22

Mental Health of Children from a Chronobiological and Epidemiological Point of View

Tetsuo Harada[1], Miyo Nakade[1,2], Kai Wada[1], Aska Kondo[1], Mari Maeda[1], Teruki Noji[1] and Hitomi Takeuchi[1]
[1]Kochi University,
[2]Tokai Gakuen University,
Japan

1. Introduction

In 24-hour society seen especially in developed countries including Japan, fluctuations in the environmental conditions that act as zeitgebers for the circadian clock, such as light, meals and even social activities (e.g. "flextime") tend to become irregular and with decreasing amplitudes. Using mobile phones, playing video games, and frequenting 24-hour stores may accelerate this irregularity of environmental diurnal rhythms. These circumstances lead to weaker zeitgebers for entraining circadian clocks in children and promote a shift to the evening-typed diurnal rhythms in daily life. This evening-typed life style may potentially cause a decline in mental health in children via these three physiological mechanisms:

1. A tendency towards inner desynchronization of the two biological clocks (main clock and slave clock in the SCN, Honma & Honma, 1988) in evening-typed children
2. Lower serotonin levels in the daytime due to lower tryptophan consumption at breakfast (no breakfast or lower nutritional quality of breakfast)
3. Shortage of actual sleep duration

This chapter includes several sections in relation to mental health of children:

- Are Japanese children shifting towards evening-typed lifestyles?
- Are evening-typed children exhibiting poorer mental health?
- Environmental factors that promote evening-typed lifestyles 1 (Light environment)
- Environmental factors that promote evening-typed lifestyles 2 (Breakfast regularity and nutritional content)
- Environmental factors that promote evening-typed lifestyles 3 (24-hour commercialization of society: mobile phones, 24-hour convenience stores, video games, late night television)
- Intervention programs to promote morning-typed lifestyles and better mental health in kindergarten children.
- Intervention programs to promote morning-typed lifestyles and better mental health in elementary and junior high school students

- Conclusions: How can we change the environmental conditions surrounding children to promote better mental health?
- References

2. Are Japanese children shifting towards evening-typed lifestyles?

Due to the rapid advance of 24-hour society in Japan, Japanese children and students have been gradually shifting to evening-typed lifestyles, especially in the five year period from 1999-2004. Figure 1 shows an example of the rapid shift to evening-typed lifestyle in junior high school students, and especially girls. Scores improved between 2001 and 2006. Kochi is the most active place in Japan for the "Early to Bed, Early to Rise, and Don't Forget Your Breakfast" campaign being promoted throughout Japan since 2003. This campaign may have caused the improvement. However, girls are still more evening-typed than boys. A small chapter later on will discuss the reasons for girls being more evening-typed. From 8 years old (grade 1 of elementary school) to 13 years old (grade 1 of junior high school), morningness-eveningness (M-E) scores gradually decrease with age (Figure 2). Students aged 9-11 years (grade 3 to 5 of elementary school) showed significantly lower M-E scores (were more evening-typed) in 2003 and 2004 than in 1998 (Figure 2).

