

Irregular Sleep Habits of Parents Are Associated with Increased Sleep Problems and Daytime Sleepiness of Children

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Longitudinal studies in Japan indicate that nocturnal sleep onset has become later and sleep duration has been progressively shortened. This study aimed to investigate the relationship between sleep patterns and sleep problems among children, and to determine the association between parents and their children's sleep habits. Questionnaires about sleep problems and life habits were administered to families living in Tokyo metropolitan areas of Japan. We analyzed the data of pre-school-age (1-5 years old; $n = 319$, including 175 girls) and elementary school-age children (6-11 years; $n = 217$, including 116 girls) as well as their parents (402 mothers: 37.0 ± 4.9 years, 402 fathers: 39.0 ± 5.9 years). Subjects were categorized as morning (evening) type when they answered their lifestyle habit as "definitely or moderately morning (evening) type". Sleep was categorized into regular, irregular, and intermediate from the sleeping-waking regularity scores. The frequency of daytime dozing is significantly high in children with evening-irregular sleep. Moreover, mothers of children (aged 1-5 and 6-11 years) with evening-irregular sleep have significantly more irregular sleep habits than those of children with morning-regular sleep. Likewise, fathers of children (aged 1-5 years) with evening-irregular sleep have significantly more irregular sleep habits. Thus, irregular late bedtime of parents is associated with sleep problems, daytime sleepiness, and irregular dietary habits of children. Mothers' sleep habits have a stronger influence on their children's sleep than fathers'. Our study indicates the importance of promoting sleep hygiene that encourages healthy sleep for all family members. ——— sleep hygiene; irregular sleep schedule; parent; limit setting; children.

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Longitudinal studies in Japan indicate that nocturnal sleep onset has become later and sleep duration has progressively decreased (NHK Broadcasting Culture Research Institute 2006). An epidemiological study showed that the prevalence of sleep problems in the general Japanese population was comparable to that reported in Western countries, and that lifestyle and multiple psychological factors are associated with sleep problems (Kim et al. 2000).

These tendencies are true not only for adults, but also for children. The nocturnal sleep onset of children has become progressively later in Japan (Kohyama et al. 2002). It is considered possible that both late bedtime and shortened sleep duration might have deleterious effects on the development of children. Irregular sleeping-waking schedules affect cognition and memory (Dahl 1996), and a chronic lack of sleep or sustained sleeplessness has negative effects on children's cognitive abilities (Bonnet 1993). Recent research has verified the correlation between irregu-

lar sleeping-waking schedule and children's inability to copy triangular figures, which suggested that sleep-related problems were related to the integration of cognitive and motor activities (Suzuki et al. 2005). Meijer et al. (2001) indicated a strong relationship between sleep quality and mental health characteristics in pre-adolescents.

Several factors were reported to negatively correlate with sleep patterns of both children and adolescents (Tazawa and Okada 2001; Ohida et al. 2004; Van den Bulck 2004; Gaina et al. 2006). Media use habits, such as television viewing, playing computer games, and internet use, led to delayed bedtime among children (Tazawa and Okada 2001; Van den Bulck 2004; Gaina et al. 2006). The International Classification of Sleep Disorders (2nd edition) indicates that inadequate limit setting by parents or caregivers may lead to delayed sleep onset in children (American Academy of Sleep Medicine 2005). However, the relationship of sleep patterns between children and their parents has not yet been

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clarified.

The first aim of the present study was to investigate the relationship between sleep patterns and sleep problems among children living in metropolitan areas of Japan by comparing morning-regular-type and evening-irregular-type of sleeping-waking schedule among children. The second aim was to clarify any association between the sleep habits of parents and their children.

Methods

Subjects and Procedure

This study was approved by the Ethical Committee of National Institute of Mental Health. The eligible criteria were all of the following: (1) families living in Tokyo metropolitan areas (Tokyo, Kanagawa, Saitama, and Chiba), (2) families living separately from grandparents, (3) families consisting of the mother, father, and at least one child. The aim of this study was explained and the anonymity of all subjects was assured in writing.

The questionnaires to be returned by post, were distributed to families who visited a baby-day-care center, children's house, children's center library, nursery, and kindergarten, and were then collected a few days later by post. If subjects did not answer all the questions, were being treated for disease, or if all members of the family did not answer the questionnaire responses were not included in the analysis. The mean age \pm S.D. of the mother was 37.0 ± 4.9 years old (range: 30-49 y; $n = 402$), that of the father was 39.0 ± 5.9 years old (range: 30-62 y; $n = 402$), and that of the children was 7.0 ± 4.4 years old (range: 0-21 y; $n = 649$). The data regarding pre-school age (1-5 years old; $n = 319$) and elementary school-age children (6-11 years old; $n = 217$) were analyzed in the present study.

