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The Relationship between Sleep Quality and Obesity in Elementary School Children

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Abstract

Objective: Obesity and sleep disorders are major health concerns in children, with long-term consequences for physical and mental health. Numerous studies have shown a correlation between poor sleep quality and obesity, highlighting the importance of a deeper investigation into this matter. This study aims to examine the association between sleep quality and obesity in elementary school children in Kerman in 2023.

Materials and Methods: This cross-sectional study was conducted on 384 children aged 7-13 years. Demographic data and sleep quality were gathered using the Pittsburgh Sleep Quality Index (PSQI). Weight status was assessed by appropriate anthropometric measurements. Data were analyzed with SPSS software version 29, using T-tests and ANOVA.

Results: Sleep quality in obese children was significantly lower than in children with normal or overweight status ($P< 0.001$). Additionally, sleep quality decreased with age ($P< 0.001$). Gender ($P= 0.222$), family income ($P= 0.625$), and chronic illness ($P= 0.664$) had no significant effect on sleep quality.

Conclusion: While obesity and age were significant indications of poor sleep quality, gender, income level, and health history were not. These results highlight the importance of obesity management and awareness among parents and educators regarding the importance of sleep quality in children's academic performance and mental health.

Keywords: Obesity, Sleep quality, Body mass index, Children, Sleep disorders

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Introduction

Obesity is a serious, chronic, and complex disease, defined by excessive fat accumulation due to an imbalance between caloric intake and energy expenditure, significantly affecting health and quality of life (1). Since direct fat measurement is not possible, body mass index (BMI) is typically used to classify weight categories (2); however, in this study, weight status was assessed with appropriate anthropometric measurements, considering the age range of the participants (3).

Childhood and adolescent obesity is one of the most important public health challenges worldwide, with increasing prevalence since 1975. More than 390 million children and adolescents aged 5-19 years were affected by obesity in 2023 (4). Although recent studies suggest a slower increase, low- and middle-income countries have been significantly impacted (5).

In the United States, obesity rates among children and adolescents have risen to over 22.4% from 2018 to 2024, with similar trends observed in Europe and Asian countries (6-10). In Iran, childhood obesity is a critical concern, especially in urban areas, with a reported prevalence of 23% (11,12).

Various factors contribute to the rise in obesity, including changes in lifestyle, increased consumption of processed foods, and decreased physical activity, particularly in the post-COVID era (13). Additionally, research indicates a bidirectional relationship between sleep and obesity. Poor sleep increases obesity risk through hormonal, biochemical, and physiological mechanisms influencing appetite and metabolism (14). Sleep regulates appetite-related hormones like leptin and ghrelin. Sleep deprivation decreases leptin levels, which reduces feelings of fullness and increases the desire to consume high-calorie, high-fat foods (15), and increases ghrelin levels, which leads to increased hunger (16). It also reduces energy expenditure and promotes unhealthy eating behaviors (15).

These hormonal changes caused by sleep deprivation directly contribute to overeating and weight gain (15). Moreover, sleep deprivation increases insulin resistance, reducing blood glucose absorption. This results in elevated blood glucose and insulin secretion levels (17). Over time, high insulin levels heighten the risk for central obesity and type 2 diabetes (18).

Additionally, insufficient sleep alters energy metabolism, encouraging fat and carbohydrate storage while lowering resting energy expenditure (19,20). Insufficient sleep activates the sympathetic nervous system, raising cortisol levels and abdominal fat accumulation, increasing appetite and a tendency to consume high-calorie foods. This enhanced sympathetic activity can create a vicious cycle where insufficient sleep leads to obesity, and obesity results in poor sleep quality (21,22).Insufficient sleep also promotes chronic inflammation via elevated cytokines such as TNF-α and IL-6, contributing to obesity-related conditions including type 2 diabetes, cardiovascular disease, and certain cancers, while impairing sleep quality (23,24).Overall, the association between obesity and poor sleep quality in children involves a complex interplay of hormonal disorders, energy imbalance, psychological factors, neurocognitive function, and circadian rhythm disturbances. Understanding this relationship is crucial for designing interventions to improve sleep quality, promote healthy lifestyles, and reduce obesity risk in children.

