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Relationship of preschoolers' chronotype with parental sleep habits and consideration of sleep behavior

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ABSTRACT

[Objective] Chronotypes reflect individual differences in circadian rhythm phases. Studies on children's chronotypes, health, and behavior exist; however, the relationship between children's chronotypes and parental sleep habits remains unknown. Therefore, we aimed to investigate the relationship between the chronotypes of preschool children and their parents' sleep habits.
[Methods] From October 2020 to November 2020, we conducted a survey on the sleep habits and sleep-conscious behaviors of preschool children and their parents in Iwate Prefecture. We used the Japanese version of the children's chronotype questionnaire to investigate morning, intermediate, and evening chronotypes in parents of preschoolers aged 3–5 years. A sleep quality index evaluation sheet was used to assess parents' sleep patterns. We compared parental sleep habits and sleep-conscious behaviors among the three chronotypes.
[Results] The morning, intermediate, and evening chronotypes accounted for 24.8%, 58.6%, and 16.6% of the children's chronotypes, respectively. The weekday bedtime, sleep onset time, sleep center time, and weekend wake-up time of parents were related to the central sleep duration on weekends. Parents of evening-chronotype children demonstrated a post-phase sleep-wake rhythm. They experienced difficulties in maintaining the motivation necessary to accomplish tasks Moreover, these parents practiced poor sleeping habits, such as "opening the curtain and permitting light in the morning," "no television in the bedroom," "not excited before bedtime at night," and "fixed return time while going out with children" in ensuring good sleep for their children.
[Conclusions] Medical staff should consider children's chronotypes and parental lifestyles while providing health guidance on optimizing sleep and reducing sleep problems in parents and children.

《Key Words》 *chronotype, preschool children, parent-child relationship, parental sleep habits, consideration of sleep behavior*

Ⅰ. Background

Chronotypes refer to individual differences in the phases of circadian rhythms. Preschool children tend strongly towards the morning chronotype, which changes to the evening chronotype during puberty. The evening chronotype peaks at approximately 21 years and 19.5 years for boys and girls, respectively, and subsequently changes to the morning chronotype[1)]. Therefore, chronotypes change with age and differ by sex. In modern society, social time and artificial lighting modify sleep habits, including bedtime and wake-up time on weekdays and weekends. Following a short sleep on weekdays, delayed wake-up time on weekends without social restrictions causes a change in the circadian rhythm phase of sleep time on weekdays. Accordingly, in a previous study that used the Munich chronotype questionnaire, chronotype assessment was based on mid-sleep time on free days without social constraints[2)]. Late mid-sleep

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time on free days indicates the evening chronotype. Social jet lag (SJL) is a condition characterized by a malfunction due to a mismatch between social time and the biological clock[3]. Extreme evenings have been associated with an increased incidence of depression in adults according to previous studies[4]. A thorough review by Taillard et al.[5] found a strong association between chronotype and attention-deficit/hyperactivity disorder in adults.

Preschool children with the evening chronotype manifest greater sleep problems than their morning and intermediate chronotype counterparts, suggesting that chronotype may play a role in early childhood sleep disorders[6]. The evening chronotype is associated with behavioral abnormalities, such as behavioral problems, which affects peer relationships in preschool children[7]. Furthermore, antisocial behaviors during childhood and adolescence were more prominent in individuals with the evening chronotype than in those with the morning chronotype[8]. Researchers have reported a consistent association between short sleep duration in early childhood and obesity[9]. Circadian rhythm preferences of mothers are associated with the development of infant circadian rhythms and may be a potential risk factor for the development of sleep problems during early childhood[10]. Infants with different chronotypes have dissimilar bedtime routines and daily schedules[11]. Parents who know their children's sleep patterns are more likely to have healthy sleep habits[12]. In addition, parents with low health literacy may place a television (TV) in the room where their baby sleeps, leading to poor sleep at night[13]. The evening chronotype is associated with delayed onset of dim-light melatonin. Moreover, bright nights affect bedtime[14]. The evening chronotype, associated with sleep deprivation, was observed in 10.0% of preschool children in Japan[15]. Small population areas, long TV viewing times, prolonged work schedule for mothers, and attending kindergarten reduced the total sleep duration in 4.5-year-old children in Japan[16]. These findings warrant evaluating the lifestyles of children and parents to improve their sleep habits. Studies have been conducted on children's chronotypes, sleep problems, behavioral problems, maternal chronotypes, and circadian rhythm development. However, reports on preschool children's chronotypes, parental sleep habits, and parental sleep-conscious behaviors are limited.