Subjects were asked to fill in a questionnaire relating to their sleep problems and habits for the previous month. The questionnaire was a slightly modified version of questionnaires used in previous studies (Komada et al. 2001; Tanaka and Shirakawa 2004). That is, we omitted the items about both hypnotics and nightcap for the children's version, and inserted items about naps (scheduled sleep during daytime), dozing (falling asleep unintentionally), and dietary habits. Questions about naps and dozing had four possible categories (i.e., frequently, sometimes, occasionally, and never). Questions about dietary habits: breakfast, lunch, supper, and late-night snacks, respectively; had three possible categories (i.e., everyday, occasionally, and rarely). We prepared 2 versions of the questionnaire, one for adults and one for children, were arranged. Subjects completed a multiple-choice questionnaire answer sheet which was computer scored. Mothers or fathers answered on behalf of preschool-aged children who were not literate.

Outcome variables

The answer to each question was given points weighted according to the method of Tanaka and Shirakawa (2004). They used factor analysis, and determined five factors of sleep problems: (1) sleep maintenance problems (based on intermittent waking, feeling of sound sleep, frequency of nocturnal urination, and early morning awakening), (2) parasomnia-like problems (based on nocturnal partial arousals, sleep paralysis (kanashibari), vivid nightmares and abnormal limb movement), (3) sleep apnea (based on snoring, and sleep breathing pattern), (4) difficulty in waking up (from the item of difficulty waking up and getting out of bed), (5) difficulty in falling asleep (from the

item of sleep latency); and sleep problem scores (total score of factor 1 to factor 5) were calculated. Higher scores indicated more serious problems.

The regularity of sleep habits is defined below. The answer for each question; bedtime regularity, wake-up time regularity, and sleep length regularity; was given points "definitely irregular" - 3 points, "moderately irregular" - 2 points, "moderately regular" - 1 point, and "definitely regular" - 0 point. Thus, the regularity of sleep habits was scored from 0 to 9 points and categorized as regular, irregular, and intermediate accordingly. The regular group was the lower 1/3 of the scores (0 point), and the irregular group was the upper 1/3 of the scores (5 points and above).

Morning-evening type of lifestyle habit was determined based on the answer to the question, "Which type do you belong to?". Subjects were categorized as morning type if they answered moderately morning type; conversely, they were categorized as evening type if they answered definitely moderately evening type.

Children were classified into morning type with regular sleep habits (M-Re), evening type with irregular sleep habits (E-Ir), or intermediate type. We analyzed data for the group aged 1-5 years (pre-school-age children, $n = 319$), and the 6-11-year-old group (elementary school aged children, $n = 217$). There were no differences related to age in M-Re and E-Ir children (M-Re of 1-5 y: $n = 47$, E-Ir of 1-5 y: $n = 15$, M-Re of 6-11 y: $n = 25$, E-Ir of 6-11 y: $n = 12$).

Statistical analyses were performed using Stat View 5.0 software (SAS Institute Inc., Cary, NC). The Mann-Whitney U test was used to compare M-Re and E-Ir types. The results were presented as means \pm standard deviation (S.D.).

Results

Sleep schedule and sleep duration

Sleep behaviors (bedtime on weekdays and weekends, waking-up time on weekdays and weekends, sleep length on weekdays and weekends) for each age group are shown in Table 1. Both bedtime and waking-up time are delayed on average on the weekends compared to weekdays in each age group. Sleep length on weekends is longer than that on weekdays in both groups.

Comparison of sleep problems, daytime sleepiness, and dietary habits between the M-Re and E-Ir groups

Sleep problems were compared between M-Re and E-Ir in the age 1-5 and age 6-11 groups. Difficulty in waking up was significantly higher in E-Ir than M-Re in both the 1-5 y ($p < 0.001$) and 6-11 y ($p < 0.001$) groups. There were no significant differences in sleep maintenance problems, parasomnia-like problems, sleep apnea, and difficulty in initiating sleep between the two groups in each age category. The total sleep problem score in the E-Ir group was higher than in the M-Re group (1-5 y: $p < 0.05$, 6-11 y: $p < 0.01$). The E-Ir group dozed more during the daytime than the M-Re group in both the age 1-5 ($p < 0.05$) and 6-11 ($p < 0.01$) groups.