On the other hand, studies evaluating this association in the Iranian population are limited, and few have been conducted in Kerman. Therefore, this study investigates the association between sleep quality and obesity in elementary school children in Kerman.

Material and methods

The sampling method was cluster sampling. First, the total number of students in public

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and non-profit primary schools in District 1 and District 2 was obtained from the Education and Training Department, totaling 93,400 students; 43,353 in District 1 and 50,147 in District 2. The school names were acquired from the same department, and 4 schools were randomly selected from each district, including two girls' schools and two boys' schools. According to Morgan's formula, the sample size was calculated as 384 individuals. Given the balanced number of girls and boys, questionnaires were distributed equally according to district and gender.

The project researcher visited the schools in person using a simple random selection process (via random number generator software) to identify children to include in the study based on class lists. Questionnaires were completed by the students or, when necessary, parents were contacted to ensure accuracy.

Anthropometric measurements: Height and weight were measured using standardized procedures appropriate for the age group. Height was measured to the nearest 0.1 cm using a stadiometer, with the child standing barefoot and erect. Weight was measured to the nearest 0.1 kg using a calibrated digital scale, with minimal clothing. Weight status was assessed using WHO growth standards and percentile charts specific for children aged 7 to 13 years. Children were categorized as underweight, normal weight, overweight, or obese based on weight-for-age and height-for-age percentiles from these standardized reference charts. This approach aligns better with pediatric growth assessment practices and addresses concerns regarding limitations of BMI in this age group.

The data collection tool was the Pittsburgh Sleep Quality Index (PSQI), a standard and validated questionnaire with 19 items measuring multiple dimensions of sleep quality through 7 subscales. Each subscale measures a specific aspect of sleep quality: subjective sleep quality, sleep latency, sleep duration, sleep efficiency, sleep disturbances, use of sleeping medications, and daytime dysfunction. Each subscale is scored 0 to 3 indicating severity: 0= no problem, 1= moderate, 2= serious, 3= very serious problem. The questionnaire's internal consistency was reported with a Cronbach's alpha of 0.83 (25).

Collected data were analyzed using descriptive statistics, chi-square tests, and independent T-tests via SPSS version 29. Significance level was set at $P< 0.05$.

Ethical considerations

The study protocol was reviewed and approved by the Ethics Committee of Kerman University of Medical Sciences (Ethics Code:IR.KMU.AH.REC.1402.085).

Participation was voluntary, with oral informed consent obtained. Confidentiality was assured and questionnaires contained no personal identifiers. Data were used exclusively for scientific purposes and not shared outside the research team.

Results

A total of 384 children (54.95% boys and 45.05% girls) aged 7 to 13 years participated in this study. The demographic characteristics of the participants are summarized in Table 1.

Sleep quality was evaluated using the Pittsburgh Sleep Quality Index. Results showed that 47.66% of children reported no problems with subjective sleep quality, 51.04% experienced moderate problems, and 1.3% had very serious problems. Regarding sleep latency, 44.27% had no problems, 54.43% had moderate problems, 0.78% had serious problems, and 0.52% had very serious problems. For sleep duration, 38.8% reported no issues, 50.52% had moderate problems, and 10.68% experienced serious problems. Sleep efficiency was problem-free in 47.14%, moderately problematic in 51.56%, seriously problematic in 0.52%, and very seriously problematic in 0.78%. Sleep disturbances affected 48.96% moderately, 0.78% seriously, while 50.26% had no problems. None of the children reported problems related to use of sleeping pills.

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Table 1. Demographic characteristics of the study participants

Variable		N (%)	Mean (± SD)
Age (years)			9.32 (±1.39)
Gender; frequency (percentage)	Boy	211 (54.95%)	
	Girl	173 (45.05%)	
Number of children			1.63 (±0.65)
School type; frequency (percentage)	Government	289 (75.26%)	
	Non-government	95 (24.74%)	
Academic GPA* (out of 20 points)			14.91 (± 1.51)
Average monthly family income; frequency (percentage)	Less than 8 million	147 (38.28%)	
	Between 8 and 15 million	184 (47.92%)	
	Above 15 million	53 (13.8%)	
History of disease; frequency (percentage)	No Sleep	327 (85.16%)	
	Disorders	15 (3.91%)	
	Asthma	29 (7.55%)	
	Diabetes	5 (1.3%)	
	Hypertension	8 (2.08%)	
Weight status; frequency (percentage)	Underweight	63 (16.41%)	
	Normal	191 (49.74%)	
	Overweight	93 (24.22%)	
	Obese	37 (9.64%)	
Average hours of sleep per day (hours)			8.75 (±0.62)
Nighttime sleep duration (hours)			7.34 (±0.81)
Daytime sleep duration (hours)			1.41 (± 0.88)

