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Comparison Study of Sleep Patterns in Urban and Rural School Going Children (5-18 Years)

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Abstract

Background and Objectives: Sleep is a fundamental physiological process essential for physical growth, cognitive development, emotional regulation and overall health in children and adolescents. Inadequate sleep has been linked to impaired academic performance, behavioral difficulties and mental health challenges. This study aimed to systematically examine sleep patterns, sleep duration, sleep quality, chronotype distribution and associated factors among urban and rural school-going children aged 5-18 years in Jaipur, India.

Methodology: A cross-sectional observational study was conducted from April 2024 to September 2025. A total of 290 students (145 urban and 145 rural) aged 5-18 years were recruited from one urban and one rural school. Data were collected using a structured questionnaire and the Sleep Hygiene Index (SHI). Exclusion criteria included students with chronic illnesses affecting sleep. Statistical analysis was performed using SPSS v28, employing descriptive statistics, Chi-square tests and independent t-tests with significance set at $p < 0.05$.

Results: The study included 290 school-going children aged 5-18 years, equally split between urban (n=145) and rural (n=145) groups with 53.1% females (urban 49.7%, rural 56.6%) and 46.9% males. Most participants were 11-14 years (30.7%), followed by 8-11 years (29.3%), 5-8 years (26.5%) and 14-18 years (13.5%) with mean ages of 11.81 ± 4.11 years (urban) and 11.50 ± 3.82 years (rural). Urban students slept 7.15 hours on weekdays and 9.2 hours on weekends, while rural students slept 6.34 hours on weekdays and 6.64 hours on weekends. Chronotype analysis showed 59% of rural students were morning types versus 21% urban and 44% of urban students were evening types versus 14% rural. Screen exposure was higher among urban adolescents (mobile phones 70% vs. 51.6% rural; television 95% vs. 76% rural) and Sleep Hygiene Index scores indicated poorer sleep habits in urban students. Urban adolescents also exhibited higher prevalence of sleep disturbances, daytime sleepiness and bedtime resistance, whereas rural students had longer, more consistent sleep duration and better overall sleep hygiene, indicating greater vulnerability of urban children to inadequate sleep and associated behavioral and cognitive effects.

Conclusion: Sleep disturbances are prevalent among school-going children with urban adolescents demonstrating greater risks due to environmental, lifestyle and behavioral factors. Targeted interventions including parental guidance, school-based education on sleep hygiene, regulated screen time and consideration of school start times are recommended to optimize pediatric sleep health. Understanding

these patterns is crucial for promoting academic performance, mental well-being and overall quality of life among children in diverse settings.

Keywords: Pediatric sleep, Urban-rural disparities, Sleep hygiene, Chronotype, School-going children, Sleep duration, Sleep quality.

1. Introduction

Sleep is a fundamental physiological process essential for physical growth, cognitive development, emotional regulation and overall health in children and adolescents. Proper sleep supports attention, memory, learning, behavior and emotional well-being, while inadequate sleep is linked to both mental and physical health problems. The American Academy of Sleep Medicine recommends that children aged 6-12 years obtain 9-12 hours of sleep per 24 hours and teenagers aged 13-18 years get 8-10 hours to ensure optimal development and functioning.[1,2] Despite these recommendations, sleep insufficiency has become a widespread public health concern. Approximately 30% of toddlers, preschoolers and school-age children and the majority of adolescents, experience inadequate sleep.[3,4] Poor sleep quality, shorter total sleep duration and excessive daytime sleepiness adversely affect academic performance, social competence, behavior and cognitive processing and are associated with increased risks of anxiety, depression and stress in adolescents.[5,6]

Significant disparities exist in sleep patterns between children living in urban and rural areas. Rural adolescents generally report longer nocturnal sleep and higher health-related quality of life, though the prevalence of sleep deprivation may be similar across environments with different contributing factors.[7,8] Urbanization, environmental exposures such as noise, artificial lighting, air pollution and socioeconomic disadvantages have been shown to reduce sleep duration and quality in children.[9-12] Chronotype distribution also differs between settings with rural students more likely to have morning preferences, while urban adolescents exhibit greater eveningness, higher fatigue, increased daytime sleepiness and overall poorer sleep quality.[10] Screen-based electronic devices have emerged as a contemporary threat to pediatric sleep, particularly among urban children, contributing to delayed sleep onset, shorter duration, decreased sleep efficiency and increased mental health challenges.[6,13-15] Early school start times further exacerbate chronic sleep deprivation due to misalignment with adolescent circadian rhythms, impacting academic outcomes, emotional regulation and overall well-being.[16]

