Factors influencing sleeping pattern of infants

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Many families apply to pediatricians with complaints of sleep problems of their infants. It is very important to inform families about the sleep pattern of infants and factors influencing it, and to answer their questions about infantile sleep.

A questionnaire was given to 165 families to elucidate the factors influencing continuous sleep pattern of the baby. Our study demonstrated that 50% of four-month-old and 96% of nine-month-old infants acquired continuous sleep pattern. Our figures were compatible and even higher than those in the literature.

None of the factors studied has an independent effect on infantile continuous sleep pattern in multifactorial analysis. Early weaning does not facilitate acquisition of continuous sleep pattern by the baby. This will help to support prolonged breast-feeding. It may be advisable not to keep children beside their mother during sleep for a long period of time. Care of the children by the maternal grandmother may facilitate their acquisition of continuous sleep pattern.

Key words: infants, sleep pattern.

Many families apply to pediatricians with complaints of sleep problems of their infants. Sleepless nights make the lives of parents less joyful and lead to loss of working power. The parents fell anxious about their baby because they think he is sick. Therefore, it is very important to inform families about the sleep pattern of infants and factors influencing it, and to answer their questions about infantile sleep.

There are several international studies about sleep pattern of babies[1-4]. However, there are no such studies in our country. In order to help parents deal with their infant's sleeping problems, one has to know when the infants will acquire continuous sleep and how long they will sleep every day normally.

There are many factors, especially those related to feeding pattern, influencing acquisition of continuous sleep pattern. Early weaning has been related to a prolonged nighttime sleep pattern; however, breast-fed babies also acquire continuous sleep pattern early[5-8].

This study was undertaken to investigate the possible factors influencing acquisition of continuous sleep pattern by infants.

Material and Methods

This study was conducted on 165 families that had children aged 9-15 months and who applied to the Department of Pediatrics at Başkent University between November 2000 and February 2001. One hundred and seventy-two mothers were asked to complete a questionnaire, and 165 (97%) consented. The questionnaire included questions about mother's and father's age, education level, employment, place of employment, maternal leave, birth weight, sex, number of other children under five years o age, breast-feeding duration (only & total), history of formula feeding, the place where the baby slept, person involved in day- and night-care of the baby, the methods used to put the baby to sleep, and the time the baby acquired continuous nighttime sleep.

'Continuous nighttime sleep' was defined as a continuous five hours of sleep at night[2,4,5]. Only breast-feeding time was defined as exclusive breast-feeding time and total beast-feeding time was defined as the period between the start of breast-feeding and its termination[9].

The feeding groups were defined as follows:

Group 1: Formula Group : Infants who received formula, whose only breast-feeding time was less than four months, and whose total breast-feeding time was less than six months.

Group 2: Beast-feeding Group : Infants whose only breast-feeding time was ≥4 months, whose total breast-feeding time was ≥6 months, and who started formula feeding at or after four months of age.

Group 3: Breast-feeding and Formula Group : Infants whose total breast-feeding time was ≥6 months, and who started formula feeding before 4 months of age.

Group 4: Babies who slept in mother's bed and baby's bed, and who never slept in separate room.

Group 5: Babies who slept in mother's bed, baby's bed, and separate room.

Group 6: Babies who slept in mother's bed and separate room, and who never slept in baby's bed.

Group 7: Babies who slept in baby's bed and who never slept in mother's bed or in separate room.

Lullaby, rocking on the legs/feet or swinging in a blanket are described as traditional methods, whereas mother's bosom and music are named as modern methods to put the baby to sleep.

The results were statistically analyzed using SPSS 10.0 Kruskal-Wallis analysis of variance, Mann-Whitney U test, chi-square test and multiple logistic regression were used for statistical analysis. The significance was taken as p=0.05.

Table I. Characteristics of mothers

Characteristics	n	%
Age (n=165)		
≤24	10	6
25-29	83	50
30-34	61	37
≥35	11	7
Education level (n=165)		
High school	65	39
University	100	61
Employment (n=165)		
Unemployed	74	45
Employed	91	55
Occupation (n=91)		
Private sector	50	55
Government sector	38	42
Private job	3	3
Maternal leave period (n=91)		
≤8 weeks	26	29
9-15 weeks	39	42
≥16 weeks	26	29

Results

The various characteristics of the mothers and fathers are given in Tables I and II. The characteristics of the infants are given in Table III. All babies were term infants. Feeding characteristics of babies are shown in Table IV.