There were significant differences in dietary habits between the M-Re and E-Ir groups. Many more E-Ir children skipped breakfast than in the M-Re group in both the 1-5 y ($p < 0.0001$) and 6-11 y ($p < 0.01$) groups. The num-

Table 1. Sleep behavior in each age group.

		1 - 5 y (n = 319)			6 - 11 y (n = 217)		
		mean	S.D.	range	mean	S.D.	range
Bedtime	Weekdays	9 : 04 _{PM}	54 min	6 : 00 _{PM} - 1 : 30 _{AM}	9 : 25 _{PM}	47 min	7 : 30 _{PM} - 1 : 00 _{AM}
	Weekends	9 : 25 _{PM}	58 min	6 : 00 _{PM} - 2 : 00 _{AM}	9 : 51 _{PM}	58 min	7 : 30 _{PM} - 1 : 30 _{AM}
Waking up time	Weekdays	7 : 09 _{AM}	36 min	5 : 30 _{AM} - 10 : 00 _{AM}	6 : 54 _{AM}	31 min	4 : 50 _{AM} - 8 : 20 _{AM}
	Weekends	7 : 38 _{AM}	47 min	5 : 30 _{AM} - 10 : 30 _{AM}	7 : 36 _{AM}	56 min	4 : 50 _{AM} - 11 : 30 _{AM}
Sleep length	Weekdays	9.8	0.94	7.5 - 13	9.3	0.74	7 - 11
	Weekends	10.1	0.95	6.5 - 13.5	9.7	0.82	7 - 12.5

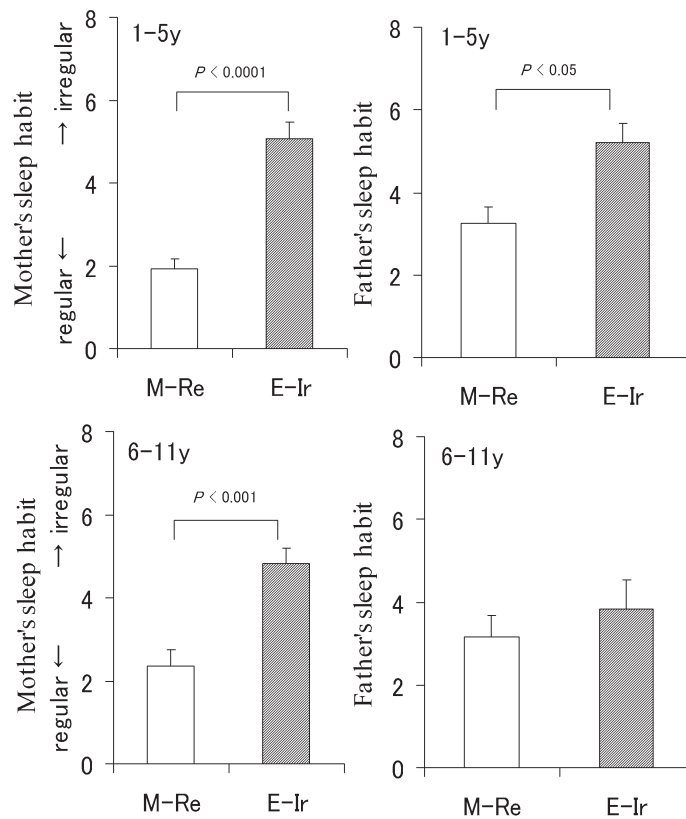


Fig. 1. Comparison of parents' sleep regularity between morning-regular and evening-irregular of the sleeping-waking schedule of children.

ber of children without supper ($p < 0.05$) and with late-night snacks ($p < 0.05$) was significantly greater in the E-Ir than M-Re children in the 1-5 y group.

Comparison of parents' sleep habits between the M-Re and E-Ir groups

Mothers of E-Ir-type children with go to bed and wake up later than those of M-Re-type children (1-5 y, bedtime of mother: M-Re 23:09 ± 1:34 vs E-Ir 23:57 ± 1:14, $p = 0.06$; waking-up time: M-Re 6:14 ± 0:48 vs E-Ir 6:46 ± 0:30, $p < 0.05$; 6-11 y, bedtime of mother: M-Re 23:05 ± 1:28 vs E-Ir 0:12 ± 1:17, $p < 0.05$; waking-up time: M-Re 6:06 ± 0:54 vs E-Ir 6:26 ± 0:35, ns). On the other hand, there is no difference between father's bedtime, waking-up time, and sleep

length between M-Re-type children and E-Ir-type children (1-5 y, bedtime of father: M-Re 0:06 ± 1:34 vs E-Ir 0:13 ± 1:13, ns; waking-up time: M-Re 6:37 ± 1:05 vs E-Ir 6:40 ± 0:44, ns; 6-11 y, bedtime of father: M-Re 23:48 ± 1:25 vs E-Ir 0:00 ± 1:21, ns; waking-up time: M-Re 6:29 ± 1:00 vs E-Ir 6:13 ± 0:43, ns).