Therefore, we aimed to clarify the relationship between preschool children's chronotype, parental sleep habits, and parental sleep-conscious behaviors to close the gap between chronotype and social time and ensure appropriate sleep habits.

Ⅱ. Methods

1. Participants and data collection

We conducted the research survey at a childcare center in the suburbs of Japan (Iwate prefecture, N39). Six childcare center directors, randomly selected from 72 childcare centers in City A contributed to this study. The participants included 354 parents with primary parenting roles for children aged 3–5 years who were attending six daycare centers. We distributed anonymous, self-administered questionnaires between October 2020 and November 2020. Consent was obtained from 214 participants (recovery rate: 60.5%).

2. Survey items

2.1) Attributes

Questions about attributes, including parental age, parental sex (father or mother), parental work status (regular or part-time staff), child's age, child's sex (boy or girl), child's birth order, child's developmental difficulties (yes or no), and family structure (nuclear family or extended family).

2.2) Children's chronotypes and sleep habits

The children's chronotype questionnaire (CCTQ) was used to evaluate differences in phases of circadian rhythms in early childhood and school-going children. The questionnaire comprised 16, 10, and one items related to sleep/wakefulness, morning/evening type, and chronotype, respectively. For the sleep/wakefulness-related items, we recorded sleep habits on scheduled and free days. Questions on the morning/evening type comprised the degree of difficulty in getting up and approximately 30 min after getting up, the best rhythm (four points), and the time when they felt tired and very sleepy. Answers were provided in three to five stages with a complete awakening latency. In addition to the responses on questions related to sleep/wakefulness, answers were provided to questions related to morning/evening chronotype. Each item was assigned 1–5 or 1–3 points according to the CCTQ score calculation method, and the total score range was 10–48 points. The chronotypes were considered "morning," "intermediate," and "evening" for ≦23 points, 24–32 points, and ≧33 points, respectively. The reliability and validity of this scale was confirmed[17,18].

Doi et al.[19] developed a Japanese version of the CCTQ. The Cronbach's alpha coefficient was set at 0.76 to confirm the reliability and validity of this scale[20]. Correlations were observed among the sleep-wake parameters measured using the Japanese version of the CCTQ and an actigraph[20]. The Japanese version of the CCTQ is a self-administered questionnaire that allows for the subjective assessment of chronotypes in preschool children. The difference between central sleep times on weekdays and weekends was defined as SJL[21].

2.3) Parents' sleep habits and quality of sleep

The Pittsburgh Sleep Quality Index (PSQI) is a widely used standardized measure for assessing subjective sleep quality. We used the Japanese version of the PSQI (PSQI-J) to assess parents' sleep quality[22]. PSQI-J is a self-administered questionnaire comprising 18 questions. Self-rated items were used to generate seven component scores (range of subscale scores: 0–3) for the following parameters: sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medications, and daytime dysfunction. The sum of these scores yielded one global score for subjective sleep quality (range, 0–21), with higher scores representing poorer subjective sleep quality. The cut-off value was set at 5.5 points, and a score ≧5.5 points indicated poor sleep. The Cronbach's alpha factor was set at 0.77 to confirm the reliability and validity of the scores according to a study that compared psychiatric patients and healthy individuals[23]. PSQI-J allows for the subjective assessment of sleep quality. Furthermore, differences in sleep time on weekdays and weekends were assessed using a question with Yes/No answer. When the answer was "Yes", we requested the participants respond to "weekend wake-up time," "weekend bedtime," and "weekend sleep onset time." SJL referred to the median sleep time zone and median sleep time, and was calculated as the difference between the central sleep time on weekdays and weekends. In addition, we requested that the parents answered Yes/No if they experienced sleep habits different from that of their infants.