Given the critical role of sleep in physical, cognitive and emotional development and the emerging evidence of urban-rural disparities in sleep health, this study seeks to comprehensively investigate sleep patterns, sleep quality, chronotype distribution and associated lifestyle and environmental factors in Indian school-going children aged 5-18 years. Findings from this study will inform evidence-based recommendations for school schedules, public health policies, parental guidance and targeted interventions to promote optimal sleep, well-being and academic performance in this population.

2. Methodology

A cross-sectional observational design was adopted to assess sleep patterns, sleep hygiene and associated behavioral and environmental factors among school-going children and adolescents aged 5-18 years. The study aimed to compare differences between urban and rural populations to identify potential disparities in sleep duration, quality, chronotype distribution and lifestyle-related influences. The study

was conducted in Jaipur, India, selecting one urban school and one rural school. A total of 290 students participated, evenly divided between urban (n=145) and rural (n=145) groups. Participants were school-going children aged 5-18 years, representing a wide developmental range to capture age-related variations in sleep patterns. Participants included students aged 5-18 years who provided informed consent to participate in the study. Students with chronic illnesses, neurological or psychiatric disorders, or any condition known to influence sleep, such as asthma, ADHD, depression, or recurrent sinusitis, were excluded to ensure that sleep assessments reflected typical patterns rather than pathology-related disturbances.

Sampling and Recruitment

Purposive sampling was employed to recruit participants from the two selected schools. Prior administrative approval was obtained from school authorities. Eligible students were informed about the study's objectives and significance in an age-appropriate manner and verbal consent was obtained. Parents were also briefed about the study to ensure transparency and cooperation.

Data Collection Tools and Procedure

Data were collected using a structured questionnaire designed to capture demographic information, habitual sleep patterns, pre-sleep behaviors and lifestyle factors influencing sleep. The Sleep Hygiene Index (SHI) was administered to evaluate sleep hygiene practices with items scored on a five-point Likert scale ranging from "strongly agree" to "strongly disagree." Each item and SHI component were carefully explained to participants and any questions or doubts were clarified to ensure accurate, independent responses. Data collection was conducted between April 2024 and September 2025, under the supervision of trained researchers.

Statistical Analysis

Data analysis was performed using SPSS version 28. Descriptive statistics summarized demographic characteristics, sleep patterns and SHI scores. Continuous variables were expressed as mean ± standard deviation, while categorical variables were presented as frequencies and percentages. Inferential analyses included Chi-square tests for categorical comparisons and independent t-tests for continuous variable comparisons between urban and rural groups. A p-value < 0.05 was considered statistically significant. This methodology provided a structured and rigorous approach to evaluate sleep behaviors and associated factors, allowing reliable comparison between urban and rural school-going children.

3. Results

A total of 290 students were included in the analysis, comprising 145 urban and 145 rural school-going children aged 5-18 years. The two groups were comparable in terms of age and gender distribution, enabling valid comparison of sleep patterns, sleep hygiene and associated factors between urban and rural settings.

Table 1: Age and Gender-wise distribution among the study subjects

Gender	Urban (n=145)		Rural (n=145)		Total (n=290)		p-value
	No.	%	No.	%	No.	%	
Gender							

Female	72	49.7%	82	56.6%	154	53.1%	0.239
Male	73	50.3%	63	43.4%	136	46.9%	
Age Group							
5-<8	39	26.90%	38	26.21%	77	26.55%	0.136
8-<11	37	25.52%	48	33.10%	85	29.315	
11-<14	47	32.41%	42	28.97%	89	30.69%	
14-18	22	15.17%	17	11.72%	39	13.45%	

The gender distribution showed a slight female predominance overall. In the urban group, males and females were almost equally represented with 50.3% males and 49.7% females, while the rural group had more females (56.6%) than males (43.4%). Overall, females constituted 53.1% and males 46.9% of the total study population. However, the difference in gender distribution between urban and rural groups was not statistically significant (p=0.239), indicating comparable gender composition. The study included 290 participants, equally distributed between urban (145) and rural (145) groups. Most participants belonged to the 11-<14 years age group, accounting for 30.69% of the total population, followed by 8-<11 years, 5-<8 years and 14-18 years. The mean age was comparable between urban and rural groups (11.81±4.11 years vs. 11.50±3.82 years). Statistical analysis showed no significant difference in age distribution (p=0.239), indicating that both groups were comparable in age structure.