Table II. Characteristics of mothers

Characteristics	n	%
Age (n=165)		
≤24	3	2
25-29	35	21
30-34	99	60
≥35	28	17
Education level (n=165)		
High school	50	30
University	115	70
Occupation (n=91)		
Private sector	48	29
Government sector	85	52
Private job	32	19

Table III. Characteristics of infants

Characteristics	n	%
Age (n=165)		
9 months	34	20
10 months	39	24
11 months	21	13
12 months	27	16
13 months	13	8
14 months	11	7
15 months	20	12
Birth weight (gr) (n=165)		
≤2800	8	5
2801-3500	105	64
3501-4000	43	26
>4000	9	5
Type of birth (n=165) cesarean section		
Cesarean section	98	59
Vaginal	67	41
Planned/Unplanned (n=165)		
Planned	144	87
Unplanned	21	13
Birth order		
First baby	82	50
Second baby	75	45
Third baby	8	5
Sibling <5 years of age (n=165)		
0	133	80
1	31	19
2	1	1

The time of acquisition of continuous nighttime sleep is given in Table V.

Mother's age, education, employment condition, maternal leave period, father's age, education, occupation, baby's sex, birth weight, type of birth, baby's being planned/unplanned, order of birth, or presence of sibling under five years of age did not significantly influence the acquisition of continuous sleep pattern by the baby (chi-square test, $p>0.05$).

Table IV. Characteristics of infants

Characteristics	n	%
Breast-feeding (n=165)		
Yes	140	85
No	25	15
Only breast-feeding (n=140)		
<4 months	29	21
≥4 months	111	79
Total breast-feeding (n=140)		
<4 months	29	21
4-6 months	29	21
>6 months	82	58
Formula (n=95)		
Yes	95	58
No	70	42
Start of formula		
<4 months	86	91
≥4	9	9

Table V. Distribution of the time of acquisition of continuous nighttime sleep

Continuous 5-hour sleep (months)	n	%	Cumulative %
2	13	7.9	7.9
3	35	21.2	29.1
4	34	20.6	49.7
5	17	10.3	60.0
6	18	10.9	70.9
7	23	13.9	84.8
8	14	8.5	93.3
9	5	3.0	96.4
10	1	0.6	97.0
12	1	0.6	97.6
13	3	1.8	99.4
14	1	0.6	100.0
Total	165	100.0	100.0

Forty-four percent (22/50) of infants of mothers working in private sector, 63% (24/38) of infants of mothers working in government sector and 0% (0/3) of infants of mothers working at a private job attained continuous sleep pattern at or before four months of age. The "private job" group was combined with the private sector group for statistical analysis. This difference was significant (chi/square test, $\chi^2=4.15$, $p=0.042$). The infants of mothers working in the government sector attained continuous sleep pattern significantly earlier than those of mother's working in the private sector.

Sixty percent (15/25) of non-breast-fed infants and 48% (67/140) of breast-fed infants attained continuous sleep pattern at or before four months of age. This difference was not significant (chi-square, $\chi^2=1.251$, $p=0.263$).

The differences between continuous sleep patterns of infants according to the sleep period in mother's bed were found to be statistically significant. The differences between sleep patterns of infants who never slept in their mother's bed and those who slept for four months or longer was significant ($p<0.05$), whereas the 1-3 month group was not significantly different from the other two groups ($p>0.05$) (Table VI).

The relation between acquisition of a continuous five-hour sleep pattern and only- and total breast-feeding times is shown in Table VI.

Fifty-three percent (37/70) of non-formula-fed infants and 47% (45/95) of formula-fed infants acquired a continuous sleep pattern at or before four months of age. This difference was not statistically significant (chi/square test, $\chi^2=0.486$, $p=0.486$).

The comparison of continuous sleep patterns of infants according to feeding groups was statistically nonsignificant ($p>0.05$) (Table VII).

The differences between continuous sleep patterns of infants according to the sleep condition were found to be statistically significant ($p<0.05$) (Table VIII). Mann-Whitney U test was used to analyze intergroup differences. The groups that were found to be significantly different from each other are: Group 1-Group 2, Group 1-Group 7, Group 2-Group 3, Group 3-Group 5, Group 3-Group 7 ($p<0.05$).

