

Original Articles

Sleep patterns, hygiene and daytime sleepiness among adolescent school-goers in three districts of Tamil Nadu: A descriptive study

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ABSTRACT

Background. Sleep is important for the growth, development and good health of adolescents. We assessed sleep patterns, hygiene and daytime sleepiness among school-going adolescents in 3 districts of Tamil Nadu.

Methods. We conducted a cross-sectional survey among 538 school-going adolescents between the ages of 10 and 17 years, from 8 schools in 3 districts of Thiruvallur, Thiruppur and Namakkal selected through multistage sampling. A questionnaire with items focusing on demographic details, sleep patterns, sleep hygiene behaviour and daytime sleepiness was given to the students for self-administration after obtaining informed consent from their parents and school authorities.

Results. Over 64% of adolescents sleep < 8 hours at night with 5.6% sleeping < 6 hours. About 48% of adolescents suffered from prolonged sleep-onset latency and about 43% had interrupted sleep. Over 64% of adolescents watched television (TV) in bed and >23% reported use of mobile phone in bed. About 64% of adolescents had at least one form of poor sleep hygiene behaviour. Decreasing age (0.7; 95% CI 0.582–0.843), studying while lying in bed (1.72; 95% CI 1.009–2.942), greater time gap between dinner and bedtime (0.795; 95% CI 0.650–0.972), staying awake late in the night and chatting on mobile phone (2.24; 95% CI 1.266–3.978) and watching TV (3.41; 95% CI 2.037–5.722) significantly influenced excessive daytime sleepiness.

Conclusion. A large proportion of adolescent students have abnormal sleep patterns and sleep hygiene behaviours. There is a need for concerted sleep-related education at the school level.

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INTRODUCTION

Sleep is important for the growth, development and good health of children and adolescents.^{1,2} Sleep is essential for cognitive development and learning.³ Sleep is not only seen as a physiological phenomenon but also as a behavioural process.⁴ Research has shown diminishing hours of sleep among adolescents in both developing and developed countries.^{5–7} One of the key determinants of sleep duration is sleep hygiene, which refers to a series of habits that are necessary to have a normal quality night-time sleep and full daytime awareness.⁸ Several sleep hygiene behaviours have been reported to determine good quality sleep. Avoiding long naps during daytime and doing adequate physical exercise are positive sleep hygiene behaviours.⁹ Alcohol consumption, smoking, vigorous physical activity, loud music or taking a nap after 6 o'clock in the evening can reduce sleep quality.^{10–12} Using electronic gadgets for watching movies, gaming, viewing television (TV), talking on the phone and text messaging have all been shown to adversely affect sleep patterns and quality.^{13–15} On the other hand, taking a warm bath, listening to soft music and reading can relax a person and encourage sleep.^{16,17}

Of late, there have been reports of poor sleep hygiene among adolescents.^{5,7,18} Some major contributors to poor sleep hygiene include excessive use of mobile phones, TV, internet and social media.¹⁹ Mobile phones have become ubiquitous in India.²⁰ Almost every adolescent has a smart phone with easy access to internet and social media.

While most studies of sleep patterns, sleep hygiene and daytime sleepiness have been from developed countries, with the penetration of mobile phones, TV and social media in India, the scenario is probably not different. However, little is known about sleep patterns and behaviour of adolescents in developing countries. We aimed to understand sleep patterns, hygiene and daytime sleepiness among adolescents in a typical low- and middle-income setting in Tamil Nadu, India.

METHODS

Study participants

School-going boys and girls between 10 and 17 years of age were selected from Thiruvallur, Thiruppur and Namakkal districts of Tamil Nadu to participate in the study. All adolescents in the defined age group in the sampled schools were eligible to

participate; those with known chronic medical disorders such as asthma and seizures were excluded from the study.

Sample size

The sample size was based on a previous study in which abnormal sleep patterns were reported to be 42% in Chandigarh.²¹ For a 95% confidence interval (CI) and a 10% relative precision, the required sample size was calculated to be 528, rounded off to 530 adolescents (10 additional students were sampled to account for dropouts and incomplete questionnaires). Therefore, 180 adolescent students were sampled from each of the three districts.

Sampling method

Students were selected using the stratified random sampling method. Two schools in Thiruvallur, 1 school in Namakkal and 5 schools in Thiruppur were chosen to achieve the required number of adolescent students. Lists of boys and girls studying in standards VIII, IX and XI were obtained from these schools. After stratifying for standard of study and sex, 30 boys and 30 girls were selected from each of the standards from each district.

