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Original Research Article

Study of sleep pattern in children aged 1-12 years attending OPD at tertiary care hospital, Puducherry, India

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ABSTRACT

Background: Children differ in their sleep pattern from adults and within their developmental age groups. Good sleep habits help them in better sleep outcomes. Inadequate sleep can contribute to various health issues. Hence, this study was carried out to find out sleep pattern in children and identify factors affecting it so that suitable measures can be taken to ensure good sleep hygiene in children.
Methods: This was a cross-sectional observational study done in children aged 1-12 years. Every 5th child who attended OPD were included. Children who were very sick or had chronic illness or pain were excluded. Details pertaining to sleep was recorded after written parental consent.
Results: The total sample size was 650. The mean age was 6.25±3.2 years. The mean bed time and wake up time was 9.18 pm±(1.02) and 6.41 am±(0.85) respectively. The mean night sleep duration was 9.38±1.05 hours. Co-sleeping was 97.5%. Sleep problem was seen in 51.1%. Screen time >2 hours contributed to late bedtime and insomnia. Reduced physical activity/exercise was significantly associated with sleep problems.
Conclusions: Sleep problems and poor sleep habits are common among children. Increased screen time and reduced physical activities in children contribute to poor sleep habits and sleep problem.

Keywords: Children, Sleep, Sleep problems, Sleep habits, Sleep hygiene, Sleep pattern

INTRODUCTION

Sleep is an important physiological function not only in childhood but also throughout life. Sleep characteristics in children are different from that of adults.[1] As children mature, their sleep pattern also changes to more of adult sleep pattern.[1]

Consistent sleep habits like regular bedtime and wake-up time and similar sleep schedules on weekends and weekdays help in better sleep outcomes. Good sleep ensures good mental and physical health. Inadequate sleep can cause learning and behavioral problems and also some disorders seen in adulthood such as obesity, hypertension and type 2 diabetes mellitus.[2]

Apart from biological determinants, there are social, environmental and cultural influencers of sleep habits. These have not been addressed adequately in this part of the country. Unlike adults, children do not usually complain of sleep problems or seek treatment on their own. Thus, sleep problems in children may go undetected. Hence, this study was carried out to find out sleep pattern in children and identify factors affecting it so that suitable measures can be taken to ensure good sleep hygiene in children.

METHODS

This cross-sectional observational study was conducted in Indira Gandhi Medical College and Research Institute, Puducherry after approval from Institute Ethics Committee. The period of study was from September 2015 to February 2016. Children aged 1-12 years who attended Pediatric Out Patient Department (OPD) for minor illnesses like upper respiratory infections and well-baby clinics for immunization formed the study subject. Sample size was calculated as 660 using the formula n= $4pq/l^2$ taking prevalence as 42 error of 10%, CI 95% and non-response rate of 10%.[3] Every 5th child who attended the OPD was enrolled till the target was reached. Children who were very sick or had chronic illness or pain were excluded. Detailed information was recorded after written consent to participate in the study was obtained from parents. Information on bedtime, wake-up time, night awakening, day nap, differences in weekend sleep schedule and co-sleeping over the previous week were entered in a semi-structured questionnaire validated by pretesting and back translation. Parental report of any sleep problem within the previous 3 months was recorded. Self-report by children older than 7 years was incorporated along with parental report. Data was analyzed using descriptive statistics. Chi-square test was used for proportions. One way ANOVA was used for comparing means.

RESULTS

Present study included 650 children with mean age of 6.25 ± 3.2 years. The children were categorized into 3 age groups viz, toddler (1-<3 years), preschool (3-5 years) and school children (>5 years). Total number of toddlers, preschoolers and school children were 106 (16.3%), 200 (30.8%) and 344 (52.9%) respectively. The literacy rate for fathers was 92.8 % and mothers 94.2%. Children from upper socio-economic group, that is, class 1 (upper) and class 2 (upper middle) and class 3 (middle) were 308 (47.4%) and from lower socio-economic group, class 4 (lower middle) and class 5 (lower) were 342 (52.6%) according to BG Prasad classification. There were 430 children (66.2%) from nuclear families and 220 (33.8%) from extended nuclear/joint families (parents, their children and others like children's grandparents or uncles/aunts). Co-sleeping was seen in 104 toddlers (98.1%), 197 preschoolers (98.5%) and 333 school children (96.8%).