SD: Standard Deviation, *GPA: Grade Point Average

Disturbances in daily functioning were absent in 50%, moderate in 48.7%, serious in 0.52%, and very serious in 0.78%. Overall, 94.79% had no diagnosed sleep disorders, while 5.21% did. The mean overall sleep quality score was 3.42 ± 1.72 (range 0-21) (Table 2).

Comparisons among weight groups revealed no significant difference in gender distribution (P= 0.061), though the proportion of girls was slightly higher in the obese group (59.46%). Over 70% of children in all groups attended public schools, consistent across weight categories (P= 0.853). Monthly family income did not significantly differ among groups (P= 0.835). History of illness was similar across weight groups (P= 0.848), but 13.51% of obese children had asthma history.

Analyses showed significant differences among weight groups for subjective sleep quality and sleep latency (P< 0.001). Notably, 13.51% of obese children reported very serious sleep problems. Sleep duration also differed significantly across groups (P= 0.005), with underweight and obese children more likely to report no sleep problems. Sleep efficiency, disturbances, and daytime dysfunction varied significantly between groups (P< 0.001), with 8.11% of obese children experiencing very serious problems. Sleep disorders differed among weight groups (P= 0.006), where 16.22% of obese children had such diagnoses (Table 3).

In this study, the comparison of qualitative variables between children with and without sleep disorders based on the total score of the Sleep Quality Questionnaire did not reveal any statistically significant differences.

Gender distribution showed no significant difference (P= 0.641), with 60% of the children with sleep disorders being boys and 40% girls, a pattern similarly observed among those without sleep disorders.

School type was also not significantly associated with sleep disorders (P= 0.614), as approximately 80% of children in both groups attended public schools. In terms of average monthly family income, there was no significant difference between the two groups (P= 0.469). 50% of the children with sleep disorders were from families with an income of less than 8 million Tomans, compared to 37.64% in the group without sleep disorders.

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Table 2. Sleep quality assessment of participating children based on the Pittsburgh sleep quality questionnaire and its subscales (N=384)

Variable		Frequency(Percentage)	Mean (±SD)
Subjective sleep quality	No problem	183 (47.66%)	
	Moderate problem	196 (51.04%)	
	Serious problem	3 (0.78%)	
	Very serious problem	2 (0.52%)	
Sleep latency	No problem	170 (44.27%)	
	Moderate problem	209 (54.43%)	
	Serious problem	3 (0.78%)	
	Very serious problem	2 (0.52%)	
Sleep duration	No problem	149 (38.8%)	
	Moderate problem	194 (50.52%)	
	Serious problem	41 (10.68%)	
Sleep efficiency	No problem	181 (47.14%)	
	Moderate problem	198 (51.56%)	
	Serious problem	2 (0.52%)	
	Very serious problem	3 (0.78%)	
Sleep disturbances	No problem	193 (50.26%)	
	Moderate problem	188 (48.96%)	
	Serious problem	3 (0.78%)	
Use of sleeping pills	No sleeping problems	384 (100%)	
Disturbance in daily functioning	No problem	192 (50%)	
	Moderate problem	187 (48.7%)	
	Serious problem	2 (0.52%)	
	Very serious problem	3 (0.78%)	
Sleep disorders diagnosis	No	364 (94.79%)	
	Yes	20 (5.21%)	
Overall sleep quality score (0-21)			3.42 (± 1.72)
Subjective sleep quality	No problem	183 (47.66%)	
	Moderate problem	196 (51.04%)	
	Very serious problem	5 (1.3%)	
Sleep latency	No problem	170 (44.27%)	
	Moderate problem	209 (54.43%)	
	Serious problem	3 (0.78%)	
	Very serious problem	2 (0.52%)	
Sleep duration	No problem	149 (38.8%)	
	Moderate problem	194 (50.52%)	
	Serious problem	41 (10.68%)	
Sleep efficiency	No problem	181 (47.14%)	
	Moderate problem	198 (51.56%)	
	Serious problem	2 (0.52%)	
	Very serious problem	3 (0.78%)	
Sleep disturbances	No problem	193 (50.26%)	
	Moderate problem	188 (48.96%)	
	Serious problem	3 (0.78%)	
Use of sleeping pills	No sleeping problems	384 (100%)	
Disturbance in daily functioning	No problem	192 (50%)	
	Moderate problem	187 (48.7%)	
	Serious problem	2 (0.52%)	
	Very serious problem	3 (0.78%)	
Sleep disorders diagnosis	No	364 (94.79%)	
	Yes	20 (5.21%)	
Overall sleep quality score (0-21)			3.42 (± 1.72)