The differences between continuous sleep patterns of infants according to the day- and night-care were found to be statistically significant (chi-square test, $\chi^2=16.871$, $p=0.002$). Mother/mother group was significantly different from maternal grandmother (MG/mother and Mg/Mg groups; mother/MG group was significantly different from paternal grandmother (PG)/mother group; Mg/

Table VI. Relation between continuous sleep pattern and only and total breast-feeding times and sleep period in the mother's bed

		Continuous 5-hour sleep pattern			
		≤4 months	>4 months	Total	Statistics
Only breast-feeding time	<4 months	8 (28%)	21 (72%)	29	chi-square, χ^2=6.023, p=0.014
	≥4 months	59 (53%)	52 (47%)	111	
Total breast-feeding time	≥6 months	59 (54%)	51 (46%)	110	chi-square, χ^2=6.871, p=0.009
Sleep period in mother's bed	0	65 (56%)	51 (44%)	116	chi-square, χ^2=7.169, p=0.028
	1-3 months	13 (40%)	20 (60%)	33	
	≥4 months	4 (25%)	12 (75%)	16	

Table VII. Comparison of continuous sleep patterns of infants according to feeding groups (analysis of variance, F=0.773, p=0.463)

Feeding groups	n	Mean of acquisition of continuous 5-hour sleep (month)±SD
1	54	5.44±2.42
2	79	5.14±2.60
3	32	4.78±1.84
Total	165	5.17±2.41

SD : Standard deviation.
Group 1: Formula group.
Group 2: Breast-feeding group.
Group 3: Breast-feeding and formula group.

Table VIII. The effect of sleep conditions on continuous sleep pattern (Kruskal Wallis analysis of variance, χ^2=15.862, p=0.015)

Sleep contiditons (group)	n	Continuous 5-hour sleep (mean ranks)
1	7	122.93
2	83	75.09
3	5	137.50
4	14	96.00
5	23	85.89
6	7	88.86
7	26	75.88
Total	165	

mother group was different from PG/mother group; and MG/MG group was different from PG/mother group (p<0.05). PG/mother and mother/mother groups obtained the worst results regarding acquisition of a continuous 5-hour sleep pattern (Table IX).

The differences between continuous sleep patterns of infants according to the methods used to put the baby to sleep were not found to be statistically significant (Table X).

The following factors were included in the multifactorial analysis of continuous sleep pattern: 1. mother's age, 2. mother's employment, 3. maternal leave period, 4. planned baby or not, 5. only breastfeeding time. None of these factors significantly influenced continuous sleep pattern independently (p>0.05) (Table XI).

Table IX. Effect of day-and night-care on continuous 5-hour sleep (chi-square tes, χ^2=16.871, p=0.002)

Day/night care	Continuous 5-hour sleep ≤4 months	Continuous 5-hour sleep >4 months	Total
Mother/Mother	10	19	29
Mother/MG	7	5	12
Mother/PG*	1	2	3
MG/Mother	44	27	71
MG/MG	10	4	14
MG/PG*	0	1	1
PG/Mother	4	16	20
PG/MG*	2	1	3
PG/PG*	0	3	3
PG/Babysitter*	0	1	1
Babysitter/Mother*	4	3	7
Babysitter/Babysitter*	0	1	1
Total	82	83	165

* Groups were omitted during statistical analysis because of low numbers in groups. The possible groups without members were not tabulated.

MG: maternal grandmother. PG: paternal grandmother.

Table X. Effect of methods used to put baby to sleep on continuous sleep pattern (chi-square test, χ^2=4.66, p=0.198)

Traditional and/or modern methods	Continuous 5-hour sleep ≤4 months	Continuous 5-hour sleep >4 months	Total
Traditional (no) Modern (no)	15	10	25
Traditional (yes) Modern (yes)	15	8	23
Tarditional (no) Modern (yes)	19	22	41
Traditional (yes) Modern (no)	33	43	76
Total	82	83	165

Table XI. Results of multifactorial analysis of factors related to continuous 5-hour sleep pattern

Variable	B	Standard error	Significance	Exp (B)
1	-0.0008	0.0466	0.9856	0.9992
2	-0.2927	0.4825	0.5440	0.7462
3	0.0232	0.0280	0.4072	1.0235
4	-0.0005	0.4913	0.9992	0.9995
5	0.0360	0.0901	0.6896	1.0366
Constant	-0.1211	1.4530	0.9336	

Discussion

The acquisition of continuous nighttime sleep is an important developmental milestone for the infant. It is generally accepted that a regular sleep pattern has been attained by the baby when he/she sleeps continuously for 5-6 hours at night. As the diurnal sleep rhythm is acquired, daytime sleep moves towards the night and the expected sleep pattern is attained. Every baby reaches this stage at different times. Although some indicate that this rhythm can be acquired as early as two weeks after birth, the general acceptance is around six weeks[2].