Sleep pattern

Bedtime and wake-up time

The mean bedtime and wake-up time for all children during weekdays was 9.18 pm±(1.02) and 6.41 am ± (0.85) respectively. The mean bedtime for toddlers was 9.27 pm±(1.15), for preschoolers 9.20 pm±(1.16) and school children 9.13 pm ±(0.88). The median bedtime was 9.30 pm for toddlers and 9 pm for preschoolers and school children. The mean wake-up time for toddlers was 6.42 am (± 1.82), for preschoolers 6.46 am (± 1.81) and for school children 6.37 am (± 0.73). The median wake-up time was 7 am for toddlers and preschoolers and 6.52 am for school children.

Sleep duration

The total sleep duration was highest among toddlers and lowest among school age children. The mean daytime nap duration was 1.2±1.2 hours and the mean night sleep duration was 9.38±1.05 hours in all the age groups.

Table 1: Sleep and nap duration in children 1-12 years of age.

Variable	Toddler n= 106	Preschool n= 200	School n= 344	t test	p value
Day nap duration (week day+weekend)					
Range	0.5-6 hours	0.5-5 hours	0.25- 5 hours		
Median	2 hours	2 hours	0	16.799	0.000*
Mean ± SD	2.14±1.15 hours	1.41±1.16 hours	0.63±1.02 hours		
Night sleep duration					
Range	6-11.5 hours	7-12 hours	6.5-13 hours		
Median	9 hours	9.5 hours	9 hours	2.261	0.003*
Mean ± SD	9.24±1.23 hours	9.42±1.09 hours	9.39±0.96 hours		
Total sleep duration (night sleep+daily nap)					
Range	6.5-15.5 hours	7-16 hours	6.5-14 hours		
Median	12 hours	10 hours	9 hours		
Mean±SD	11.58±1.81 hours	10.33±1.75 hours	9.46±1.07 hours	11.281	0.000*
*p value <0.01					

The day nap and total sleep duration was highest in toddlers and lowest in school children, the difference being statistically significant. (Day nap duration ANOVA 16.799, p=0.000 and total sleep duration ANOVA

11.281, p = 0.000). The mean night sleep duration was lowest in toddlers and highest in preschoolers compared to school children, the difference being statistically significant (ANOVA 2.261, p value 0.003).

Daytime napping

Regular day time nap was seen in 138 children (21.2%). Proportion of children who napped during the day was significantly higher in toddlers (n=73, 52.9% of regular nappers) compared to preschoolers (n=59, 42.8%). It was seen only in 6 (4.3%) school children. Out of the toddlers who napped, 40 (54.8%) napped during the afternoons between 12 pm to 4 pm while 27 (37%) napped in the mornings before 12 pm and 8 children (8.2%) napped both during morning and afternoon. Among preschoolers, 54 (91.5%) napped in the afternoon while only 5 (8.5%) napped in the morning. All the 6 school children napped in the afternoons only. Thus, afternoon naps were more common than morning naps across all the age groups, which was statistically significant (Chi test 24.44, p=0.000)

Night awakenings

Night awakening on at least 2 or more nights per week occurred in 295 children (45.4%). It was seen in 76 (71.7%) toddlers, 89 preschoolers (44.5%) and 130 school children (37.7%). Frequent night awakenings more than 2 in a single night was seen in 28 children (4.3%). It was significantly higher among toddlers (n=14, 13.2%) compared to other groups (preschoolers n=7, 3.2%, school children n=7, 2%, Chi test 68.682, p value=0.000). The most common reason for night wakings in toddlers and preschoolers was hunger and thirst (toddlers n=62, 58.5 % and preschoolers n=42, 30 %), and in school aged children was to visit the restroom (n=74, 18.4%).