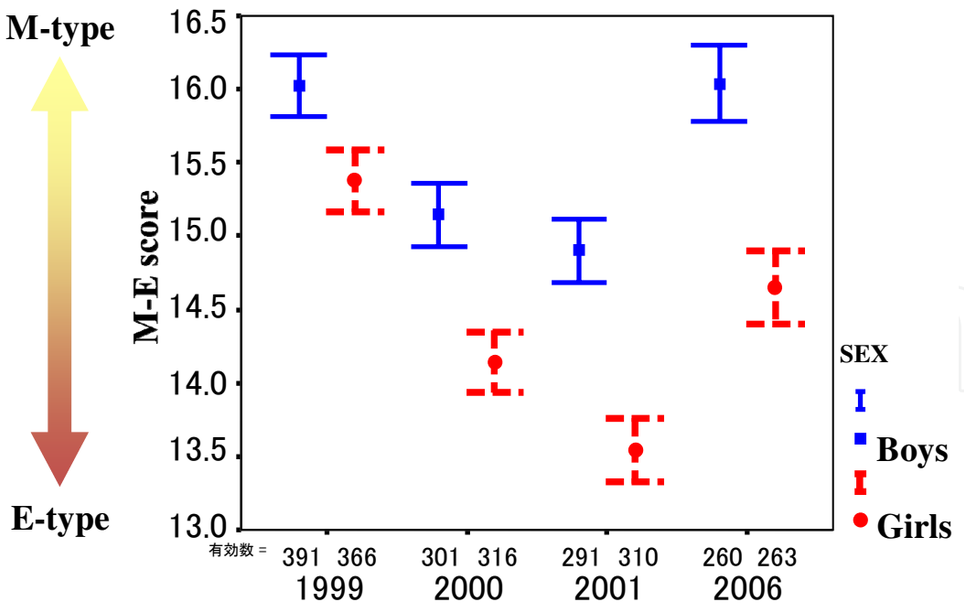


Fig. 1. Inter-annual variation in Morningness-Eveningness (M-E) scores of students attending a Japanese junior high school in Kochi (33ºN).

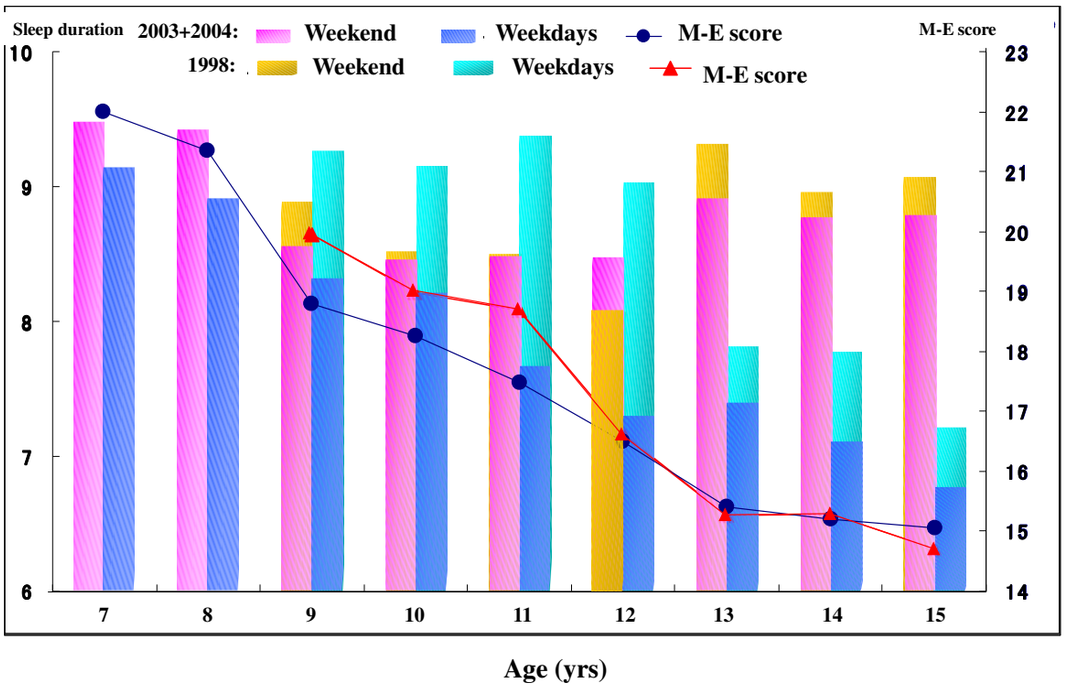


Fig. 2. Comparison between 1998 and 2003-2004 in variation of sleep duration and Morningness-Eveningness (M-E) scores by age in Japanese children attending elementary school (7-12 years) or junior high school (13-15 yrs) located in Kochi city (33ºN).

Among older students aged 18-30 years, men were significantly or tended to be more evening-typed than women. However, this gender difference in M-E scores disappeared in 2009 (Table 1). This phenomenon can be explained by the recent rapid shifting to evening-type life observed only in women.