Table 2: Sleep Patterns among the study subjects

Sleep Patterns		**Urban (n=145)**		**Rural (n=145)**		**Total (n=290)**		**p-value**
		No.	**%**	**No.**	**%**	**No.**	**%**	
Sleep time	Before 10 pm	16	11.0%	50	34.5%	66	22.8%	0.001*
	10-12 pm	108	74.5%	95	65.5%	203	70.0%	
	After 12 pm	21	14.5%	0	0.0%	21	7.2%	
Wake time	Before 6 am	13	9.0%	42	29.0%	55	19.0%	0.001*
	6-8 am	96	66.2%	87	60.0%	183	63.1%	
	After 8 am	36	24.8%	16	11.0%	52	17.9%	
Sleep latency in min.	<15 min	32	22.1%	35	24.1%	67	23.1%	0.558
	15-30 min	50	34.5%	56	38.6%	106	36.6%	
	>30 min	63	43.4%	54	37.2%	117	40.3%	
Sleep changed post COVID	Improved	72	49.7%	55	37.9%	127	43.8%	0.112
	Same	30	20.7%	41	28.3%	71	24.5%	
	Worse	43	29.7%	49	33.8%	92	31.7%	

* Significant (p<0.05)

Rural children tended to sleep earlier with 34.5% going to bed before 10 pm, compared to 11.0% of urban children, while 74.5% of urban children slept between 10-12 pm and 14.5% after 12 am (p=0.001). Early waking before 6 am was more common in rural children (29.0% vs. 9.0%) and waking after 8 am was higher in urban children (24.8% vs. 11.0%) (p=0.001). Sleep latency and post-COVID changes showed no significant differences. Overall, rural children followed earlier sleep-wake cycles, whereas urban children exhibited delayed patterns likely influenced by lifestyle and environment.

Table 3: Co-morbidities observed in study subjects

Co-morbidities	Urban (n=145)		Rural (n=145)		Total (n=290)		p-value
	No.	%	No.	%	No.	%	
Day time sleep	43	29.7%	59	40.7%	102	35.2%	0.049*
Drowsy in class	38	26.2%	29	20.0%	67	23.1%	0.210
Snoring	16	11.0%	15	10.3%	31	10.7%	0.849
Bed Wetting at 6 months	7	4.8%	13	9.0%	20	6.9%	0.164
Abnormal sleep activity	9	6.2%	16	11.0%	25	8.6%	0.143
Bronchial asthma	27	18.6%	30	20.7%	57	19.7%	0.658
Mouth breathing	55	37.9%	54	37.2%	109	37.6%	0.904
H/o abnormal body movement	19	13.1%	18	12.4%	37	12.8%	0.860
Nasal problem	18	12.4%	33	22.8%	51	17.6%	0.021*

* Significant ($p<0.05$)

The distribution of sleep-related co-morbidities showed that daytime sleepiness was higher among rural children (40.7%) than urban children (29.7%) ($p=0.049$) and nasal problems were also more prevalent in rural children (22.8% vs. 12.4%; $p=0.021$). Other co-morbidities, including drowsiness in class, snoring, bedwetting, abnormal sleep activity, bronchial asthma, mouth breathing and history of abnormal body movements, were observed in both groups but did not differ significantly ($p>0.05$). Mouth breathing was common in both groups (urban: 37.9%, rural: 37.2%), while snoring and abnormal sleep activities were less frequent. Overall, certain sleep issues like daytime sleepiness and nasal problems were more common in rural children, whereas most other co-morbidities were similarly distributed across urban and rural populations.