Bedtime routine

The mean dinner-to-bedtime gap for all children was 1.4 ± 0.62 hours. Bedtime routine was more commonly followed in toddlers (n=61, 57.5%) when compared to preschoolers (n=85, 42.5%) and school children (n=116, 33.7%), the difference being statistically significant (Chi test 21.227, p=0.000). The most common routine followed for toddlers was giving milk bottle (n=27, 25.5%), telling bedtime stories (n=22, 20.8%) in preschool age group and watching television or playing with mobile in school children (n=43, 12.5%).

Weekend pattern

Weekend difference >1 hour from weekday schedule in bedtime was noted only in preschool (n=8, 4%) and school children (n=8, 2.3%) and not in toddlers. However, weekend difference >1 hour in wake-up time was seen in 6 toddlers (5.7%), 23 preschoolers (11.5%) and 79 school children (23%), increasing with age group with the highest in school children, the difference being statistically significant (Chi test 22.970, p value 0.000). Weekend difference was noted in day time naps also. While the number of toddlers having weekend naps was 23 (21.7%) compared to 73 (68.7%) during weekdays, it was higher among preschoolers and school children, being 81 (40.5%) compared to 59 (29.5%) and 109 (31.7%) compared to 6 (1.7%) during weekends and weekdays respectively, the difference between regular naps and weekend naps being statistically significant for each age group (Chi test 47.593, p=0.000; Chi test 5.319, p=0.021, Chi test 59.898, p=0.000 respectively).

Lifestyle

Extra physical activities like playing outdoor physical games or exercise at least for half an hour for at least 3 days in a week was noted only in 33.2% of all the children (n=216). Proportion of toddlers, preschoolers and school children having physical activity were 31 (29.2%), 60 (30%) and 125 (36.4%), with no statistical difference between the age groups (Chi test 3.196, p value 0.202). The average screen time per day for toddlers was 0.95 hours, preschool 1.7 hours and school children 2.3 hours, highest in school aged children, the difference being statistically significant (Chi test 201.600, p < 0.0001). Screen time more than 2 hours was seen in 212 children (32.6%) and was highest among school children (n=142, 41.3%) compared to preschoolers (n=58, 29%) and toddlers (n=12, 11.3%, and this difference was significant (Chi test 87.779, p=0.000). Significant proportion of children from upper socio-economic group were found to have screen time of more than 2 hours compared to children from lower socio-economic group (n=118, 38.3 % vs n=94,27.5%; Chi test 8.643, p=0.003). Significant proportion of children who had screen time > 2 hours showed reduced physical activity compared to those with screen time less than 2 hours (n=128, 29.2% vs 88, 49.5%; Chi test 9.718, p=0.002). However, there was no statistical difference in physical activity in upper and lower socio-economic groups (Chi test 0.370, p=0.543)

Poor sleep habits

Late bedtime after 9 pm was seen in 316 children (48.6%) being comparable in all 3 groups (Chi test 0.964, p=0.618). However late wake-up time after 7 am was seen in 27 toddlers (25.5%), 48 preschoolers (24%) and 56 schoolchildren (16.3%) with the lowest incidence in school aged which was statistically significant (Chi test 6.911, p =0.032). Insufficient sleep or sleep deprivation was seen in 100 children (15.4%) with no statistically significant difference among the 3 groups. Significantly higher proportion of children in upper socio-economic group went to bed late compared to children from lower socioeconomic group (mean bed time 9.51±1.03 vs 9.12 ± 0.97, t test 5.007, p=0.000). Similarly, significant proportion of children having screen time > 2 hours went to bed late after 9 pm compared to those with lesser

screen time (mean bed time 9.47±0.99 vs 9.22±1.02, t test -2.961, p=0.003). After univariate and multivariate logistic regression, upper socio-economic class and screen time more than 2 hours remained significant (Chi test 9.022, p=0.003, OR 1.619, 95% CI 1.182-2.218 and Chi test 5.058, p=0.025, OR 0.671, 95 % CI 0.474-0.950 respectively).