Females				
2003	**2004**	**2005**	**2006**	**2009**
. 15.89 ± 3.64 (220)	14.98 ± 4.47 (140)	15.30 ± 3.59 (353)	15.24 ± 3.54 (210)	15.15 ± 3.07 (198)
Males				
2003	**2004**	**2005**	**2006**	**2009**
. 14.66 ± 4.14 (236)	14.26 ± 3.3 (129)	14.15 ± 3.19 (211)	13.99 ± 3.311 (198)	14.73 ± 3.29 (198)
Mann-Whitney U-test: z , p				
-3.391, 0.001	-1.700, 0.089	-3.679, <0.001	-3.904, <0.001	-1.067, 0.286
In total				
15.25 ± 3.95 (457)	14.63 ± 4.901 (269)	14.89 ± 3.48 (574)	14.63 ± 3.49 (408)	14.97 ± 3.20(396)
Kruskal- Wallis test:	*χ2 value =9.952,*	*df =3,*	*p=0.019 (2003-2006)*	

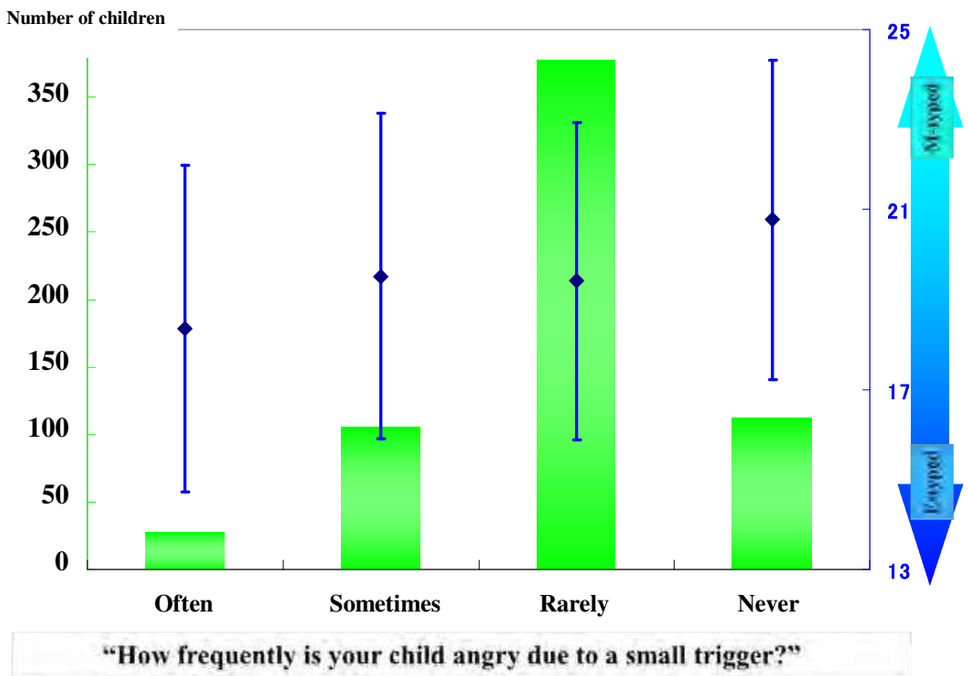
Table 1. Inter-annual variation of M-E scores in Japanese university students and students of training schools for medical nurses and physical therapists aged 18-30 years in Kochi (30ºN).

In conclusion of this section, females continue to be evening-typed through adolescence and adulthood. This evening-typed lifestyle for females is very dangerous in terms of mental and physical health, as extremely evening-typed lifestyle is associated with irregular menstrual cycles, severe symptoms of premenstrual syndrome, and more severe menstrual pain (Takeuchi et al., 2005). Especially for adolescent girls, a morning-typed lifestyle is critical for the development of a stable reproductive system including the regular menstrual cycle.

3. Are evening-typed children exhibiting poorer mental health?

Figures 3 & 4 show a significant relationship between chronotype of young Japanese children and mental health. Young children who became depressed frequently or frequently became angry due to a very small trigger are significantly more evening-typed than those who did not exhibit these symptoms. Figures 5 & 6 also indicate the relationship between chronotype of Japanese adolescents (junior high school students) and frequency to feel depression or irritation. Evening-typed adolescents felt more depressed and irritated more frequently than morning-typed adolescents.

In older Japanese students aged 18-30 years, students who lived in rooms with sufficient light exposure and had stable moods were significantly more morning-typed than those who did not (Figure 7). This phenomenon suggests that students who tried to expose themselves to sunlight even indoors shifted to morning-types with a more stable mood. Improvement of mood that accompanies greater morningness may be caused by better coupling of two internal oscillators (Honma & Honma, 1988) and by higher serotonin synthesis (Nakade et al., 2009).