Regarding medical history, no significant difference was observed (*P*= 0.664). Although a higher proportion of children with sleep disorders (15%) had a history of asthma, this was 7.14% among children without sleep disorders (Table 4).

The comparison of the mean total sleep quality score according to children's qualitative characteristics showed that most variables were not significantly related to sleep quality, with the exception of weight status.

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Table 3. Comparison of the frequency of qualitative study variables among children according to their weight status

Variable		Weight Status				*P*-value
		Underweight (N, %) Below the 5th percentile	Normal Weight (N, %) Between the 5th and 85th percentiles	Overweight (N, %) Between the 85th and 95th percentiles	Obese (N, %) Above the 95th percentile	
Gender	Male	31 (49.21%)	105 (54.97%)	60 (64.52%)	15 (40.54%)	0.061
	Female	32 (50.79%)	86 (45.03%)	33 (35.48%)	22 (59.46%)	
Type of school	Public	49 (71.15%)	143 (74.87%)	71 (76.34%)	26 (70.27%)	0.853
	Private	14 (26.41%)	48 (25.13%)	22 (23.66%)	11 (29.73%)	
Monthly family Income	< 15 million tomans	37 (42.86%)	74 (38.74%)	36 (34.41%)	23 (37.84%)	0.135
	> 15 million tomans	15 (9.52%)	40 (15.71%)	20 (12.9%)	35 (13.51%)	
History of illness	None	55 (87.3%)	163 (85.34%)	80 (86.02%)	29 (78.38%)	0.848
	Sleep disorders	3 (4.76%)	5 (2.62%)	5 (5.38%)	2 (5.41%)	
	Asthma	4 (6.35%)	15 (7.85%)	5 (5.38%)	5 (13.51%)	
	Diabetes	0 (0%)	3 (1.57%)	2 (2.15%)	0 (0%)	
	Hypertension	1 (1.59%)	5 (2.62%)	1 (1.08%)	1 (2.7%)	
Subjective sleep quality	No Problems	37 (58.73%)	84 (43.98%)	45 (48.39%)	17 (45.95%)	< 0.001
	Problems	26 (41.27%)	107 (56.02%)	48 (51.61%)	20 (40.54%)	
Sleep latency	No problem	34 (53.97%)	79 (41.36%)	40 (43.01%)	17 (45.95%)	< 0.001
	Problem	29 (46.03%)	112 (58.64%)	53 (56.99%)	20 (40.54%)	
Sleep duration	No problem	30 (41.66%)	61 (27.85%)	42 (45.16%)	16 (43.24%)	0.005
	Problem	42 (58.33%)	158 (72.14%)	55 (50.54%)	21 (56.76%)	
Sleep efficiency	No problem	27 (42.86%)	92 (48.17%)	47 (50.54%)	15 (40.54%)	< 0.001
	Problem	36 (57.14%)	99 (51.83%)	46 (49.46%)	22 (59.45%)	
Sleep disturbances	No problem	26 (41.27%)	100 (52.36%)	54 (58.06%)	13 (35.14%)	< 0.001
	Problem	37 (58.73%)	91 (47.64%)	39 (41.94%)	24 (64.86%)	
Daytime functioning disorders	No problem	32 (50.79%)	94 (49.21%)	48 (51.61%)	18 (48.65%)	< 0.001
	Problem	31 (49.21%)	97 (50.79%)	45 (48.39%)	19 (37.84%)	
Sleep disorders	No	62 (98.41%)	180 (94.24%)	91 (97.85%)	31 (83.78%)	0.006
	Yes	1 (1.59%)	11 (5.76%)	2 (2.15%)	6 (16.22%)	