According to one study, 35% of babies under three months of age could sleep continuously for five hours at night; this figure increased to 72% by 9-12 months of age. However, another study indicated that 60-70% of 3-4-month-old infants attained a continuous sleep pattern[10,11]. Our study demonstrated that 50% of four-month-old and 96% of nine-month-old infants acquired a continuous sleep pattern. Our figures were compatible and even higher than those in the literature.

It must be stressed that our study group included selected families, because these parents had a higher education level than seen in the rest of the country. Forty percent of the mothers had high school education and 60% had a university degree. Thirty percent of the fathers had high school education and 70% had university degree. It is obvious that our study group does not represent our population. However, the educational level of the mothers and fathers does not significantly influence the regular sleep pattern of infants. There are studies in the literature indicating the presence and absence of effect of parental education on infantile sleep pattern[12-14].

Fifty-five percent of our mothers were working mothers, and 55% of these worked in the private sector. In our previous study, we showed that mothers working in the government sector and in their own jobs had a longer maternal leave period and could breast-feed longer than those working in the private sector[15]. Since mothers working in their own job made up a very small group they were included in the private sector for statistical analysis. Mother's occupation significantly influenced acquisition of continuous sleep by the baby. The infants of mothers working in the government sector attained continuous sleep significantly earlier than those of mothers working in the private sector. However, maternal leave period did not significantly influence sleep pattern of infants.

Parallel to our study, several studies proved that sex of infant, birth weight, type of birth, order of birth, and presence of brother or sister younger than five years of age did not significantly influence infantile continuous sleep pattern[2,6,10].

Unplanned babies made up 13% of the study group. However, this factor did not significantly affect sleep pattern neither in uni- nor in multifactorial statistical analysis. It is well known that sensory stimuli by the parents and their close relationship with their baby is very important in acquisition of diurnal rhythm and sleep pattern[16]. This relationship may be weak in unplanned babies. Thus our figures may change by increasing the number of subjects in the study group.

The most important result of our study is the insignificant difference between sleep patterns of feeding groups (breast-feeding group, formula-fed group, and group with both breast-feeding and formula). Several uncontrolled studies in the literature have indicated that early weaning facilitated acquisition of continuous sleep pattern[5-8]. Clinical experiences show that many parents start supplementary food early with the expectation of early sleep pattern. However, the American Academy of Pediatrics and WHO suggest that supplementary food must be postponed until 4-6 months of age[9]. Furthermore, there are several studies indicating lack of effect of supplementary food upon sleep pattern[17-21].

Our study revealed that developmental and adaptive procedures rather than the nutritional composition are effective in determining the acquisition of a continuous sleep pattern. The most important factor determining nighttime awakenings of the baby has been demonstrated to be attitudes of the parents[22]. It has been

indicated that babies who are instantaneously handled by the parents upon awakening wake up more frequently, learn to wake up, and repeat it. The babies may wake up during REM sleep, but continue to sleep if not handled by the parents. It has also been shown that babies who lie next to their parents before falling asleep wake up more frequently, and that as the baby is handled by the parents with behaviors such as rocking, holding or feeding, they will be unable to fall asleep alone[23-24]. Because all mothers indicated that they were with their babies before they fall asleep, we could not investigate it as a possible factor in sleep pattern.

Our results also revealed that babies sleeping beside their mothers acquire continuous sleep pattern late. This appears to be due to the increased body temperature of the baby because of the presence of the mother[4,25].

Grandmothers are very important figures in childcare in our country. We could not find a study on breast-feeding times and sleep patterns of babies who were cared for by their grandmothers. However, the PG may increase the stress of the mother, compared to the MG. According to our results, babies cared for by the PG acquired continuous sleep pattern significantly later than those cared for by the MG. This subject is important in our country and requires further research.

There is a need for studies on continuous sleep patterns of babies in our country, which are conducted on a sufficient number of families of different sociocultural levels, where mothers are asked to fill in a 24-hour diary for their baby. Such studies give better results if they are prospective, rather than retrospective.

In conclusion, none of the factors studied has an independent effect on infantile continuous sleep pattern in multifactorial analysis. Early weaning does not facilitate acquisition of continuous sleep pattern by the baby. This will help to support prolonged breast-feeding. Furthermore, sleeping babies away from their mothers for a long period of time, and care by the MG may facilitate their acquisition of a continuous sleep pattern.

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