Study instrument

A questionnaire was developed to understand sleep pattern, sleep hygiene behaviour and daytime sleepiness. It had questions related to sleep pattern such as time of going to bed, time of waking up and interruptions to sleep. To understand sleep hygiene behaviour, it had questions related to dinner time, homework time, pre-sleep activities such as use of mobile phone and social media, and TV viewing. These questions were modified and adapted from the Adolescent Sleep Hygiene Scale.²² Questions on daytime sleepiness, excessive sleepiness in class and feeling refreshed on waking up in the morning were asked to understand the quality of sleep. The questionnaire also recorded sociodemographic variables of the participants.

Data collection and management

We explained the details of the study to the principal/head of the school. After obtaining their permission, the details of the study were explained to the adolescent students. Informed consent forms were sent to the students' homes to obtain the parents' consent for participation. The students were given the questionnaire in Tamil for self-administration. The average time for filling the questionnaire was about 20 minutes. The completed questionnaires were collected and data were entered in an MS Excel spreadsheet. About 10% of the data entry was cross-verified for validation.

Ethical considerations

The study was approved by an expedited review by the Institutional Ethics Committee of Employees' State Insurance Corporation (ESIC) Medical College and Post-Graduate Institute of Medical Sciences and Research, Chennai, Tamil Nadu, India. Informed assent was obtained from all participants and written informed consent was obtained from their parents. The questionnaires were anonymized, and the confidentiality of data collected from students was strictly maintained. To engage with the community, social media dissemination of research information was done to create awareness about poor sleep patterns and hygiene in these areas.

Statistical analysis

The data were analysed using Epi Info software version 7.²³ Simple descriptive statistical analysis was done to assess sleep

pattern and sleep hygiene behaviour. To understand the influence of sleep hygiene behaviour and sleep pattern on daytime sleepiness, multiple logistic regression analysis was performed. Statistical significance was determined by using a value of $p < 0.05$ for hypothesis testing and 95% CI for odds ratios.

RESULTS

A total of 540 adolescent students were included in the study. Of the data collected, 2 incomplete questionnaires were removed from the analysis. The characteristics of the students who participated in the study are summarized in Table I. There was almost an equal representation of boys and girls in each age group. At the time of the survey, about 10% (53) of the adolescents had some form of morbidity, and about 6% (10) of the adolescents did no physical exercise.

Sleep pattern

Over 23% (125) of adolescents went to bed after 10 p.m. and about 35% (190) woke up before 5 a.m. (Table II). More than 64% (348) of adolescents slept ≤ 8 hours at night with 5.6% (30) sleeping < 6 hours (Table III). About 48% (256) of adolescents suffered from prolonged sleep-onset latency. The commonly stated reasons were emotional concerns and worries. About 43% (232) had interrupted sleep.

TABLE I. Characteristics of the study participants

Characteristic	n (%)
<i>Sex</i>	
Male	268 (49.5)
Female	270 (50.5)
<i>Age (years)</i>	
12	23 (4.3)
13	159 (29.6)
14	124 (23)
15	114 (21.2)
16	114 (21.2)
17	4 (0.7)
<i>Standard</i>	
VIII	180 (33.5)
IX	178 (33.0)
XI	180 (33.5)
<i>Father's occupation</i>	
Professional	31 (5.8)
Executive	107 (19.9)
Skilled	124 (23.0)
Manual labour	240 (44.6)
No father	36 (6.7)
<i>Family income per month (₹)</i>	
<10 000	124 (23.0)
10 001–36 000	95 (17.7)
36 001–60 000	130 (24.2)
60 001–100 000	111 (20.6)
>100 001	78 (14.5)
<i>Morbidity</i>	
Present	53 (9.8)
Absent	485 (90.2)
<i>Do physical exercise</i>	
Daily	149 (27.7)
Sometimes	356 (66.3)
Never	32 (6.0)

TABLE II. Bedtime and time of waking up in the morning

Time	n (%)
<i>Bedtime</i>	
Before 9 p.m.	37 (6.9)
9–10 p.m.	376 (69.9)
10–11 p.m.	105 (19.5)
After 11 p.m.	20 (3.7)
<i>Wake up in the morning</i>	
Before 5 a.m.	190 (35.3)
5–6 a.m.	223 (41.4)
6–7 a.m.	109 (20.3)
After 7 a.m.	16 (3.0)

TABLE III. Sleep patterns among adolescents

Characteristic	Categories	n (%)
Duration of sleep in hours	<6	30 (5.6)
	6–8	318 (59.1)
	>8	190 (35.3)
Prolonged sleep-onset latency	Yes	256 (47.6)
Interrupted sleep	Yes	232 (42.6)
Number of times you wake up in the middle of sleep at night (n=232)*	1	154 (66.4)
	2	62 (26.7)
	3	13 (5.6)
	4	1 (0.4)
	≥5 times	2 (0.9)
Reason for waking up in the middle of sleep at night (n=232)*	Breathing problem	6 (2.2)
	Nightmares	46 (17.2)
	To go to toilet	79 (29.5)
	To drink water	109 (40.7)
	Snoring of family members	1 (0.4)
	Others	27 (10.1)

* total exceeds 232 as some had more than one reason

Sleep hygiene

Nearly 80% (430) of adolescents slept along with family members in the same room and about 76% (410) did not have a separate bedroom to sleep (Table IV). About 48% (257) of adolescents had a heavy meal before going to bed and about 76% (409) had a ≤1-hour gap between dinner and bedtime. A majority of adolescents (64.1%, 345) watched TV in bed and about 23% (125) used their mobile phone in bed (Table IV). We found that about 64% of adolescents had at least one form of poor sleep hygiene behaviour.