Table 4. Comparison of the frequency of qualitative study variables among children participating in the current study according to their sleep disorders based on the total score of the sleep quality questionnaire

Variable		Sleep disorder		*P*-value
		No n (%)	Yes n (%)	
Gender	Male	199 (54.67%)	12 (60%)	0.641
	Female	165 (45.33%)	8 (40%)	
Type of school	Public	273 (75%)	16 (80%)	0.614
	Private (Nonprofit)	91 (25%)	4 (20%)	
Monthly family income	< 8 million tomans	237 (65.10%)	12 (60%)	.0.121
	> 15 million tomans	127 (34.89%)	8 (40%)	
History of illness	None	311 (85.44%)	16 (80%)	0.664
	Sleep disorders	14 (3.85%)	1 (5%)	
	Asthma	26 (7.14%)	3 (15%)	
	Diabetes	5 (1.37%)	0 (0%)	
	Hypertension	8 (2.2%)	0 (0%)	

No significant differences in sleep quality were found by gender (*P*= 0.222), as boys and girls had similar average sleep quality scores. Likewise, there were no significant differences in school type (*P*= 0.416), with children in public and non-profit schools having comparable sleep quality.

Family income also showed no significant association with sleep quality (*P*= 0.625), and children from families across all income levels had similar sleep quality scores.

In terms of medical history, although children with sleep disorders and asthma had higher mean sleep quality scores (indicating poorer sleep quality), this difference was not statistically significant (*P*= 0.359).

However, weight status was significantly associated with sleep quality (*P*= 0.001). Post hoc analysis revealed that obese children had

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significantly poorer sleep quality compared to children with normal weight (*P*= 0.004), overweight (*P*< 0.001), and underweight (*P*= 0.004). No significant differences were observed between underweight and normal weight (*P*= 0.649), underweight and overweight (*P*= 0.975), or normal weight and overweight groups (*P*= 0.238) (Table 5).

Regarding quantitative variables, a weak but significant positive correlation was observed between age and total sleep quality score (r= 0.209, *P*< 0.001), indicating that sleep quality slightly declines as age increases.

A weak but significant positive correlation was also observed between grade point average (GPA) and sleep quality score (r= 0.104, *P*= 0.041), suggesting slightly poorer sleep quality in children with higher academic achievement.

No significant correlation was found between child's birth order and sleep quality (r= 0.03, *P*= 0.57).

Body Mass Index (BMI) had a significant negative correlation with sleep quality (r= -0.209, *P*< 0.001), meaning higher BMI was associated with poorer sleep quality.

Average daily sleep duration showed a similar negative and significant correlation with sleep quality (r= -0.214, *P*< 0.001), indicating that longer sleep duration was associated with better sleep quality.

However, nighttime sleep duration (r= -0.06, *P*= 0.24) and daytime sleep duration (r= -0.1, *P*= 0.062) did not significantly correlate with sleep quality, although daytime sleep showed a weak trend toward improving sleep quality (Table 6)

Discussion

This study investigated associations between sleep quality and obesity in elementary children in Kerman. Obese children had higher scores on the Pittsburgh Sleep Quality Index, indicating poorer sleep quality. This finding is consistent with Jiang et al. study in 2009 which reported a significant relationship between obesity and poor sleep quality in preschool children. They suggested that increased fat in the neck and abdomen may obstruct airways and cause frequent pauses in breathing during sleep (sleep apnea), which significantly lowers sleep quality (26).

Similarly, Gonzaga et al. in 2016 found that overweight and obese children and adolescents had poorer sleep quality. They concluded that obesity disrupts sleep structure and reduces sleep depth and quality, attributing these effects to metabolic changes such as increased insulin resistance and hormonal imbalances. This leads to frequent awakenings and decreased restfulness and energy restoration (27). Furthermore, Blinder et al. (2023) also found a link between obesity and respiratory disorders. According to their findings, obese children are at increased risk of obstructive sleep apnea due to higher respiratory load and airway narrowing. This condition causes frequent nighttime awakenings and prevents children from reaching deep sleep stages, reducing overall sleep quality. It also leads to daytime fatigue, decreased concentration, and increased irritability, negatively affecting academic performance and mental health (28). The consistency between our results and the existing literature strongly suggests a detrimental impact of excess weight on the physiological mechanisms that regulate children's sleep.