2.4) Children sleep-habit conscious behavior

The items for behaviors that affected children's sleep were created with reference to the original lifestyle-related[13,24] and environmental factors[25] that affect sleep. Factors affecting sleep included breakfast, caffeine intake, and media use as lifestyle factors, and light and bedroom environments as environmental factors. The participants were requested to answer Yes/No for the following items: "regular breakfast consumption," "fixed place to sleep at night," "fixed wake-up time," "opening the curtains and permitting light in the morning,", "spending the day in a bright place," "fixed return time while going out with children," "fixed dinner time," "not consuming caffeinated beverages (carbonated drinks and coffee) 3 h before bedtime," "no smartphone or tablet use within 1 h before bedtime," "not excited before bedtime at night," "fixed place to sleep at night," "dark bedroom," "no TV in the bedroom," and "staying awake until the child falls asleep."

3. Statistical analysis

Based on the CCTQ classification of children, we compared the chronotypes using three groups as follows: morning, intermediate, and evening. Parents' insomnia, use of sleeping pills, and obstacles to daily life were compared between the "none" and other groups. Parental sleep quality was classified as "good" or "bad." We performed Fisher's exact and χ^2 tests to assess parental sleep difficulties, use of sleeping pills, disturbances in daily life, sleep quality, and discrepancies in sleep habits between children and parents.

We performed residual analysis to determine significant differences between the three chronotypes. Regarding the sleep habits of the children and their parents, we performed the Kruskal–Wallis test and one-way analysis of variance (ANOVA) for variables with and without confirmed normality, respectively. To determine significant differences in the one-way ANOVA, we conducted multiple comparisons (Bonferroni-Dunn method, Tukey's method). To compare sleep time on weekdays and weekends, t-test and Wilcoxon signed-rank test were performed for variables with and without normality, respectively. IBM SPSS Statistics ver.27.0 for Windows (IBM, Tokyo, Japan) was used for statistical analysis, and the significance level was set at <5 % (two-sided test).

4. Ethical considerations

Participants were provided with written explanations concerning the purpose of the study, their right to withdraw from participation, an assurance of anonymity, and publication of the results. The participants were advised that they were not obliged to answer any questions they felt uncomfortable answering, as they may have been preoccupied with their parental responsibilities during the survey period. Written and verbal requests were made to the directors of the daycare facilities to ensure that there was no children participation without parental consent. This research procedure was approved by the research ethics committee of the Aomori University of Health and Welfare (approval number: 20001).

Ⅲ. Results

1. Parent and child characteristics

Data of 157 parent and child dyads were analyzed without missing values (valid response rate: 45.8%). Table 1 presents an outline of the participants' characteristics. Parents who responded comprised 156 mothers (99.4%) and one father (0.6%), with an average age of 35.6 years (SD = 4.8 years). The working conditions included 93 (59.2%), 50 (31.9%), and 14 (8.9%) full-time, part-time, and other employees, respectively. Others were self-employed, unemployed, or on childcare leave. The children included 76 boys (48.4%) and 81 girls (51.6%). The average age of the children was 4.6 years (SD = 0.6 years), with 30 (19.1%), 84 (53.5%), and 43 (27.4%) children aged 3, 4, and 5 years, respectively. The birth order was 44 (28.0%), 41 (26.1%), and 72 (45.9%) for children without siblings, younger brothers and sisters, and second and subsequent children, respectively. Eleven (7.0%) children developed anxiety. The family structure comprised 131 (83.4%), 23 (14.6%), and three (1.9%) nuclear families, extended families, and single-parent households, respectively.

2. Children's chronotypes

There were 39 (24.8%), 92 (58.6%), and 26 (16.6%) CCTQ-classified morning, intermediate, and evening chronotypes, respectively. Table 2 summarizes the sleep habits of children according to their chronotypes. There were significant differ-

Table 1. Participants' characteristics

		n	%
Employment	Regular	93	59.2
	Non-regular	50	31.8
	Others	14	8.9
Child's age	3 years	30	19.1
	4 years	84	53.5
	5 years	43	27.4
Child's sex	Boy	76	48.4
	Girl	81	51.6
Birth order	First (non-sibling)	44	28.0
	First	41	26.1
	Other than first	72	45.9
Anxiety in children	Yes	11	7.0
	No	146	93.0
Family structure	Nuclear family	131	83.4
	Extended family	23	14.6
	Others	3	1.9

