

An assessment of the sleeping pattern in healthy infants

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Abstract

Background: Sleep plays a significant role in good physiological state and well-being throughout life. Sleep is necessary for children because it directly impacts mental and physical development.

Objective: To assess the sleep pattern, sleep habits and parental reporting of sleep problems and to examine the factors affecting sleep in a group of healthy infants in Sri Lanka.

Method: Two hundred and fifty parent / baby pairs participated in this descriptive cross-sectional study. Sample was divided into the following age categories: one month, three months, six months, nine months and twelve months. Data were collected from parents / caregivers at well-baby clinics in selected public health midwife (PHM) areas, using an interviewer-administered sleeping questionnaire and infants' sleeping hours were recorded using a sleeping chart. Data were analysed using SPSS version 25.

Results: Mean daytime, nighttime and total sleep duration of infants at 1 month of age was 6.09 hours, 8.47 hours and 14.26 hours respectively. The mean daytime, nighttime and the total sleep duration of the infants at 12 months of age was 2.57 hours, 8.33 hours and 10.87 hours respectively. About 12% of babies had total sleep durations not in agreement with the National Sleep Foundation (NSF) 2015 recommendations. Total sleep bouts tended to decrease with increasing age but 6 month old babies had higher sleep bouts than 3 month old babies. About 26.4% of infants were reported to have problematic sleep. There was no significant difference in total sleep time between female and male babies.

Conclusions: There was a statistically significant difference of total sleep for the five age groups. There was a statistically significant difference in daytime sleep between the five age groups. Total sleep duration of most infants was adequate according to the NSF recommendation.

(Key words: Sleep duration, Sleep habits, Sleep problems, Infants)

Introduction

A good quality regular sleep helps shield physical health, psychological status, quality of life and safety¹. Sleep is particularly necessary for youngsters because it directly impacts mental and physical development². Development of nighttime sleep consolidation is one of the main biological tasks of infancy³. Several factors are related to the length of infants' sleep like pain, hunger, anxiety, close temperature, noise changes and frequently scheduled periods of social interaction⁴. Newborn babies begin sleeping through the night by the age of three months. They will still have one or more naps throughout the day and will still want to sleep during the daytime for many years⁵. When they are between four and eleven months old, they need 12 to 15 hours of sleep a day⁶. Sleep patterns show important changes throughout infancy⁷.

Studies have shown that intense parental involvement and reduced self-soothing skills could interfere with nighttime sleep consolidation^{8,9}. In fact, studies have shown that parents of infants who bed-share reported an increased number of awakenings compared to solitary-sleeping infants^{7,10}. Babies of younger mothers sleep longer than babies of older mothers and babies in larger families tend to go to bed later¹¹. Causes of sleep disturbance and sleep issues throughout infancy are not well understood¹². As sleep issues tend to persist from infancy to adulthood, early identification and management by a sleep specialist is critical to improving the quality of life of the child and entire family². Studies have shown that the frequency of nighttime awakening is one of the chief factors by which parents decide the standard of their kid's sleep¹¹. A recent study showed that, overall, kids from predominantly Asian countries have later bedtimes, total sleep times and accrued parental perception of sleep issues and are more bed-sharing and room-sharing than children from predominantly Caucasian countries¹³.

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Objectives

To assess the sleep pattern, sleep habits and parental reporting of sleep problems and to examine the factors affecting sleep in a group of healthy infants in Sri Lanka.

Method

Two hundred and fifty parent/baby pairs participated in this descriptive cross-sectional study. Purposive convenience sampling was used. There are 15 public health midwife (PHM) areas in the Galle Medical Officer of Health (MOH) area. Simple random sampling (lottery method) was used to select 9 PHM areas (Madawalamulla, Mahamodara, Hirimbura, Katugoda, Talapitiya, Magalle, Ethiligoda, Dangedara & Dadalla). Using the well-baby clinic list of the selected areas we visited them. At the well-baby clinics we addressed the mothers of eligible babies and explained about the study. Mothers who volunteered to participate were recruited until we reached the decided sample of 250. Sample was grouped in 5 age categories, 1 month, 3 months, 6 months, 9 months and 12 months (SD ± 1 week). We selected 50 babies in each age group. Data were collected from the parents/caregivers who attended well-baby clinics in the 9 selected PHM areas from September to November 2019. We excluded babies who were unhealthy, babies on drugs affecting sleep and babies who were not in their permanent sleeping place when calculating the period of sleep pattern.