Moreover, this study also found an association between sleep quality and age. Specifically, older children had higher scores on the sleep quality questionnaire, indicating poorer sleep. This finding aligns with previous studies suggesting that developmental changes and increased academic and social responsibilities negatively affect sleep quality as children grow older. For instance, Fatima et al. (2016), in a meta-analysis, confirmed that sleep quality declines with age among children and adolescents. They attributed this to shifts in circadian rhythms and increasing demands related to academics and social life. As children age, their circadian clock tends to shift toward later sleep times, which may reduce sleep duration and quality (29).

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Table 5. Comparison of the mean total score of the sleep quality questionnaire among children according to demographic characteristics

Variable		Total score of the sleep quality Mean (± SD)	*P*-value
Gender	Male	3.32 (± 1.46)	0.222
	Female	3.54 (± 1.99)	
Type of school	Public	3.46 (± 1.75)	0.416
	Private (Nonprofit)	3.29 (± 1.62)	
Monthly family income	< 8 million tomans	3.52 (± 1.96)	0.625
	8 to 15 million tomans	3.37 (± 1.6)	
	> 15 million tomans	3.3 (± 1.39)	
History of illness	None	3.36 (± 1.56)	0.359
	Sleep disorders	3.6 (± 2.8)	
	Asthma	3.97 (± 2.65)	
	Diabetes	3 (± 1.41)	
	Hypertension	3.88 (± 1.13)	
Weight status	Underweight	3.19 (± 1.29)	0.001
	Normal	3.48 (± 1.38)	
	Overweight	3.08 (± 1.28)	
	Obese	4.38 (± 3.6)	

Table 6. Correlation assessment between overall sleep quality score and quantitative study variables

Variables	Overall sleep quality score	
	Pearson correlation coefficient (r)	***P*-value**
Age	0.209**	< 0.001
GPA	0.104*	0.041
Child rank	0.03	0.57
Body mass index	-0.209**	< 0.001
Average sleep duration in 24 hours	-0.214**	< 0.001
Night sleep duration	-0.06	0.24
Daytime sleep duration	-0.1	0.062

* *P*< 0.05, ** *P*< 0.01, *GPA: Grade Point Average

Similarly, Elizabeth et al. (2021) reported that lifestyle changes and growing academic pressure in older children adversely impact sleep. Their results showed that increased academic workload and screen time in older children contribute to poorer sleep, as these factors are linked to shorter sleep duration and greater nighttime irritability (30). Additionally, the findings of this study are consistent with research by Mindell and Owens (2015), who examined sleep quality in children and adolescents. They found that aging, particularly during adolescence, involves significant changes in sleep patterns, which often result in reduced sleep quality and more frequent nighttime awakenings (31). These changes may stem from physiological changes during puberty, hormonal fluctuations, and increasing social and academic pressures, all of which place stress on the nervous system and affect sleep (31,32).

Regarding other demographic factors, this study found no significant difference in sleep quality among children from different income groups. Children from families with various income levels exhibited relatively similar sleep quality. This suggests that economic status alone may not be a direct determinant of children's sleep quality. The findings are consistent with those of Taheri et al. (2015), who concluded that economic factors do not significantly impact sleep quality. Instead, factors like overall health, lifestyle, and home sleep routines may play a more substantial role (33). Likewise, Anam et al. (2022), in a study in Bangladesh, also found that in a society with significant income disparities, family income did not directly influence children's sleep quality. Instead, the sleep environment, parental presence, and consistent bedtime routines had more influence. They emphasized that having a supportive home environment can be more beneficial than income alone (34).

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Elizabeth et al. (2021) also found that psychological and social support within the family contributes positively to sleep quality, even when economic conditions are unfavorable (30).