Table 2. Child sleep-wake rhythm according to the chronotypes

	Morning chronotype (n = 39)				Intermediate chronotype (n = 92)				Evening chronotype (n = 26)				p-value	*Post hoc p*-value		
	Mean	SD	Median	IQR	Mean	SD	Median	IQR	Mean	SD	median	IQR				
Weekday																
Wake up time	6 : 25	0 : 30	6 : 30	0 : 40	6 : 47	0 : 29	6 : 45	0 : 35	7 : 13	0 : 28	7 : 15	0 : 40	< .001**	M<I**	M<E**	I<E**
Bedtime	20 : 53	0 : 36	21 : 00	0 : 45	21 : 18	0 : 28	21 : 10	0 : 30	21 : 48	0 : 46	21 : 50	1 : 18	< .001**	M<I**	M<E**	I<E**
Sleep latency	0 : 18	0 : 10	0 : 15	0 : 20	0 : 22	0 : 14	0 : 20	0 : 20	0 : 21	0 : 23	0 : 15	0 : 10	.166			
Sleep onset	21 : 16	0 : 34	21 : 20	0 : 40	21 : 50	0 : 28	21 : 54	0 : 30	22 : 21	0 : 51	22 : 20	1 : 00	< .001**	M<I**	M<E**	I<E*
Sleep period†	9 : 12	0 : 34	9 : 10	0 : 50	9 : 06	0 : 36	9 : 11	0 : 48	9 : 06	0 : 51	9 : 07	1 : 01	.772			
Midsleep point†	1 : 52	0 : 26	1 : 55	0 : 34	2 : 24	0 : 22	2 : 23	0 : 28	2 : 54	0 : 33	2 : 53	0 : 38	< .001**	M<I**	M<E**	I<E**
Weekend																
Wake up time	6 : 53	0 : 41	7 : 00	1 : 00	7 : 31	0 : 37	7 : 30	1 : 00	8 : 00	0 : 45	8 : 00	1 : 11	< .001**	M<I**	M<E**	I<E*
Bedtime	20 : 59	0 : 41	21 : 00	1 : 00	21 : 15	0 : 34	21 : 30	0 : 45	21 : 57	0 : 46	22 : 00	1 : 06	< .001**	M<I**	M<E**	I<E**
Sleep latency	0 : 15	0 : 09	0 : 15	0 : 13	0 : 20	0 : 14	0 : 19	0 : 20	0 : 22	0 : 23	0 : 12	0 : 12	.286			
Sleep onset	21 : 21	0 : 39	21 : 30	0 : 40	21 : 54	0 : 34	22 : 00	0 : 44	22 : 25	0 : 54	22 : 22	1 : 10	< .001**	M<I**	M<E**	I<E*
Sleep period†	9 : 18	0 : 45	9 : 10	1 : 05	9 : 24	0 : 44	9 : 25	0 : 51	9 : 23	0 : 57	9 : 20	1 : 28	.778			
Midsleep point	2 : 01	0 : 34	2 : 02	0 : 50	2 : 36	0 : 24	2 : 37	0 : 31	3 : 07	0 : 40	2 : 53	0 : 55	< .001**	M<I**	M<E**	I<E**
SJL	0 : 15	0 : 14	0 : 09	0 : 24	0 : 18	0 : 13	0 : 15	0 : 20	0 : 19	0 : 17	0 : 19	0 : 21	.284			

SD: Standard deviation; IQR: Interquartile range; SJL: Social jet lag; M: Morning chronotype; I: Intermediate chronotype; E: Evening chronotype.
Kruskal–Wallis test (Multiple comparison: Bonferroni-Dunn method); †: ANOVA (Multiple comparison: Tukey method).
*: $p < .05$, **: $p < .01$.

ences in weekday wake-up time ($p<.001$), weekday bedtime ($p<.001$), weekday sleep onset time ($p<.001$), weekday central sleep time ($p<.001$), weekend-day bedtime ($p<.001$), weekend-day sleep onset time ($p<.001$), and weekend-day mid-sleep time ($p<.001$). In particular, the mid-sleep time was 2:54 on weekdays, which was later than that of the morning and intermediate types (1:52 and 2:24, respectively; $p<.001$). There were no significant differences between the time taken to fall asleep on weekdays and that to fall asleep on weekends. Similar results were obtained for sleep time and SJL.