(Kruskal-Wallis test: χ^2-value=13.86, df=3, p=0.003)

Fig. 3. Relationship between chronotype and frequency of becoming angry due to a small trigger in Japanese children aged 2-6years in 2003.

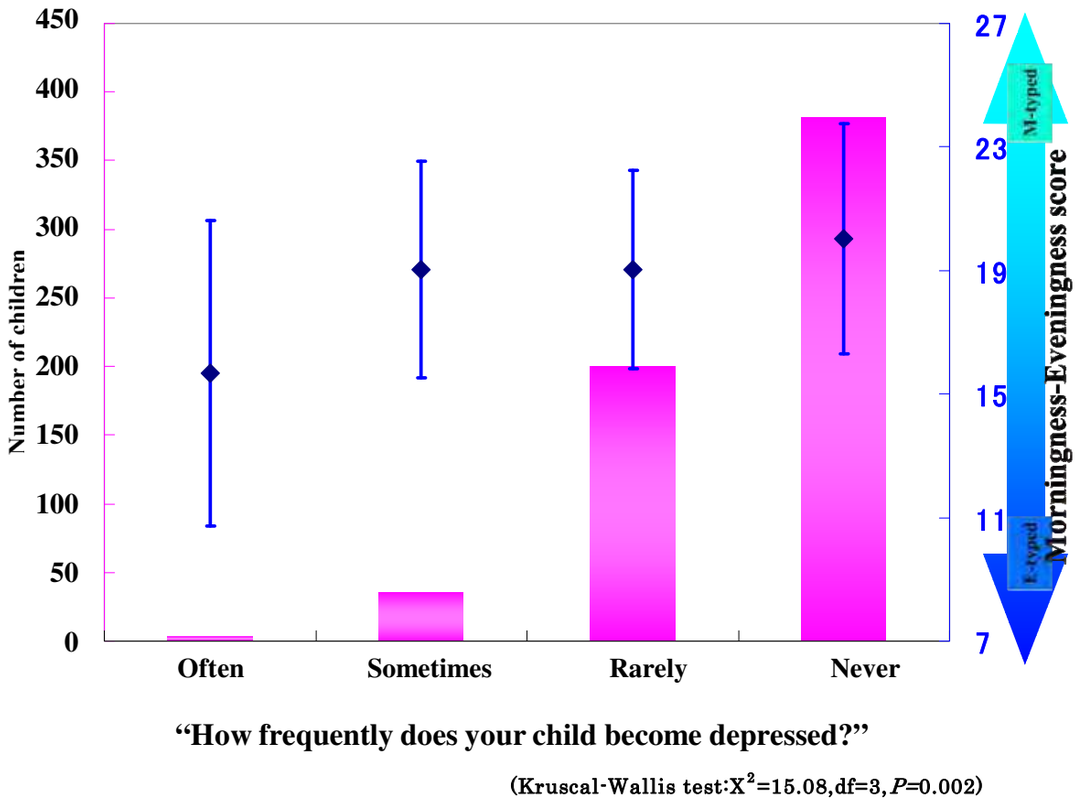


Fig. 4. Relationship between chronotype and frequency of becoming depressed in Japanese children aged 2-6years in 2003.