Table 4: Presence of Parasomnias among the study subjects

Presence of Parasomnias	Urban (n=145)		Rural (n=145)		Total (n=290)		p-value
	No.	%	No.	%	No.	%	
Sleep Talking	39	26.9%	38	26.2%	77	26.6%	0.894
Teeth Grinding	28	19.3%	47	32.4%	75	25.9%	0.011*
Sleep Walking	4	2.8%	3	2.1%	7	2.4%	0.702
Night Terrors	8	5.5%	12	8.3%	20	6.9%	0.354
Night Mares	27	18.6%	30	20.7%	57	19.7%	0.658

* Significant ($p<0.05$)

The distribution of parasomnias showed that sleep talking affected 26.9% of urban and 26.2% of rural children (total 26.6%; $p=0.894$) and sleep walking was rare (urban 2.8%, rural 2.1%; $p=0.702$). Night terrors were reported in 5.5% of urban and 8.3% of rural children (total 6.9%; $p=0.354$), while nightmares occurred in 18.6% of urban and 20.7% of rural children (total 19.7%; $p=0.658$) with no significant differences. Teeth grinding was significantly more prevalent in rural children (32.4%) compared to urban children (19.3%; total 25.9%; $p=0.011$). Overall, except for teeth grinding, parasomnias were similarly distributed between urban and rural children.

Table 5: Screen and Digital Exposure among the study subjects

Screen and Digital Exposure	Urban (n=145)		Rural (n=145)		Total (n=290)		p-value
	No.	%	No.	%	No.	%	
Watch TV at night	73	50.3%	36	24.8%	109	37.6%	0.001*
View mobile phone in late night hours	87	60.0%	47	32.4%	134	46.2%	0.001*
Use in tablet or laptop in night	42	29.0%	28	19.3%	70	24.1%	0.045*
Play videogames at night	102	70.3%	37	25.5%	139	47.9%	0.001*
Reading novels in night	110	75.9%	36	24.8%	146	50.3%	0.001*
Use internet or social media	65	44.8%	90	62.1%	155	53.4%	0.003*
TV in room	88	60.7%	37	25.5%	125	43.1%	0.001*

* Significant (p<0.05)

The study showed significant differences in screen and digital exposure between urban and rural children. Watching TV at night was reported by 50.3% of urban children versus 24.8% of rural children (total 37.6%; p=0.001) and late-night mobile phone use was higher in urban children (60.0% vs. 32.4%; total 46.2%; p=0.001). Tablet or laptop use at night occurred in 29.0% of urban versus 19.3% of rural children (total 24.1%; p=0.045), while video game play was markedly higher in urban children (70.3% vs. 25.5%; total 47.9%; p=0.001). Reading novels at night was also more common in urban children (75.9% vs. 24.8%; total 50.3%; p=0.001). In contrast, internet or social media use was higher in rural children (62.1% vs. 44.8%; total 53.4%; p=0.003). Having a TV in the room was reported by 60.7% of urban children versus 25.5% of rural children (total 43.1%; p=0.001). Overall, urban children had significantly higher exposure to electronic media and digital devices, except for internet/social media usage, which was more prevalent in rural children.

Table 6: Duration of Sleep among the study subjects (n=145)

Duration of Sleep (hrs)	Urban Mean±SD	Rural Mean±SD	p-value
Day time sleep time (hrs)	0.417±0.738	0.528±0.798	0.223
Required Sleep (hrs)	8.531±0.501	8.834±0.372	0.001*
Sleep Debt (hrs)	1.269±0.615	1.062±0.661	0.006*
Total sleep time (hrs)	7.262±0.996	7.838±0.591	0.001*
Total Sleep Hygiene Index	41.04±5.316	20.46±5.863	0.001*
Sleep hygiene category			
Good	7 (4.8%)	29 (20.0%)	0.001*
Average	7 (4.8%)	116 (80.0%)	
Poor	131 (90.3%)	0 (0.0%)	

* Significant (p<0.05)

Comparison of sleep duration showed that rural children had slightly higher mean daytime sleep (0.528±0.798 hours) than urban children (0.417±0.738 hours; p=0.223), though not significant. Required sleep duration was higher in rural children (8.834±0.372 hours) compared to urban children (8.531±0.501 hours; p=0.001). Urban children had greater sleep debt (1.269±0.615 hours vs.

1.062±0.661 hours; p=0.006) and lower total sleep time (7.262±0.996 hours vs. 7.838±0.591 hours; p=0.001), indicating higher sleep deprivation. Sleep hygiene assessment revealed markedly poorer practices in urban children with mean SHI scores of 41.04±5.316 versus 20.46±5.863 in rural children (t=31.311; p=0.001). In terms of categories, 90.3% of urban children had poor sleep hygiene compared to none in the rural group, where 80.0% had average and 20.0% had good hygiene (χ^2=241.038; p=0.001). Overall, rural children had better sleep duration, lower sleep debt and healthier sleep hygiene, whereas urban children were more affected by reduced total sleep and poor sleep practices.