Table 3 summarizes the sleep habits of the parents according to their chronotypes. For parents, weekday bedtime ($p=.038$), weekday sleep onset time ($p=.030$), weekday sleep central time ($p=.008$), weekend wake-up time ($p=.044$), and weekend sleep central time ($p=.013$) were significantly different as parental weekend day was 3:30 for evening-time children. This was significantly slower than that of the morning chronotype of 2:48 ($p=.027$).

A chronotype-based comparison of the sleeping hours of children and their parents on weekdays and weekends revealed that the sleeping hours of children with intermediate chronotype were 9:06 and 9:24 on weekdays and weekends, respectively, which differed significantly ($p<.001$). However, there was no significant difference in sleep duration between children with morning and evening chronotypes ($p=.267$ and $p=.070$, respectively). We observed a significant difference in parental sleep time between weekdays and weekends (morning chronotype, $p=.029$; intermediate chronotype, $p<.001$; and evening chronotype, $p=.009$).

Table 3. Parental sleep-wake rhythm according to children's chronotype

	Morning chronotype (n=39)				Intermediate chronotype (n=92)				Evening chronotype (n=26)				*p*-value	*Post hoc* *p*-value
	Mean	SD	Median	IQR	Mean	SD	Median	IQR	Mean	SD	median	IQR		
Weekday														
Wake up time	5 : 50	0 : 38	6 : 00	0 : 45	6 : 04	0 : 44	6 : 00	1 : 00	6 : 10	0 : 33	6 : 15	0 : 30	.080	
Bedtime	22 : 17	1 : 08	22 : 00	1 : 40	22 : 33	1 : 04	22 : 30	1 : 00	23 : 01	1 : 07	23 : 00	1 : 52	.038*	M<E* I<E*
Sleep latency	0 : 22	0 : 22	0 : 15	0 : 20	0 : 25	0 : 18	0 : 20	0 : 20	0 : 22	0 : 16	0 : 20	0 : 20	.367	
Sleep onset	22 : 39	1 : 07	22 : 55	1 : 35	22 : 59	1 : 01	23 : 00	1 : 22	23 : 24	1 : 04	23 : 30	1 : 25	.030*	M<E** I<E*
Sleep period†	7 : 10	1 : 05	7 : 04	1 : 45	7 : 05	1 : 08	7 : 04	1 : 18	6 : 46	1 : 07	6 : 47	1 : 01	.349	
Midsleep point	2 : 15	0 : 44	2 : 17	0 : 57	2 : 31	0 : 41	2 : 30	0 : 53	2 : 47	0 : 38	2 : 51	0 : 37	.008**	M<E** I<E*
Weekend														
Wake up time	6 : 37	1 : 00	7 : 00	1 : 19	6 : 57	0 : 58	7 : 00	1 : 30	7 : 16	1 : 09	7 : 30	1 : 48	.044*	M<E*
Bedtime	22 : 37	1 : 18	23 : 00	2 : 30	22 : 59	1 : 14	23 : 00	2 : 00	23 : 21	1 : 16	23 : 30	1 : 07	.155	
Sleep latency	0 : 22	0 : 24	0 : 15	0 : 20	0 : 27	0 : 24	0 : 26	0 : 20	0 : 23	0 : 18	0 : 20	0 : 20	.155	
Sleep onset	22 : 59	1 : 18	23 : 10	2 : 05	23 : 26	1 : 11	23 : 17	2 : 00	23 : 45	1 : 16	23 : 47	1 : 11	.115	
Sleep period	7 : 38	1 : 16	7 : 45	1 : 39	7 : 30	1 : 14	7 : 27	1 : 59	7 : 30	1 : 10	7 : 47	2 : 13	.876	
Midsleep point†	2 : 48	0 : 59	2 : 50	1 : 32	3 : 11	0 : 54	3 : 14	1 : 18	3 : 30	1 : 03	3 : 35	1 : 07	.013*	M<E*
SJl	0 : 36	0 : 35	0 : 30	1 : 05	0 : 42	0 : 41	0 : 36	1 : 13	0 : 42	0 : 37	0 : 39	0 : 45	.773	
PSQI	4.82	3.0	5.0	4	5.64	3.0	5.0	4	6.35	2.7	6.0	3	.060	

SD: Standard deviation; IQR: Interquartile range; SJL: Social jet lag; PSQI: Pittsburgh Sleep Quality Index; M: Morning chronotype; I: Intermediate chronotype; E: Evening chronotype.
Kruskal–Wallis test (Multiple comparison: Bonferroni-Dunn method); †: ANOVA (Multiple comparison: Tukey method).
*: $p<.05$, **: $p<.01$.

