 14 hours of sleep, school children aged 6-13 need between 9 and 11 hours, and adolescents need between 8 and 10 hours. This requirement decreases across age groups, reaching approximately 7-9 hours in adults (Hirshkowitz et al., 2015).

2. Obesity

Obesity is defined as an excess fat accumulation that disrupts health and may cause death (WHO [World Health Organisation], 2025a). It is a chronic and progressive disease, becoming public pandemic dramatically. Unfortunately, our country is strongly affected by this pandemic. The body mass index (BMI) is a metric used to categorise adults as either underweight, overweight, or obese. It is determined by dividing a person's weight in kilograms by the square of their height in metres (kg/m²). WHO defines 'overweight' as a BMI of 25 or more and 'obese' as a BMI of 30 or more (WHO, 2025a). If obesity is not treated and progresses, it exerts a profoundly deleterious effect on all organs and systems, particularly the endocrine and other systems. Obesity-related metabolic syndrome leads to insulin resistance, type 2 diabetes, dyslipidemia, hypertension, pregnancy-related illness, polycystic ovary syndrome, sleep apnea, asthma, osteoarthritis, and various cancers, including endometrial, breast, and gallbladder, colon, rectal, and prostate cancers (Mühürdaroğlu & Akdağ, 2024).

According to World Health Organisation in 2022, it was found that 43% of adults aged 18 and over were overweight and 16% were obese. By 2022, 1 in 8 people in the world will be diagnosed with obesity (WHO, 2025b). The prevalence of obesity and obesity-related deaths in our country is similar to the global prevalence, which is a worrying trend. The average adult BMI in Türkiye increased by 17% from 24.71 in 1975 to 28.94 in 2016. During the same period, a rise was seen in the rate of obesity in the population from 7.60% to 32.20% (Turkish Statistical Institute, 2020).

There are so many main causes of obesity. These are overeating, low energy expenditure, and physical inactivity. Upon examination of the fundamental causes, it becomes evident that a confluence of socio-cultural factors, a paucity of knowledge, peer pressure, uncontrolled eating, emotional eating, snacks, sleep deprivation, medications, the ageing process, gender, genetics and epigenetics, neuroendocrine factors, sarcopenia, microbiota, chronic fatigue, muscle pain, joint pain, and emotional barriers emerge as the predominant factors (Sharma & Padwal, 2010). In addition, cultural differences and changes also influence body weight. Over the years, individuals' body perceptions have changed in society. For instance in some cultures, it was believed that high body weight was, make a person attractive for marriage (Blüher, 2019).

a. Childhood obesity

In parallel with the increasing prevalence of obesity in adults, childhood obesity is also becoming increasingly common and can lead to many metabolic, chronic conditions in early life. One of the six global nutrition targets set by WHO for 2025 is to halt the rise in childhood overweight (WHO, 2025a).

When overweight and obesity are being defined for children, age should also be taken into account. For children under 5, being overweight is defined as having a weight-for-height that is two standard deviations above the WHO Child Growth Standards median. Obesity is defined as having a weight-for-height that is three standard deviations above the WHO Child Growth Standards median. For children aged 5-19, being overweight is defined as having a BMI-for-age greater than 1 standard deviation above the WHO Growth Reference median. Obesity is defined as having a BMI-for-age greater than 2 standard deviations above the WHO Growth Reference median (WHO, 2025a).

b. Epidemiology

The prevalence of childhood obesity in Türkiye has been increasing in recent years. It is estimated that in 2025, predicted prevalence and number of cases were 16.2% and 2990.8 (thousands) in children 5-19 (Word Obesity Federation,2020). According to the results of the Childhood Obesity Surveillance Initiative (COSI-TUR), 2013, 2016, and 2022 surveys, the prevalence of overweight among second-grade primary school students in Türkiye is 14.2%, 14.6%, and 12.5%, respectively, and the prevalence of obesity is 8.3%, 9.9%, and 9.9%, respectively. The number of people who are obese, including those who are overweight, is 22.5%, 24.5%, and 22.4%, in that order. COSI-TUR surveys found that more and more second-grade primary school students were overweight or obese between 2013 and 2016. But since then, the number of students who are overweight or obese, including those who are overweight, has been going down. However, the decrease in the prevalence of overweight is greater than the prevalence of obesity (COSITUR, 2022). According to recent study conducted by Pulat Demir (2022) , it was found that overweight and obesity prevalence was 20.3% and 13.2%, respectively. The obesity rate was found higher in males than females.

c. Ethiology

Changes in eating habits are related to changes in lifestyle, social environment and other social and societal factors (Yardımcı et al., 2016). Obesogenic environments defines as a environments faciliate abnormal weight gain. Unhealthy eating and a sedentary lifestyle, also known as obesogenic environments, are frequently cited in studies on childhood obesity. The impact of these factors is becoming increasingly pronounced as societies become more modernised (Yardımcı et al., 2016). Children are more likely to become obese if their mothers gain too much weight during pregnancy, smoke, or develop gestational diabetes. Obesity can be caused by epigenetic changes caused by toxins, medications, infections and exogenous hormones. A role is played by genetic factors in a person's predisposition to obesity (Baş & Aycan, 2020).