An interviewer-administered sleeping questionnaire and sleeping chart were used to collect data. The sleeping questionnaire was developed by the principal investigator under the guidance of the supervisor. It was pre-tested by using 10 eligible parents of infants. According to the parents' answers, questionnaire was filled by the researcher including information of the parents such as role of responder, education, job, monthly income, characteristics of the infant, including sex, birth order, age and weight and information about infant's sleep such as method of falling asleep, location of sleep and the sleeping position in which they sleep most of the time.

Infants sleeping hours were recorded by using a sleeping chart. We gave clear instructions to parents about filling of the sleeping chart, and it was given to the parents and they were asked to maintain it for 24 hours. The completed sleeping charts were collected. Sleep measurements included nocturnal sleep duration (between 7pm and 7am), daytime sleep duration (between 7am and 7pm), number of night awakenings, nocturnal sleep-onset time (the clock time at which the child falls asleep for the night) and number sleep bouts per 24 hours (one bout was defined as the infant going to sleep and waking up).

Ethical issues: Ethical approval was obtained from the Ethics Review Committee of the Faculty of Allied Health Sciences, University of Ruhuna, Galle, Sri Lanka (No. MD/BN/2015/343). Written informed consent was obtained from the parents before commencement of the study.

Statistical analysis: All analyses were completed using Statistical Package of Social Sciences (SPSS) version 25. Frequencies were used to analyse demographic data of infants and parents. Frequencies, means and standard deviations (SDs) were used to analyse sleep variables and sleep habits. Comparisons between continuous distributions were carried out by means of the analysis of variance (ANOVA). One way ANOVA was used to compare across ages the following variables: (1) nighttime sleep, (2) daytime sleep, and (3) total sleep time. Independent sample t-test was used to analyse significant differences in total sleep between male and female, association between total sleep and noises around the house, and relationship between sleep position and total sleep duration.

Results

Parents' response rate was 100%. Table 1 indicates the demographic characteristics of the infants.

Table 1
Demographic characteristics of infants (n=250)

Information	n (%)
<i>Gender</i>	
Female	138 (55.2)
Male	112 (44.8)
<i>Nationality</i>	
Sinhala	159 (63.6)
Tamil	03 (01.2)
Muslim	88 (35.2)
<i>Religion</i>	
Buddhist	156 (62.4)
Hindu	03 (01.2)
Islam	88 (35.2)
Christian	03 (01.2)
<i>Siblings</i>	
No siblings	122 (48.8)
1 sibling	87 (34.8)
2 sibling	34 (13.6)
3 sibling	04 (01.6)
4 sibling	03 (01.2)
<i>Parity</i>	
1	122 (48.8)
2	87 (34.8)
3	34 (13.6)
4	04 (01.6)
5	03 (01.2)

Table 2 shows the socio-demographic characteristics of the parents. Table 3 shows the sleep time across age groups.

Table 2: Socio-demographic characteristics of the parents (n=250)

Information	n (%)	Information	n (%)
<i>Responder</i>		<i>Mother's occupation</i>	
Mother	242 (96.8)	Government job	23 (09.2)
Father	04 (01.6)	Labourer	01 (0.4)
Grand parents	04 (01.6)	Private job	08 (03.2)
		House wife	218 (87.2)
<i>Educational level of responder</i>		<i>Place of residence</i>	
Below Ordinary Level	35 (14.0)	Rural	10 (04.0)
Ordinary Level	92 (36.8)	Suburban	171 (68.4)
Advance Level	108 (43.2)	Urban	69 (27.6)
Higher education	15 (06.0)		
<i>Father's occupation</i>		<i>Monthly income level</i>	
Working abroad	15 (06.0)	Below 10000 LKR	05 (02.0)
Businessmen	35 (14.0)	10000-30000 LKR	91 (36.4)
Driver	22 (08.8)	30000-50000 LKR	79 (31.6)
Government job	60 (24.0)	Above 50000 LKR	75 (30.0)
Labourer	55 (22.0)		
Private job	63 (25.2)		

Table 3: Sleep time across age groups

Sleep time	1 month Mean ± SD	3 months Mean ± SD	6 months Mean ± SD	9 months Mean ± SD	12 months Mean ± SD
Nighttime (hrs.)	8.47 (±1.53)	8.40 (±1.47)	8.68 (±1.03)	8.59 (±1.18)	8.33 (±1.20)
Daytime (hrs.)	6.09 (±1.57)	4.02 (±1.68)	3.54 (±1.44)	2.65 (1.05)	2.57 (±1.12)
Total (hrs.)	14.26 (±2.12)	12.4 (±2.22)	12.2 (±1.92)	11.22 (±1.51)	10.87(±1.64)

Nocturnal, daytime, and total sleep duration showed high inter-individual variability in the first year of life. Nighttime sleep showed the highest mean value in 6-month-old babies. Daytime sleep tended to decrease significantly with increasing age. Overall, 100 (40%) babies had a total sleep duration within the recommended level of the NSF 2015 recommendations. About 120 (48%) babies had total sleep duration in the appropriate level and in 30 (12%) babies total sleep duration was not satisfactory compared to the NSF 2015 recommendations.