3. Children's chronotype and parental sleep quality

Table 4 summarizes parental sleep problems according to their children's chronotype. Approximately 80.8% of the parents of evening-chronotype children had a high percentage of problems related to adequate enthusiasm ($p=.008$). There were no significant differences in sleep difficulty, use of sleeping pills, drowsiness, sleep quality, or PSQI-J scores. Approximately 15.4%, 18.5%, and 34.5% of parents experienced differences in their sleep habits and those of their children for the morning, intermediate, and evening chronotypes, respectively, without significant differences ($p=.132$).

4. Children sleep-habit consciousness behavior

Table 5 summarizes the sleep-conscious behav-

Table 4. Parental sleep problems

	Morning chronotype (n = 39)		Intermediate chronotype (n = 92)		Evening chronotype (n = 26)		p-value
	n	%	n	%	n	%	
Cannot fall asleep within 30 min†	16	41.0	49	53.3	14	53.8	.408
Wake up in the middle of the night or early morning	24	61.5	57	62.0	15	57.7	.924
Wake up to use the bathroom	17	43.6	38	41.3	12	46.2	.899
Cannot breathe comfortably†	3	7.7	2	2.2	0	0.0	.161
Cough or snore loudly†	4	10.3	4	4.3	2	7.7	.390
Feel extremely cold†	5	12.8	14	15.2	2	7.7	.605
Feel extremely hot†	2	16.7	8	66.7	2	16.7	.914
Had bad dreams	8	20.5	15	16.3	4	15.4	.814
Experience pain†	6	15.4	8	8.7	2	7.7	.468
Consume sleeping pills†	0	0.0	4	4.3	1	3.8	.450
Have trouble staying awake	8	20.5	30	32.6	11	42.3	.161
Have adequate enthusiasm††	17	43.6	46	50.0	21	80.8	.008**
Overall sleep quality†††	12	30.8	36	39.1	12	46.2	.440
PSQI score§	16	41.0	42	45.7	18	69.2	.059

†: Answer choices; past month, <once a week, once or twice a week, ≦thrice a week.
††: Answer choices; moderate problem, somewhat a problem, big problem.
†††: Answer; fairly good, fairly bad, very bad.
§: >5.5
**: $p<.01$ (Fisher's exact test, χ^2 test)

Table 5. Parental sleep-conscious behaviors according to children's chronotypes

	Morning chronotype (n = 39)		Intermediate chronotype (n = 92)		Evening chronotype (n = 26)		p-value
	n	%	n	%	n	%	
Regular breakfast consumption*	39	100.0	88	95.7	24	92.3	.192
Fixed place to sleep at night*	39	100.0	88	95.7	23	88.5	.055
Dark bedroom*	36	92.3	88	95.7	22	84.6	.125
Spend the day in a bright place	33	84.6	81	88.0	18	69.2	.068
Staying until the child falls asleep	34	87.2	78	84.8	20	76.9	.520
Opening the curtains and permitting light in the morning	34	87.2	78	84.8	17	65.4	.047*
Fixed dinner time	29	74.4	65	70.7	20	76.9	.786
Fixed wakeup time	26	66.7	64	69.6	14	53.8	.326
No television in the bedroom	29	74.4	64	69.6	12	46.2	.042*
Not consuming caffeinated beverage 3 h before bedtime	20	51.3	65	70.7	13	50.0	.040*
Taking a nap on holidays	28	71.8	38	41.3	11	42.3	.005**
No media use within 1 h before bedtime	18	46.2	49	53.3	7	26.9	.059
Not excited before bedtime at night	22	56.4	46	50.0	6	23.1	.021*
Fixed return time while going out with children	16	41.0	24	26.1	3	11.5	.030*