Table 7: Lifestyle and Habits affecting sleep pattern of study subjects

Lifestyle and Habits	Urban (n=145)		Rural (n=145)		Total (n=290)		p-value
	No.	%	No.	%	No.	%	
Tea before sleep	28	19.3%	40	27.6%	68	23.4%	0.096
Coffee before sleep	18	12.4%	9	6.2%	27	9.3%	0.069
Beverage 2h before	39	26.9%	41	28.3%	80	27.6%	0.793
Midnight snack	21	14.5%	4	2.8%	29	10.0%	0.027*
Drug use 1 week	18	12.4%	7	4.8%	25	8.6%	0.012*
Play sports in evening	126	86.9%	128	88.3%	254	87.6%	0.722

* Significant (p<0.05)

The analysis of lifestyle habits showed that midnight snacking and drug use were significantly more prevalent among urban children (14.5% vs. 2.8%; p=0.027 and 12.4% vs. 4.8%; p=0.012, respectively), while other habits were comparable. Tea consumption before sleep was higher in rural children (27.6% vs. 19.3%; p=0.096), coffee intake (12.4% urban vs. 6.2% rural; p=0.069) and beverage consumption within 2 hours of sleep (26.9% urban vs. 28.3% rural; p=0.793) showed no significant differences. Playing sports in the evening was common in both groups (urban 86.9%, rural 88.3%; p=0.722). Overall, urban children exhibited higher prevalence of certain unhealthy habits, whereas most other lifestyle behaviors were similar between groups.

Table 8: Family and Environment among the study subjects

Family and Environment		Urban (n=145)		Rural (n=145)		Total (n=290)		p-value
		No.	%	No.	%	No.	%	
Room Hygiene	Good	67	46.2%	32	22.1%	99	34.1%	<0.001*
	Average	49	33.8%	63	43.4%	112	38.6%	
	Poor	29	20.0%	50	34.5%	79	27.2%	
Room share with family members	1 member	72	49.7%	36	24.8%	108	37.2%	<0.001*
	2 members	60	41.4%	30	20.7%	90	31.0%	
	3 members	7	4.8%	38	26.2%	45	15.5%	
	4 members	6	4.1%	41	28.3%	47	16.2%	
No. of Family Members	3 members	30	20.7%	17	11.7%	47	16.2%	<0.001*
	4 members	32	22.1%	15	10.3%	47	16.2%	
	5 members	28	19.3%	21	14.5%	49	16.9%	

	6 members	23	15.9%	25	17.2%	48	16.6%	
	7 members	16	11.0%	24	16.6%	40	13.8%	
	8 members	15	10.3%	43	29.7%	58	20.0%	
	10 members	1	0.7%	0	0.0%	1	0.3%	
Bedrooms	1	39	26.9%	44	30.3%	83	28.6%	0.926
	2	36	24.8%	35	24.1%	71	24.5%	
	3	34	23.4%	31	21.4%	65	22.4%	
	4	36	24.8%	35	24.1%	71	24.5%	
Disturbed sleep in family	Yes	20	13.8%	30	20.7%	50	17.2%	0.120
	No	125	86.2%	115	79.3%	240	82.8%	

* Significant ($p<0.05$)

Evaluation of family and environmental factors revealed significant differences between urban and rural children. Good room hygiene was more common in urban children (46.2%) than rural children (22.1%), while poor hygiene was higher in rural children (34.5% vs. 20.0%; $p<0.001$). Room sharing reflected family size differences with urban children more often sharing with 1-2 members (49.7% and 41.4%), whereas rural children shared with 3-4 members (26.2% and 28.3%; $p<0.001$). Overcrowding was more evident in rural settings with 29.7% living with 8 members compared to 10.3% in urban areas ($p<0.001$). The number of bedrooms was similar ($p=0.926$) and disturbed sleep among family members showed no significant difference (13.8% urban vs. 20.7% rural; $p=0.120$). Overall, rural children experienced more overcrowded living conditions and poorer room hygiene, while urban children had smaller family units and better environmental conditions.

4. Discussion

The present cross-sectional comparative study assessed sleep hygiene, sleep duration, lifestyle habits and family-environmental factors among 290 school-going children aged 5-18 years, equally divided between urban (n=145) and rural (n=145) settings. Sleep is a fundamental biological need and its adequacy during childhood and adolescence is critical for physical growth, cognitive development, emotional regulation and academic performance. Maintaining sufficient and high-quality sleep during these formative years is known to impact attention, learning capacity, mood regulation and long-term health outcomes, making the exploration of urban-rural differences particularly relevant.