Daytime sleepiness

A majority of adolescents (69.5%) reported not feeling refreshed on waking up from sleep. Most of the students (65.1%) also complained of feeling sleepy during daytime in the class.

Multiple logistic regression analysis revealed that decreasing age, studying while lying in bed, lower time gap between dinner and bedtime, staying awake late at night and chatting on mobile phone and watching TV significantly influenced excessive daytime sleepiness (Table V).

DISCUSSION

Our school-based study found that about 64% of adolescents had ≤8 hours of sleep, which is the recommended sleep duration for adolescents.⁷ Also nearly half the adolescents studied had prolonged sleep latency and interrupted sleep. These indicate a poor sleep pattern and quality. About 64% of adolescents had at least one of the poor sleep hygiene behaviours. We also observed

TABLE IV. Pre-sleep activities and sleep hygiene behaviour of adolescents

Characteristic	Category	n (%)
Sleep alone or with family	Alone	108 (20.5)
	With family	430 (79.5)
Separate bedroom to sleep	Yes	128 (23.8)
	No	410 (76.2)
Have heavy meals before going to bed	Yes	257 (47.8)
Time gap between dinner and bedtime (in minutes)	No gap	54 (10.0)
	<30	167 (31.0)
	30–60	188 (34.9)
	61–120	98 (18.2)
	121–180	25 (4.6)
>180	6 (1.1)	
Read books lying on bed	Yes	91 (16.9)
Watch TV lying on bed	Yes	345 (64.1)
Stay awake late into the night and watch TV	Yes	118 (21.9)
Use mobile for playing games/watch movies in bed	Yes	125 (23.2)
	No	
Stay awake late into the night and chat on in bed	Yes	85 (15.8)
Keep mobile near pillow before sleeping	Yes	115 (21.4)

that age and certain abnormal pre-sleep behaviours were associated with daytime sleepiness.

Sleep pattern among adolescents

Studies have shown that adolescents require at least 8 hours of sleep at night. Those who sleep lesser than this show signs of sleep deficit including daytime sleepiness.^{7,24} Deprivation of sleep at night is also associated with an increased risk for hypertension, obesity and cardiovascular risk.^{25–28} Further, poor sleep duration, sleep quality and sleepiness during daytime significantly impact school performance in adolescents.² Therefore, sleep deficit noticed in this sample of adolescents is a matter of concern, as it predicts a high risk of future non-communicable diseases and poor performance in school.

Prolonged sleep-onset latency of >30 minutes was observed among >65% of adolescents in a study in Norway.²⁹ Prolonged sleep-onset latency is a typical indicator of insomnia and a predictor of future sleep problems.³⁰ We found that about 47% of adolescents had prolonged sleep-onset latency. Therefore, this indicates a considerable morbidity burden for the future.

Similarly, interrupted sleep has been shown to impair the quality of sleep. Interrupted sleep among adolescents can result in daytime sleepiness and poor performance in school.³¹ The high prevalence (42%) of sleep interruptions in our study is an indicator of poor sleep quality. An analysis of reasons for interrupted sleep revealed that some of the common causes reported by the adolescents were thirst and urge to void urine. Measures could be taken to prevent the urge to void urine during sleep by ensuring that adolescents follow a sleep hygiene behaviour of emptying their bladder before going to bed and avoid drinking excessive fluids during the 2 hours before sleep.

Sleep hygiene behaviour among adolescents

Our study was done in rural and peri-urban areas of 3 districts of Tamil Nadu. Therefore, the practice of the entire family sleeping together in a common room was observed in a majority of the families of the respondents. Whether such a sleeping practice compromises the quality of sleep of an adolescent in this setting is not clear.