Childhood obesity can have a strong impact on adults, especially those with a family history of obesity (Shenoy & Nayak, 2023). It is well-documented that children of obese parents are at increased risk of obesity themselves. The risk of obesity in children is increased in cases where one parent is obese, with a risk of 30%. This risk is increased further, to 90%, in cases where both parents are obese (Brown et al., 2019). According to the results of a recent study, having both parents overweight/obese significantly increases the likelihood of children being overweight/obese (Fan & Zhang, 2022). Fetal programming during pregnancy and the effects of parents' early nutritional status on their children are important factors to consider. A recent longitudinal study has shown that mothers' early exposure to famine is associated with obesity in their children, suggesting a link between maternal nutrition during pregnancy and the child's future health. Childhood obesity is also influenced by psychological factors. Maintaining a healthy body weight may depend on changes in cortisol secretion caused by chronic stress. Parent-child relationships and family body image disturbances are known to contribute to the perpetuation of obesity in children (Tung et al., 2023).

Obesity can be developed by a number of environmental factors, including high glycemic index foods, sugar-containing beverages, cornstarch-based foods and beverages, large portions of prepared foods, fast food services, a decrease in the habit of eating meals with family, a decrease in physical activity, a reduction in sleep duration, and a lack of play areas. Watching TV is one of the biggest things that affects whether kids get fat. Research has also found a link between playing electronic games and obesity in childhood, although this link is weaker than the one between playing games and obesity caused by watching television. This is thought to be because electronic games do not contain food advertisements (Baş & Aycan, 2020). It is recommended by the American Academy of Pediatrics that meals be eaten at home with the television off and that no more than 2 hours per day be spent on television and video games (Krebs & Jacobson , 2023).

d. Effects on growth

Healthy eating, increasing physical activity levels, and regular sleep and bedtime routines are crucial for preventing childhood obesity and ensuring that children achieve ideal anthropometric measurements for their age (Baş & Aycan, 2020). Several studies have found that obesity causes an increase in health expenditures. Increasing the prevalence of childhood obesity will have a significant impact on future healthcare costs. A relationship that is the opposite of what would be expected appears to exist between obesity and healthcare costs, at least in the short term (Karamelikli & Gül,2022).Gaining weight quickly during the first few years of life can be a sign of two problems. It can lead to children being more likely to be very overweight later in life. It can also lead to girls starting their periods earlier than expected. A lower BMI standard deviation score in overweight children is linked to a later start to puberty in girls (Chung, 2017).

Many factors influence the timing and pace of pubertal development, including environmental conditions. Adequate nutrition is essential for normal pubertal development. Childhood obesity can lead to early signs of puberty in girls. It can also lead to delayed puberty in boys. Obesity in early childhood also appears to be linked to later puberty in girls. Age at menarche is negatively correlated with body mass index (Freedman et al., 2022). Individuals who become or remain obese during adolescence have been observed to have low self-image, high self-consciousness and impaired social functioning. Studies of adolescents with obesity have revealed an obsession with being overweight, as well as passivity and withdrawal from social contact (Decaluwe & Braet , 2003).

3. Sleep and childhood obesity

It is well-known that short sleep duration is associated with decreased leptin levels and increased ghrelin levels. These changes are linked to increased appetite, potentially leading to overeating and an elevated BMI. Litsfeldt et al. conducted in a study found that sleep duration of less than seven hours was found to be significantly linked to a higher risk of overweight/obesity, academic failure and a lower socioeconomic status (Litsfeldt et al., 2020).

Similarly, poor sleep quality was found to be a risk factor for obesity, with children experiencing 8.6 times more obesity than those who had good sleep quality (Elizabeth et al., 2021). A study conducted by Marfuah et al. (2013) revealed that primary school-aged children who do not get quality sleep are 2.23 times more likely to experience obesity than children who do get quality sleep. Similarly, Yildiz et al. (2024) conducted in a study found that adolescents diagnosed with obesity had significantly higher The Pittsburgh Sleep Quality Index scores than those of normal weight and overweight adolescents ($p<0.001$). An analysis of 11 studies by Chen et al. (2008) found that children with the shortest sleep duration were more likely to be obese than those with longer sleep duration (OR 1.92; 95% CI 1.15–3.20).

A study specifically examined sleep timing and obesity in early childhood. The study found that late bedtimes (after 9:00 PM) increased the association between short sleep duration and obesity (Miller et al.,2014). Studies involving children aged 8-17 found an association between going to bed late and obesity, independent of sleep duration (Golley et al., 2013). A study of 13-year-old children diagnosed with obesity (n = 26) found that going to bed late was associated with increased energy intake and more screen time (Adamo et al., 2013). In a study conducted by Seo and Shim (2019) aimed to determine the effect of changing sleep duration on obesity risk in adolescents, it was seen that individuals with short and very short sleep duration had a higher risk of being overweight, obese or having increased waist circumference compared to those who achieved optimum sleep.

Conclusion

Globally, one of the most significant public health challenges is the issue of childhood obesity. Numerous elements are responsible for the issue of childhood obesity. The effects of sleep restriction on children's body weight are examined in this review, based on recent studies. Poor sleep timing, late bedtimes or not getting as much sleep as needed may indicate a 'slipped' or 'delayed' sleep phase. A lack of sleep can have a detrimental effect on the general long-term health of everyone, but especially children. It is important for children to get an average of 10-11 hours of sleep per night, depending on their age, as this is key to helping them to rest and recover. Especially today, with so many people being addicted to screens, the time it takes to fall asleep is delayed or total sleep duration and quality is negatively affected. Animated media are increasingly designed to prompt children to go to bed or to support sleep initiation. In this context, families should adopt a more attentive approach to bedtime routines and take responsibility for monitoring both the duration and the quality of their children's sleep.

Conflict of Interest

There was no conflict of interest.

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Referee Evaluation

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Author Contributions

M.G.K.G.: Idea, Design, Literature Review, Article Writing, Critical Review

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