*: $p<.05$; **: $p<.01$ (χ^2 test, Fisher's exact test.)

iors of parents according to their children's chronotypes. In the evening chronotype, the percentage of "Yes" responses for "opening the curtains and permitting light in the morning," "no TV in the bedroom," "not excited before bedtime at night," and "fixed return time while going out with children" was 65.4% (p = .047), 46.2% (p = .042), 23.1% (p = .021), and 11.5% (p = .030), respectively. The intermediate chronotype demonstrated a high percentage (75.7%, p = .040) of those who stopped consuming caffeinated beverages (carbonated beverages and coffee) within 3 h of bedtime. There were no significant differences in regular breakfast consumption, fixed supper time, smartphone and tablet screens turned off within 1 h before bedtime, fixed wake-up time, spending time in a bright place during the day, or fixed sleeping place at night. There was no significant difference in the percentage of respondents who kept their bedrooms dark and quiet and were on their sides until they fell asleep.

Ⅳ. Discussion

In this study, we investigated the relationship between parental sleep habits and sleep-conscious behavior according to their children's chronotypes. Sleep habits and sleep-conscious behaviors differed among parents depending on their children's chronotypes. Parents of evening-chronotype children showed late central sleep time on weekdays and weekends, in addition to late bedtime, sleep on weekdays, and waking up on weekends. Thus, the sleep habits of evening-chronotype children and their parents were related, suggesting a regressed circadian rhythm phase. There were 24.8%, 58.6%, and 16.6% morning, intermediate, and evening-chronotypes children, respectively. The proportion of children with the evening chronotype tended to be slightly higher than that reported by Doi[15] (10.0%). In a study involving Japanese participants (aged 20–79 years), there was no clear seasonal variation in sleep onset time; however, there was seasonal variation in waking time, with the most recent peak recorded in winter[26]. Sleep duration was found to be the longest in the winter and shortest in the summer (age 15–79 years)[27]. This present study was conducted during the late fall period. Therefore, the late sleep-wake rhythm of parents and their children with evening chronotypes may have regressed.

Late sleep by parents and "going out after 20:00" affect children's bedtime[28]. Moreover, children's bedtimes have been shown to be positively related to their mother's return from work and dinner times[29]. Ikeda et al.[16] reported the association between children's bedtime and their mothers' long working hours. The participants in this study were employed and their children attended childcare centers. However, Doi et al.[15] included kindergarten and childcare center children, and higher evening-chronotype children in this study were supposedly affected by their mothers' working hours.

The evening chronotype has been associated with substantial SJL[3]. However, in the present study, there was no difference in the sleeping hours of parents on weekdays and weekends among the morning, intermediate, and evening chronotypes. In addition, the SJL of the parents was 30, 36, and 39 min for the morning, intermediate, and evening chronotypes, respectively, with no significant difference. This difference is believed to be attributed to the children's adjustment to their parents' sleep patterns. Parents of children with an evening-chronotype tend to prioritize securing sufficient sleep time by going to bed and waking up late. Parents of evening-chronotype children indicated that their sleep-wake rhythms were in the post-phase. This may have caused problems in sustaining the drive required to accomplish tasks. Thus, sleep-conscious behaviors that can be improved through evening chronotype sleep habits should be advocated.

For sleep-conscious behavior, the rate of bedroom darkening was high for all chronotypes, with non-significant differences. However, for the evening chronotype, the rate of "not placing a TV in the bedroom" was 46.2% (p=.042), that of "not excited before going to bed" was 23.1% (p=.021), and that of "fixed return time while going out with children" was as low as 11.5% (p=.030). There was no significant difference in the percentage of participants who stopped utilizing multimedia devices before going to bed, although this percentage was as low as 26.9%. Ikeda et al.[16] reported that long game and TV viewing times promoted late bedtime in children. Hattori et al.[29] reported that the bedtime of a child is related to their TV or video viewing time from dinner to bedtime. Melatonin secretion has been shown to be suppressed in children who receive light stimulation at night[30]. Other studies[31] have suggested that melatonin secretion, which is more sensitive to light, is suppressed more by night light in elementary school children than in adults. Our findings revealed that the circadian rhythm was in the late phase because of habitual night light and stimulation. Furthermore, the proportion of those involved in brightening of the room in the morning was as low as 65.4% among those with the evening chronotype (p=.047). Moreover, their median wake-up times (median) was 7:15 (p<.001) and 8:00 (p<.001) on weekdays and weekends, respectively. Exposure to strong light in the morning has been shown to accelerate the onset of melatonin secretion[32]. Considering the cross-sectional design of this study, the detailed causal relationship is unknown. However, the findings indicate that children's chronotypes may be determined by their parents' sleep consideration. Therefore, parents should be aware of their children's sleep habits.