TABLE V. Factors influencing daytime sleepiness

Characteristic	Sleepiness during the day		Adjusted p value	Adjusted odds ratio	95% confidence interval (CI)
	Yes	No			
<i>Age (years)</i>					
12	21.7	78.3	<0.001	0.700*	0.582–0.843
13	21.4	78.6			
14	21.8	78.2			
15	33.3	66.7			
16	50.9	49.1			
17	50	50			
<i>Sex</i>					
Female	31.1	68.9	0.553	0.872	0.562–1.351
Male	29.9	70.1			
<i>Family income (₹)</i>					
<10 000	27.4	72.6	0.728	0.982	0.834–1.157
10 001–36 000	26.3	72.6			
36 001–60 000	20	80			
60 001–100 000	36.9	63.1			
>100 001	48.7	51.3			
<i>Keep mobile near pillow</i>					
Yes	47	53	0.671	0.996	0.979–1.013
No	25.8	74.2			
<i>Use mobile for playing games/watch movies in bed</i>					
Yes	50.4	49.6	0.705	0.996	0.976–1.016
No	24.3	75.7			
<i>Have heavy meal before bedtime</i>					
Yes	30	70	0.227	0.998	0.996–1.001
No	30.8	69.2			
<i>Study while lying in bed</i>					
Yes	48.4	51.6	0.073	1.723*	1.009–2.942
No	26.7	73.3			
<i>Watch TV lying in bed</i>					
Yes	35.7	64.3	0.263	1.335	0.841–2.119
No	21.2	78.8			
<i>Sleep alone or with family members</i>					
Alone	40.7	59.3	0.927	0.944	0.553–1.612
With family	27.9	72			
<i>Separate room for sleeping</i>					
Yes	32	68	0.643	0.864	0.528–1.416
No	30	70			
<i>Time gap between eating and sleeping (minutes)</i>					
No gap	34.4	65.6	0.993	0.795*	0.650–0.972
30–60	25	75			
60–120	23.5	76.5			
>120	58.1	41.9			
<i>Stay awake late at night and chat on mobile</i>					
Yes	51.8	48.2	0.006	2.244*	1.266–3.978
No	26.5	73.5			
<i>Stay awake late at night and watch TV</i>					
Yes	60.2	39.8	<0.001	3.414*	2.037–5.722
No	22.1	77.9			
<i>Habit of playing outdoors</i>					
Daily	26.8	73.2	0.627	1.000	0.670–1.493
Sometimes	32.9	67.1			
Never	21.9	78.1			
<i>Interrupted sleep</i>					
Yes	36.7	63.3	0.019	1.217	0.797–1.859
No	25.9	74.1			
<i>Sleep duration (hours)</i>					
<6	35.7	64.3	0.127	0.921	0.638–1.330
6–8	33.1	66.9			
>8	25.6	74.4			

* Statistically significant based on CIs

About half the respondents had a heavy meal at dinner time and >75% went to bed within 1 hour of having dinner. An experimental study from Brazil showed that having dinner close to the bedtime and late-night snacking can lead to poor sleep quality and sleep interruptions.³² Adolescents who had greater time gap between dinner and sleep had better quality sleep as indicated by lesser daytime sleepiness.

Other important sleep hygiene behaviours that we noticed were watching TV late at night and viewing TV in bed. Previous studies have shown an association between impaired sleep quality and watching TV, night-time TV viewing and viewing TV in the bedroom.^{13,33–35} We found that adolescents who watched TV late at night had excessive daytime sleepiness, an indicator of poor sleep quality. There is also evidence to show that use of electronic media and mobile phone also impairs sleep quality.^{36,37} We too found this in our study.

Daytime sleepiness

A majority of adolescents in our study reported daytime sleepiness. This is an indicator of inadequate and poor-quality sleep.³⁸ Several factors could influence this including poor sleep hygiene, medical problems such as obstructive sleep apnoea and psychological and emotional stress associated with adolescence. Daytime sleepiness can aggravate behavioural, adjustment, psychological, mood and emotional problems, and also affect academic performance in school. It could also increase the incidence of accidents and injuries.³⁹ Several factors influenced daytime sleepiness including age, pre-sleep activities and sleep hygiene behaviour.

Strengths and limitations of our study

We focused on adolescents from a rural and peri-urban background in Tamil Nadu. With the increasing penetration of TV, internet and mobile phones into the daily life of people in developing countries, changes in lifestyle and sleep are likely to happen and this is one of the early attempts to understand its impact. We excluded children with chronic medical disorders such as asthma and seizures. However, it is possible that some amount of the poor sleep quality that was observed in the study in the form of daytime sleepiness could be because of an undetected medical problem such as sleep apnoea. Most associations mentioned are cross-sectional and therefore caution needs to be exercised in interpreting them causally.

Conclusion

The prevalence of abnormal sleep patterns, poor sleep hygiene behaviour and daytime sleepiness was high in our sample of adolescents. It is important to address sleep deficit and poor sleep quality by appropriate interventions to modify abnormal sleep hygiene behaviour at the school level to minimize the adverse impact of poor sleep on the health and development of adolescents.

Conflicts of interest. None declared

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