Table 4 shows details about group comparison of sleep duration. Total sleep durations of the 1 month, 3 month, 6 month, 9 month and 12 month age groups were compared using one way ANOVA. There was a significant difference of total sleep at the $p < 0.05$ level for five age groups [$F(4, 245) = 24.246, p < 0.05$]. There was no statistically significant differences in nighttime sleep between five age groups as determined by one-way ANOVA [$F(4, 245) = 0.594, p = 0.667$]. There was a statistically significant difference in daytime sleep between five age groups as determined by one-way ANOVA [$F(4, 245) = 52.485, p < 0.05$].

Table 4: Group comparison of the sleep durations

Age group	Compared age groups	Daytime sleep		Nighttime sleep		Total sleep	
		Mean ± SD	p value	Mean ± SD	p value	Mean ± SD	p value
1 month	3 months	4.02±1.68*	<0.05	8.40±1.47	1.0	12.4±2.22*	<0.05
	6 months	3.54 ±1.44*	<0.05	8.68±1.03	1.0	12.2±1.92*	<0.05
	9 months	2.65±1.05*	<0.05	8.59±1.18	1.0	11.22±1.51*	<0.05
	12 months	2.57±1.12*	<0.05	8.33 ±1.20	1.0	10.87±1.63*	<0.05
3 months	1 month	6.09±1.57*	<0.05	8.47±1.53	1.0	14.26±2.12*	<0.05
	6 months	3.54 ±1.44	0.928	8.40±1.47	1.0	12.2±1.92	1.00
	9 months	2.65±1.05*	<0.05	8.68±1.03	1.0	11.22±1.51*	0.01
	12 months	2.57±1.12*	<0.05	8.59±1.18	1.0	10.87±1.63*	<0.05
6 months	1 month	6.09±1.57*	<0.05	8.47±1.53	1.0	14.26±2.12*	<0.05
	3 months	4.02±1.68	0.928	8.40±1.47	1.0	12.4±2.22	1.0
	9 months	2.65±1.05*	.015	8.59±1.18	1.0	11.22±1.51	0.078
	12 months	2.57±1.12	0.06	8.33 ±1.20	1.0	10.87±1.63*	0.004
9 months	1 month	6.09±1.57*	<0.05	8.47±1.53	1.0	14.26±2.12*	<0.05
	3 months	4.02±1.68*	<0.05	8.40±1.47	1.0	12.4±2.22*	0.01
	6 months	3.54 ±1.44*	0.015	8.40±1.47	1.0	12.2±1.92	0.078
	12 months	2.57±1.12	1.0	8.59±1.18	1.0	10.87±1.63	1.0

* $p < 0.05$

Table 5 shows the changes in sleep duration and sleep variables across the ages. Total sleep bouts tended to decrease with increasing age but 6-month

old babies had higher sleep bouts than 3-month-old babies. Nighttime wakefulness decreased with increasing age.

Table 5: Sleep variables across age group

Sleep variable	1 month Mean (SD)	3 months Mean (SD)	6 months Mean (SD)	9 months Mean (SD)	12 months Mean (SD)
Number of sleep bouts	9 (1.78)	7 (1.91)	7 (1.50)	6 (1.49)	5 (1.29)
Average number of night awakenings	3 (1.09)	2 (1.51)	3 (.96)	2 (1.18)	2 (1.16)
Nighttime wakefulness (min)	125.7 (76.1)	68.0 (52.5)	59.80 (43.0)	46.90 (62.4)	49.60 (61.5)

Of the total parents 185 (74%) were satisfied and 65 (26%) dissatisfied about their baby’s sleep. We analysed the prevalence of parental perception about baby’s sleep as a problem and found that 66 (26.4%) infants were reported to have a problematic sleep. Common parent-reported sleep

problems were baby having poor daytime sleep, inadequate sleep and baby being sensitive to sounds.

Table 6 shows the sleep habits of the infants.