Table 2: Sleep problems in children aged 1-12 years.

Variable	Toddler n=106		Preschool n=200		School n=344		Chi square	p value
	No.	Percent	No.	Percent	No.	Percent		
Difficulty falling asleep (bedtime to sleep onset time >30 minutes)	11	(10.4)	17	(8.5)	33	(9.6)	0.324	0.850
Teeth grinding	9	(8.5)	24	(12)	28	(8.1)	2.335	0.311
Sleep talking	6	(5.7)	46	(23)	53	(15.4)	8.113	0.017†
Snoring	9	(8.5)	13	(6.5)	31	(9)	1.084	0.581
Sleep walking	0	(0)	1	(0.5)	4	(1.2)	1.710	0.429
Day time sleepiness	0	(0)	0	(0)	2	(0.6)	1.785	0.410
Day time tiredness	1	(0.9)	1	(0.5)	5	(1.5)	1.100	0.577
Night terrors	4	(3.8)	10	(5)	5	(1.5)	5.929	0.052†
Nightmares	2	(1.8)	20	(10)	40	(11.6)	8.982	0.011
Hypnic jerks	0	(0)	1	(0.5)	1	(0.3)	0.572	0.751
Lip biting	1	(0.9)	0	(0)	0	(0)	5.140	0.077
Bedwetting inappropriate for age	0	(0)	10	(5)	53	(16.7)	29.242	0.000‡
*some children showed multiple response-so values overlap; † p value <0.05 ‡p value <0.01								

Sleep problems

Sleep problems (Table 2) such as difficulty in falling asleep, snoring, sleep talking, nightmares and others were present in 332 children (51.1%). Out of these 336 children, sleep problems were seen in 35 toddlers (10.5%), 125 preschoolers (37.7%) and 172 school children (51.8%), the difference being statistically significant (Chi test 24.436, p=0.000). The most common sleep problem noted in toddlers was difficulty in falling asleep which was defined as bed time to sleep onset time >30 minutes (n=11, 10.4%). In preschoolers, the common problems were sleep talking (n=46, 23%), and in school children, it was bedwetting inappropriate for age (n=53, 15.4%). Insomnia was seen in 96 children (14.8%) with a prevalence of 12.5% (n=25) and 12.8% (n=44) in preschool and school children respectively and 25.5% (n=27) among toddlers and this difference was statistically significant (Chi test 11.533, p=0.003). Insomnia was significantly associated with bedtime TV use (n=72, 75% vs n=24, 25%; Chi test 3.932, p=0.047). Sleep talk and nightmares were higher if there was lack of physical exercise (Sleep talk Chi test 9.442, p=0.002 and nightmares Chi test 13.196, p=0.000). On univariate and multivariate logistic regression, it was found that the only factor that caused sleep problem was inadequate physical activity.

DISCUSSION

The prevalence of sleep problems in our study was 51.1% which is similar to that reported by other studies in India with a prevalence ranging from 40-50%.[3-5] The prevalence in western nations ranges from 10-40%.[6,7] Parental perception of sleep problems vary in different cultures some parents perceiving them as a problem while others consider them as normal process of growing up. A report showed that in Australia and America, sleep difficulties were discussed by 20% of parents during consultation.[8] On the other hand in our study all the children were brought to the OPD primarily for some other complaint and not for a perceived sleep problem. However, they readily reported sleep problem when asked about them.