Regularity of sleep habits (bedtime, waking-up time, and sleep length) of parents are shown in Fig. 1. Mothers of E-Ir-type children have significantly more irregular sleep habits than those of M-Re-type children (age 1-5 y, $p < 0.0001$; age 6-11 y, $p < 0.001$). Moreover, fathers of E-Ir-type children aged 1-5 y have significantly more irregular sleep habits than those of M-Re-type children ($p < 0.05$). There is no difference between the aged 6-11 y groups.

Discussion

We set out to determine whether parental sleep habits affect the sleeping pattern of their children and whether we could identify any pattern of influence of the former on the latter. We represented children's sleep behavior categorized as 1-5 y and 6-11 y age groups. The bedtime of children in Japan is late, compared to a U.S. national survey conducted by the National Sleep Foundation (National Sleep Foundation 2004). The waking-up time and sleep length of those of U.S. children aged 1-5 and 6-10 was relatively later and longer than in our Japanese sample. The mean sleep duration of both junior high school students and high school students in Japan was also estimated to be shorter than that in the U.S. and China (Ohida et al. 2004). The results of these studies imply that greater bedtime discipline at home during childhood is required, especially in Japan.

The evening-irregular sleep habits had deleterious effects on the sleep of children and the frequency of daytime dozing was high in this group. Moreover, this study showed that children with evening-irregular sleep habits tended to skip breakfast (both 1-5, and 6-11 groups) and supper (1-5 group), and the 1-5 group also had more frequent late-night snacks. It has been reported that late bedtime and short sleeping hours are related to obesity in children (Kagamimori et al. 1999; Sekine et al. 2002). A previous study indicated a relationship between eating habits and sleep problems, i.e. the rate of poor sleepers among those who only occasionally ate breakfast was relatively high (Ohida et al. 2004). Recently it has been suggested that there is a relationship between intestinal motility, namely bowel habits, and sleep problems (Ono et al. 2004). Since intestinal motility has circadian rhythms as well as sleeping-waking cycles, it is possible that there are certain relationships between gastrointestinal tract function, especially intestinal motility, and sleep problems. There are many children who feel half-awake and cannot pay attention during school hours, especially during their midmorning class. The Ministry of Education, Culture, Sports, Science and Technology in Japan views this as a serious problem. The Ministry has begun a campaign to raise awareness of the importance of early-to-bed and early-to-rise as well as the importance of breakfast for elementary school students and their parents. Our study supports the importance of promoting sleep hygiene by encouraging healthy sleep for all family members.

We have already reported that wives and husbands in families interact with one another in their sleep problems and habits (Komada et al. 2002). Both wives and husbands whose partners showed a higher score of sleep problems also had poor sleep. On the other hand, sleep habits of husbands affected the sleep of their wives, but the sleep habits of wives did not affect their husband's sleep. The influences of husbands' sleep on wives' sleep are thought to be predominant. In the present study, there were no significant differences in the fathers' sleep habits between morning-

regular and evening-irregular of sleeping-waking schedule, although mothers' sleep quality was correlated with the sleep quality of their children. That fathers' sleep quality had no correlation with their children's sleep patterns may be a Japanese cultural particularity. We want to emphasize that establishment of regular sleeping-waking rhythms during childhood is a crucial issue, and thus it is important to recognize the effect of parental sleep habits on children's sleep habits and problems.

This study has some limitations. First, the sample is a confined group, living in metropolitan Japan. Recruitment and sampling should be reconsidered in future studies. Second, the classification of morning-evening type, and regularity of sleep was from subjective assessment by children's parents. It would be useful to reassess this classification using specific questionnaires. In the present study, we combined morning-evening and regular-irregular variables, since irregular late bedtime has been acknowledged as a problem in Japan. However, we should approach factors separately to determine which has more influence on sleep and development of children. Third, we were not able to determine either work style or working hours of the children's parents using our questionnaire. The problem of long working hours is currently serious in Japan. Future study is needed to investigate the relationship between sleep problems of children and the work style of their parents.

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