This study also found no significant gender differences in sleep quality. The overall sleep quality scores were nearly identical between boys and girls. This aligns with previous studies suggesting that gender alone does not significantly influence sleep quality in children. Baran et al. (2018) examined gender differences in sleep among obese children and found no statistically significant disparities, suggesting that factors such as BMI and lifestyle may play more important roles (35).

Similarly, Jiang et al. (2009) concluded that gender does not have a major influence on children's sleep quality. Observed differences were often minimal and likely due to individual or cultural factors rather than inherent gender traits (26). A study by Khazaei et al. (2017) on Iranian children also reported comparable sleep quality between boys and girls, with any variations more related to family and demographic factors (36). These findings suggest that gender alone is not a major determinant of sleep quality in children. Instead, elements such as lifestyle, sleep environment, and both physical and mental health indicators may have a greater impact. This highlights the need for lifestyle-based interventions and supportive environments at home and school to improve sleep for all children, regardless of gender.

Finally, our study observed no significant differences in sleep quality based on medical conditions. Children with and without conditions such as sleep disorders, asthma, diabetes, and hypertension had similar sleep quality. This indicates that having a medical condition does not necessarily affect sleep quality in this age group. These results are in agreement with previous studies suggesting that lifestyle and weight status may play a more prominent role in shaping sleep quality. Duraccio et al. in 2022 found that children with chronic illnesses like asthma or diabetes, though at risk of sleep disorders, often experience sleep quality influenced more by environmental and lifestyle factors (37). Taheri et al. (2015) also found no significant difference in sleep quality among children with chronic illnesses, emphasizing that well-managed physical conditions do not necessarily impair sleep quality. Instead, psychological state and sleep environment are more crucial (33).

In addition, Anam et al. (2022) likewise concluded that medical history alone does not determine sleep quality. Instead, family support, psychological well-being, and structured sleep habits have a greater influence (34). These findings suggest that proper illness management, a supportive environment, and psychological care can help maintain good sleep quality in children with chronic conditions.

Overall, the findings from our study and previous ones emphasize the detrimental impact of obesity on children's sleep quality and the decline in sleep quality with increasing age.

These results underscore the importance of early interventions for weight management, which can not only help control obesity but also improve sleep quality. Furthermore, the association between age and sleep quality highlights the need to regulate sleep patterns in older children as they face increasing academic and social demands. Based on the findings, early interventions targeting obesity prevention and healthy lifestyle promotion can help improve sleep quality in children.

Educating parents and teachers about the importance of adequate sleep, encouraging regular sleep routines, and reducing screen use before bedtime may serve as practical strategies. Weight management programs and health education in schools could further support children's physical and mental well-being.

This study had several main limitations that may affect the interpretation of the results. First, the study was conducted cross-sectionally; therefore, it was not possible to

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examine causality more precisely between sleep quality and various factors such as obesity and age. It is suggested that future studies be conducted longitudinally to clarify the causal relationships between these variables.

A second limitation is the reliance on the Pittsburgh Sleep Quality Questionnaire, which is more concerned with assessing subjective sleep quality and may not reveal more precise dimensions of physiological sleep quality. The use of more advanced tools such as polysomnography could provide a more accurate understanding of children's sleep patterns. In addition, environmental and cultural factors that influence children's sleep may not have been fully controlled for in this study; therefore, extending this research to different populations with different cultures could help to better compare and understand the findings.

Conclusion

This study showed associations between sleep quality and certain demographic and health factors among elementary school children. The results indicate that obese children have poorer sleep quality than their normal weight peers. Additionally, sleep quality in older children was lower compared to younger ones, which may be due to developmental changes and increased academic and social pressures. However, the effect of factors such as gender, family income status, and medical history on sleep quality in this study was not significant, indicating that environmental and lifestyle factors may play a more important role. The findings of this study emphasize the importance of weight management and attention to sleep patterns in children, and indicate that raising awareness among parents, teachers, and educators in this area can help improve sleep quality and children's health.

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Conflict of Interest

The authors report there are no competing interests to declare.

Authors' contributions

Conceptualization and study design: FJ and MY. Data analysis: FR. Data collection: RMJ. Manuscript writing: LSH. All the authors critically revised the manuscript, agree to be fully accountable for the integrity and accuracy of the study, and read and approved the final manuscript.

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