The mean sleep duration in our study for schoolchildren was 9.39 hours, which was higher than that reported by Rozario, (9.08 hours).[9] Although similar to an observation from China where the total duration of sleep in children was 9.25 hours, it is lesser than that reported from the west where children had longer duration of sleep (10.15 hours).[10] The mean bedtime observed in our study was 9.18 pm. Other Indian studies have reported similar or even later bed times.[6,7] A study by Mindell reported Indian children having bedtime as late as 10.30 pm. Children in the west have been observed to have earlier bedtime than those in the east ranging from 7.43 pm in Australia and New Zealand to 8.27 pm in US.[10,11] This may be due to socio-cultural racial differences and climatic influences.[12]

Regular naps were given up by 8 years in our study while in the west it is given up by 5-7 years of age.[3,13] There are racial variations in the age at which regular naps are

given up as reported by Crosby where 39.1% of black children napped at 8 years of age compared to 4.9% of white children.[4] There can be variation within the same cultural milieu also as the prevalence of regular naps in school children in our study (3.2%) was higher than that observed in Kerala, where only 0.25% of school age children napped regularly.[9] This difference could be due to school shifts with morning sessions only, which allows the child to nap in the afternoon. It may also be due to hot and humid weather prevailing in this part of the country which is conducive to sleep in the afternoons.

The role of chronotype and biological clock may be a contributory factor in this regard since biological clock varies while the same standard time is followed in different places.[14,15] This may also contribute to differences in bedtime, sleep duration, and napping, besides socio-cultural variations.

Frequent night awakening among toddlers (13.6%) and preschoolers (3%) were comparable to studies from Nepal and India where the corresponding frequencies were 13.2% and 3% respectively.[16,17] However, in our school children, only in 2% which is much lower than that reported from China where 9.8% school children had frequent night awakenings.[18] This again could be due to dietary factors and environmental conditions like temperature which have a direct or indirect effect on sleep habits.

Co-sleeping was seen in 97.5 % of all children in present study which is slightly higher than that reported by Bharti (93%) and Rozario (84%).[3,9] Co-sleeping was reported as 46% in Chinese school children while it was only 5% in a study from Italy.[19,20] In the west even among infants and toddlers co-sleeping prevalence ranged from 5-36%.[21,22] Higher prevalence of co sleeping in the east could be due to socio-cultural factors where it is believed that children feel well loved and secure and secondly due to economic factors. The prevalence of nightmares and night terrors in our study was 9.5% and 2.9% respectively which is comparable or even lower with that observed in western population (nightmares 10-50%, night terrors 3%), despite higher rate of co-sleeping.

Insomnia was 25.5% among school children in our study higher than that reported by Suri et al (17.3%) but lesser than that reported by Archbold et al.[8,23] In present study, 32.6% had screen time >2 hours. TV / mobile devices and increased screen time in children especially in school age were a significant contributor to late bedtime and thus inadequate sleep duration. This is similar to observations made in other studies where increased screen time caused reduced duration of sleep.[24,25]

In fact, Owens suggests that TV habits are a marker for sleep disturbances.[26] Apart from increased screen time causing late bedtime, reduced physical activity was a significant contributor to sleep problems. Similar observation has been made by Nixon and Brand.[27,28] It is therefore important for schools to organize physical training and sports activities in children and not focus only on academics since improving sleep duration by even half an hour has been found to lower body mass index and obesity in children.[29]

Limitations of the study was a cross-sectional study and rural-urban divide was not taken into consideration. It was hospital based whereas community based study would be better. Objective methods like actigraphy would be better.

What is already known

Sleep problems are not uncommon in children.

What this study adds

Parents do not perceive poor sleep hygiene as a problem. Reduced physical activity and screen time more than 2 hours significantly contribute to sleep problems.

CONCLUSION

In conclusion, sleep problems and poor sleep hygiene are not uncommon in children. Significant contributory factors to these were reduced physical activity in children and screen time more than 2 hours per day. Parents, educators and health professionals should be aware of the importance of good sleep hygiene in ensuring good health not only in childhood but also in adulthood. Measures must be taken to promote physical activities and reduce screen time in children to ensure good sleep hygiene to avoid sleep problems. This can go a long way in reducing the morbidity caused by sleep problems and promoting good health especially in adulthood.

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