Table 6: Sleep habits of the infants (n=250)

Information	n (%)	Information	n (%)
<i>Sleeping arrangements</i>		<i>Sleep position</i>	
With parents in a separate room	199 (79.6)	On his/her belly	112 (44.8)
With other siblings	35 (14.0)	On his/her side	100 (40.0)
With another person	01 (0.4)	On his/her back	38 (15.2)
With grandmother	01 (0.4)		
With mother	14 (05.6)		
<i>Baby’s sleeping place</i>		<i>Making the baby sleep</i>	
On a bed	219 (87.6)	By mother	237 (94.8)
On a cot	20 (08.0)	By father	01 (0.4)
On a mattress on the floor	11 (04.4)	By grandparents	10 (04.0)
		By nanny	2 (0.8)
<i>Sleep initiation method</i>			
Breast feeding	164 (65.6)		
Being rocked	67 (26.8)		
Hold in arms	13 (05.2)		
Alone	06 (02.4)		

Factors affecting infant’s sleep

Some factors were compared with total sleep time by performing a t-test to identify the association between them. Our questionnaire included questions about the noises around the residences of the babies. Then we identified the noisy houses. Statistical test was performed between the babies who sleep in noisy houses and other houses. We compared gender, sleeping position and noises around the house with total sleep time. There was no significant difference in total sleep time between female and male babies (p=0.33). There was no significant difference between sleep duration and the sleep position (p=0.09) and there was no significant difference between sleep duration and noises around the house (p=0.90).

Discussion

As far as we know, this is the first cross-sectional study conducted on the sleep pattern during infancy in a Sri Lankan population. Cross-sectional studies have shown that nighttime sleep is a major developmental task of infancy¹⁴. There is a positive connection between sleep, memory, language, executive function and overall development in

typically developing infants¹⁵. We found that nocturnal, daytime, and total sleep duration showed high inter-individual variability in infancy. Nighttime sleep showed the highest mean value in 6-month-old babies. Daytime sleep tended to decrease with increasing age. Total sleep duration decreased with increasing age from 14.26 hours at 1 month to 10.87 hours at 12 months. One main result of our study was that 12% of infants did not have sufficient sleep duration as per NSF recommendations. Our data showed that nighttime wakefulness decreased with increasing age. Total sleep bouts tended to decrease with increasing age but 6-month-old babies had higher sleep bouts than 3-month-old babies. We found that nighttime awakening tended to remain stable during infancy, the mean number of nighttime awakenings varying from 2 episodes per night at 3 months to 2 episodes per night at 12 months. Our data showed that 74% parents were satisfied about their baby’s sleep whilst 26% parents were dissatisfied about their baby’s sleep. We analysed the information about sleeping habits of the infants. Out of 250 infants 79.6% were reported to sleep with parents in a separate room whilst 14% were sleeping with their

siblings. Overall 87.6% of infants were sleeping on a bed and 8% in a cot.

Only 2.4% of infants fell asleep alone, 97.6% of the babies needing support to fall asleep (breast feeding, holding and rocking). Considering sleep position, 44.8% of infants slept on his/her belly, 40% slept on his/her side and 15.2% slept on his/her back. In 94.8%, infant's sleep was made by the mothers. Gender, sleeping position and noises around the house were compared with total sleep time by performing independent sample t-test to identify the association between them. There was no significant difference in total sleep time between female and male babies ($p=0.33$). Sleep duration was not affected by gender. There was no statistically significant difference between sleep duration and the sleep position ($p=0.09$) and no statistically significant difference between sleep duration and noises around the house ($p=0.90$).

A South Korean medical team had conducted research regarding sleep patterns in infants and toddlers¹⁶. Their results indicated that sleep patterns changed with the increasing age of the child. Total sleep decreased with increasing age. Daytime sleep duration and nocturnal awakenings decreased with increasing age whilst nighttime sleep duration and longest sleep episode both increased¹⁶. In our study we found the same trend. We observed that total sleep decreased with increasing age from 14.26 hours at 1 month to 10.87 hours at 12 months and daytime sleep decreased significantly with increasing age. A study in Italy reported that nighttime awakening tended to remain stable during infancy, the mean number of nighttime awakening varying from 1.1 episodes per night for 3-month-old infants to 1.4 episodes for 12-month-old infants⁷. In our study we observed a similar trend with the mean number of nighttime awakenings being 2 at both 3 and 12 months. Many studies showed that parents of infants who bed-share reported an increased number of awakening when compared with solitary-sleeping infants^{7,17}. However, in our sample we could not analyse that trend because the majority of the infants slept with parents in a separate room. Studies done in Canada regarding infants' sleep have found that, there was no significant difference in sleep duration between girls and boys^{18,19}. We also found in our study that there was no significant difference in total sleep time between girls and boys.

Conclusions

There was a statistically significant difference of total sleep for the five age groups. There was a statistically significant difference in daytime sleep between five age groups. Total sleep duration of

most infants was adequate according to the NSF recommendation.

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