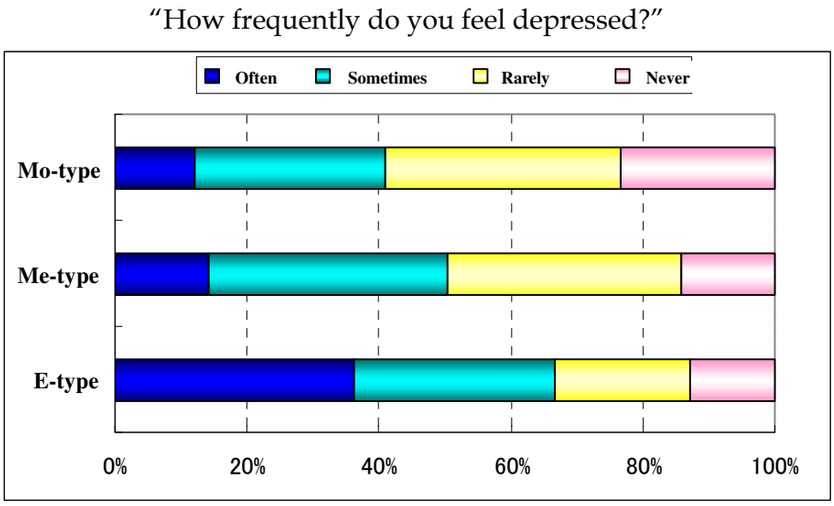


Fig. 5. Relationship between chronotype and frequency to feel depression in Japanese junior high school students in 2005. Mo-type =Morning-type: 25% of the distribution; Me-type=Medium-type: 50% of the distribution; E-type=Evening-type: 25% of the distribution.

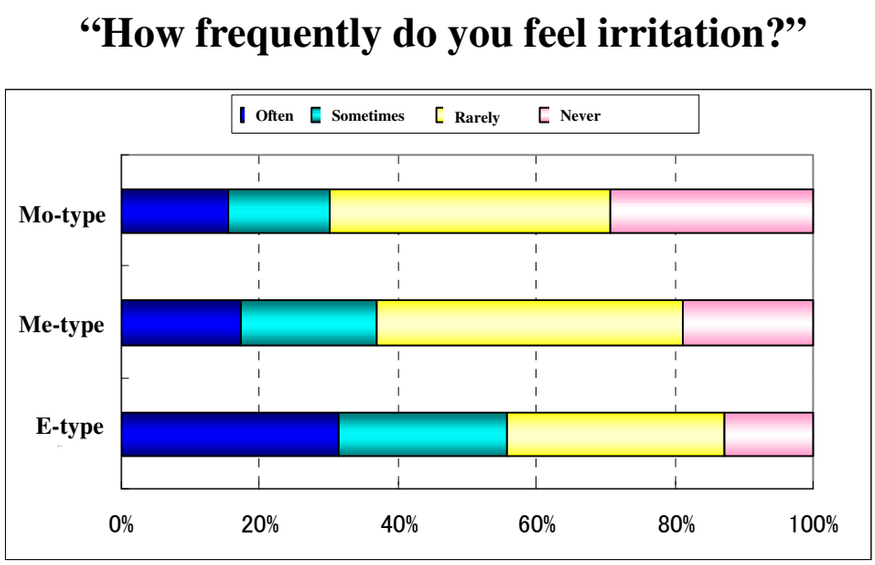


Fig. 6. Relationship between chronotype and frequency to feel irritation in Japanese junior high school students in 2005. Mo-type =Morning-type: 25% of the distribution; Me-type=Medium-type: 50% of the distribution; E-type=Evening-type: 25% of the distribution

4. Environmental factors that promote evening-typed lifestyles 1 (light environment)

Children aged 2-6 years who used black-out curtains or blinds (Mean ± SD, 20.27 ± 3.48, n=245) were more evening-typed than those who used cotton or lace curtains (21.09±3.39, 507) (Mann-Whitney U-test, z=-3.073, p=0.002), although no such differences were observed in older students (z=-1.449, p=0.147) (Figure 8). Children aged 2-6 years who used a fluorescent lamp as their evening lighting went to bed significantly later on nights before holidays than those who used other types of lighting (mostly orange color and other lower color temperature light bulbs), although no such difference was observed in older students aged 18-30 years (Figure 9). No significant differences due to evening lighting were seen in bed times on weekdays in either young children or older students (Figure 9). Actigraph data of a university student showed that use of blackout curtains in the summer (August) in Kochi (33°N) caused his bed times to become free running (Harada et al., 2003) (Figure 10).

Black-out curtains shut out early morning sunlight which has powerful potential for inducing a phase advance of human circadian oscillators, and use of such curtains induces a phase delay of the sleep-wake cycle. In the evening, blue light included in wave components emitted from fluorescent lamps may induce a phase delay of circadian rhythms. These results match those of light pulse experiments by Honma and Honma (1988).

Strong light from fluorescent lamps induces a phase advance of circadian rhythms in the early morning and a phase delay in the first half of subjective night. These phase altering effects may be observed even under weak 200-300 lux lighting.