In the present study, females constituted 53.1% (n=154) and males 46.9% (n=136) with no statistically significant difference in gender distribution between urban and rural groups ($\chi^2=1.385$; $p=0.239$). This slight female preponderance aligns with the findings of Olorunmoteni et al. (2024)[17], who enrolled 900 adolescents across rural and urban schools in southwestern Nigeria and reported a similar distribution. Similarly, Gupta et al. (2016)[18], in their study of 831 Indian school children, found near-equal gender distribution and noted that gender did not significantly influence sleep schedules or parental perceptions of sleep. In contrast, Chandran et al. (2020)[19] and Wang et al. (2013)[20] reported slight male predominance in their samples, highlighting regional and cultural differences in gender enrollment or participation patterns. Other studies, such as Zacharia et al. (2022)[21], Ghosh et al. (2023)[22] and Sha et al. (2025)[23] reported distributions comparable to the present study, reinforcing that gender ratios in school-based sleep studies are broadly balanced, though minor variations exist across populations.

The enrolled children were distributed across four age groups: 5-<8 years (26.55%), 8-<11 years (29.31%), 11-<14 years (30.69%) and 14-18 years (13.45%) with mean ages of 11.81±4.113 years for urban and 11.50±3.817 years for rural children, showing no significant urban-rural difference (χ^2=1.385; p=0.239). These age ranges include both primary and secondary school children, capturing developmental differences in sleep needs and behaviors. Comparative studies have reported similar mean ages, though some studies focused exclusively on narrower adolescent bands (Gupta et al., 2016)[18]; (Wang et al., 2013)[20]; (Gokdemir et al., 2021)[24]; (Chandran et al., 2020)[19]; (Zacharia et al., 2022)[21]. The present study uniquely incorporated younger age groups (5-11 years), enabling insights into early childhood sleep habits alongside adolescent patterns, a feature not addressed in many prior studies (Singh et al., 2024)[25].

Sleep timing differed markedly between urban and rural children. Urban children went to bed predominantly between 10-12 pm (74.5%), while 34.5% of rural children slept before 10 pm, reflecting a delayed urban sleep schedule. Wake times also differed with 29.0% of rural children waking before 6 am versus 9.0% in urban children, while urban children more commonly woke after 8 am (24.8% vs. 11.0%). This pattern of later bedtimes and wake times among urban children mirrors prior observations across multiple settings (Gupta et al., 2016)[18]; (Chandran et al., 2020)[19]; (Singh et al., 2024)[25]; (Olorunmoteni et al., 2024)[17]. Notably, delayed bedtime among urban children appears to be the primary contributor to shorter total sleep duration, as wake times were comparable between groups (Olorunmoteni et al., 2024)[17].

Co-morbidities affecting sleep showed mixed urban-rural patterns. Daytime sleep was more prevalent in rural children (40.7% vs. 29.7%; p=0.049), consistent with normal napping behavior in younger rural children. Nasal problems were significantly higher in rural children (22.8% vs. 12.4%; p=0.021), which may impact nocturnal sleep quality. In contrast, urban children experienced daytime somnolence likely indicative of sleep deprivation (Gupta et al., 2016)[18]; (Olorunmoteni et al., 2024)[17]. Snoring prevalence was similar across groups (11.0% urban vs. 10.3% rural; p=0.849), in line with prior reports (Olorunmoteni et al., 2024)[17]. Mouth breathing was common (37.6%) without significant urban-rural differences, while bronchial asthma prevalence was comparable (urban 18.6% vs. rural 20.7%; p=0.658), minimizing confounding effects on sleep quality. Importantly, bruxism was significantly higher in rural children (32.4% vs. 19.3%; p=0.011), suggesting environmental and genetic factors influence parasomnias (Gokdemir et al., 2021)[24].

Academic performance did not significantly differ between urban and rural children with test scores and performance levels broadly comparable, although rural children had slightly higher proportions scoring above 75%. Previous studies have linked poor sleep to lower academic achievement (Li et al., 2023)72; however, the present study indicates that self-reported academic performance may not immediately reflect urban sleep deficits, despite potential cognitive risks (Chandran et al., 2020)[19]; (Olorunmoteni et al., 2024)[17].