Sleep habits on free days without time constraints reflect an individual's body clock and should be adapted to the individual's chronotype as much as possible[3]. The development of individual differences in adolescent circadian rhythms begins in mid-childhood[33]. In secondary schools in Singapore[34] and in high schools in the United States[35], efforts are being made to delay school start times and reduce SJL to ensure sufficient sleep on weekdays. This in turn secured children's sleep time and improved their drowsiness and health conditions. Such efforts are being proposed in early childhood to minimize the gap between the chronotype and social clock; therefore, sleep habits should be adjusted to a sleep-wake phase (morning type), in addition to moderate adjustment in social clock (going to kindergarten considerably late)[36]. In our study, 34.5% of parents experienced different sleep habits compared to their children (evening chronotype). Parents of evening-chronotype children are likely to face difficulties falling asleep and waking up. These findings warrant supporting parents to adjust the light environment in the morning and evening for their children and recognize the need to advance the sleep-wake phase of the circadian rhythm.

Our study had some limitations. First, this was a cross-sectional study that could not determine any effects between the variables. Second, the prevalence of the coronavirus disease 2019 supposedly caused changes in family life patterns, such as parental work styles and school closures. Third, the study's sample size was limited, necessitating careful consideration of its generalization. However, as there are few reports on parental sleep habits and sleep-conscious behaviors according to the CCTQ-based chronotype classification of children, this study is significant because its findings will facilitate the accumulation of such data.

V. Conclusions

The sleep habits of parents of evening-chronotype children were slower than those of morning- and intermediate-type children. Second, they demonstrated a post-phase circadian rhythm. Third, it was difficult to continuously motivate them. Finally, they did not practice the habit of ensuring good sleep for their children. These findings prompt for the consideration of the chronotype of children and the social time of their parents.

Conflict of Interest Statement

The authors declare that they have no conflict of interests.

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原著論文

幼児のクロノタイプと親の睡眠習慣，睡眠配慮行動との関連

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抄　録

〔目的〕 クロノタイプは，概日リズムの位相の個人差を表している。これまで幼児のクロノタイプと幼児の健康や行動に関連する研究は報告されているが，親の睡眠習慣との関連についてはよくわかっていない。本研究では，幼児のクロノタイプと親の睡眠習慣の関連について調査することを目的とした。

〔方法〕 2020年10月～11月にかけて，岩手県の幼児とその親の睡眠習慣と睡眠に配慮した行動に関する調査を実施した。3～5歳児の親を対象に，子どもの朝型―夜型質問票日本語版（CCTQ）を用い朝型，中間型，夜型のクロノタイプを調べた。睡眠の質評価票を用いて，親の睡眠状態を評価した。3つのクロノタイプ間で，親の睡眠習慣，睡眠に配慮した行動を比較した。

〔結果〕 未就学児の朝型，中間型，夜型はそれぞれ24.8%，58.6%，16.6%を占めた。親の平日就床時刻，平日入眠時刻，平日睡眠中央時刻，週末起床時刻，週末中央睡眠時間は未就学児のクロノタイプと関連がみられた。夜型児の親の睡眠相は後退していた。また，物事をやり遂げるために必要な意欲を維持するのが困難であった。さらに，未就学児の良い睡眠を確保するための，朝はカーテンを開ける，寝室にはテレビを置かない，夜寝る前は興奮させない，外出時は帰宅時刻を決めていることなどの睡眠習慣の実践が不十分であった。

〔結論〕 専門家は幼児のクロノタイプと親のライフスタイルを考慮しながら，親子で最適な睡眠を確保し，睡眠問題の軽減のための保健指導をすることが必要である。

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Key words: クロノタイプ，幼児，親子関係，親の睡眠習慣，睡眠配慮行動

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