Urban children exhibited substantially higher screen time and exposure to electronic devices and recreational activities: television (50.3% vs. 24.8%), mobile phones (60.0% vs. 32.4%), tablets/laptops (29.0% vs. 19.3%), video games (70.3% vs. 25.5%) and reading (75.9% vs. 24.8%) - all statistically significant (p≤0.045). The presence of media in bedrooms was higher in urban children (60.7% vs.

25.5%). Such pre-sleep behaviors contribute to later bedtimes and sleep restriction, consistent with prior research (Gupta et al., 2016)[18]; (Chandran et al., 2020)[19]; (Rajarao et al., 2024)[26]; (Olorunmoteni et al., 2024)[17]. Interestingly, rural children reported higher mobile internet usage (62.1% vs. 44.8%; p=0.003), reflecting India's mobile-first rural connectivity, though this exposure remains lower in its sleep-disrupting impact compared to multi-device urban use (Rajarao et al., 2024)[26].

Total sleep time differed significantly: urban children slept 7.26 ± 0.996 hours versus 7.84 ± 0.591 hours in rural children (p=0.001), reflecting an urban sleep deficit driven primarily by later bedtime. Urban children underestimated their sleep requirement (8.53 ± 0.501 h) relative to rural children (8.83 ± 0.372 h; p=0.001), resulting in greater accumulated sleep debt (1.27 ± 0.615 h vs. 1.06 ± 0.661 h; p=0.006), indicating chronic sleep insufficiency (Rajarao et al., 2024)[26]; (Zacharia et al., 2022)[21]; (Gupta et al., 2016)[18]. Daytime napping did not fully compensate for urban sleep loss, consistent with other reports (Gupta et al., 2016)[18]; (Silva-Caballero et al., 2023)[27].

Sleep hygiene, measured using the Sleep Hygiene Index, was significantly worse in urban children (41.04 ± 5.316 vs. 20.46 ± 5.863; t=31.311; p=0.001) with 90.3% of urban children classified as having poor sleep hygiene compared to none in the rural group. Rural children primarily had average or good sleep hygiene (80% average, 20% good), highlighting the protective effect of structured family routines, earlier bedtimes and limited nighttime technology use (Chandran et al., 2020)[19]; (Olorunmoteni et al., 2024)[17]; (Rajarao et al., 2024)[26]. Factors such as midnight snacking (14.5% vs. 2.8%; p=0.027) and drug use (12.4% vs. 4.8%; p=0.012) were higher among urban children, further contributing to sleep disruption, while evening sports participation was similar across groups (86.9% vs. 88.3%; p=0.722), indicating lifestyle behaviors rather than exercise underlie the urban-rural sleep hygiene gap (Gupta et al., 2016)[18]; (Chandran et al., 2020)[19]; (Rajarao et al., 2024)[26].

Environmental and family factors also differed. Urban children had better room hygiene (46.2% good vs. 22.1% rural) but shared rooms with fewer family members (91.1% with 1-2 vs. 54.5% rural), whereas rural children lived in larger households (29.7% ≥8 members vs. 10.3% urban), reflecting cultural differences in co-sleeping and family routines. Parental bedtime-setting and shared family sleep schedules in rural households likely contributed to better sleep hygiene despite higher household density (Gupta et al., 2016)[18]; (Olorunmoteni et al., 2024)[17]. Bedroom number and family sleep disturbances were not significantly different, emphasizing that social and behavioral sleep determinants outweigh purely physical environmental factors.

5. Conclusion

The study highlights significant differences in sleep patterns, hygiene and related factors between urban and rural children. Rural children slept and woke earlier, while urban children had delayed sleep, shorter duration, higher sleep debt and poorer sleep hygiene due to greater screen and digital media exposure. Certain sleep problems, like daytime sleepiness and nasal issues, were more common in rural children, whereas parasomnias such as teeth grinding were higher in this group. Academic performance was similar, though many reported unchanged or worsened outcomes. Lifestyle and environmental factors also played a role with urban children more likely to snack at night or use drugs and rural children experiencing overcrowding and larger family sizes. Overall, inadequate sleep, poor hygiene and unhealthy habits were prevalent, particularly in urban areas, underscoring the need for targeted

interventions to promote healthy sleep and support children's physical, cognitive and emotional well-being.

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