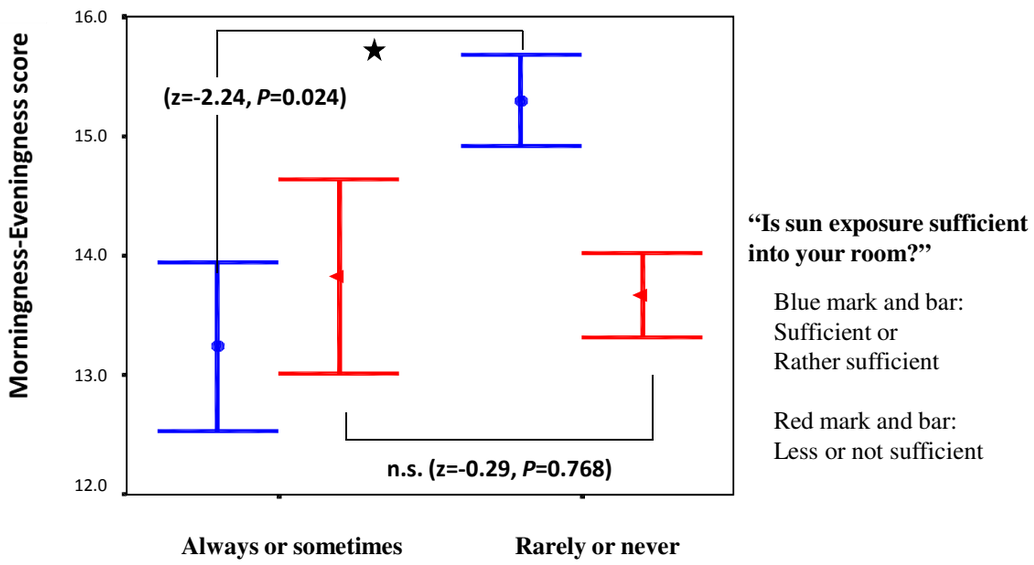


Fig. 7. Integrated relationship among circadian typology, sun-exposure extent and mood change in Japanese elder students aged 18-30 years in 2003.

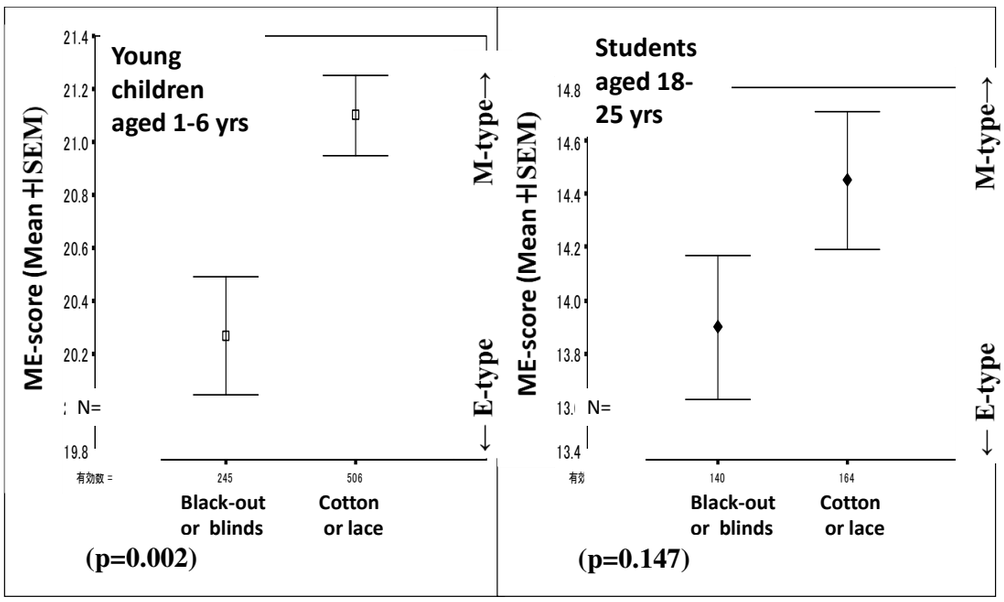


Fig. 8. Effects of type of bedroom curtain on circadian typology of young Japanese children and older students.

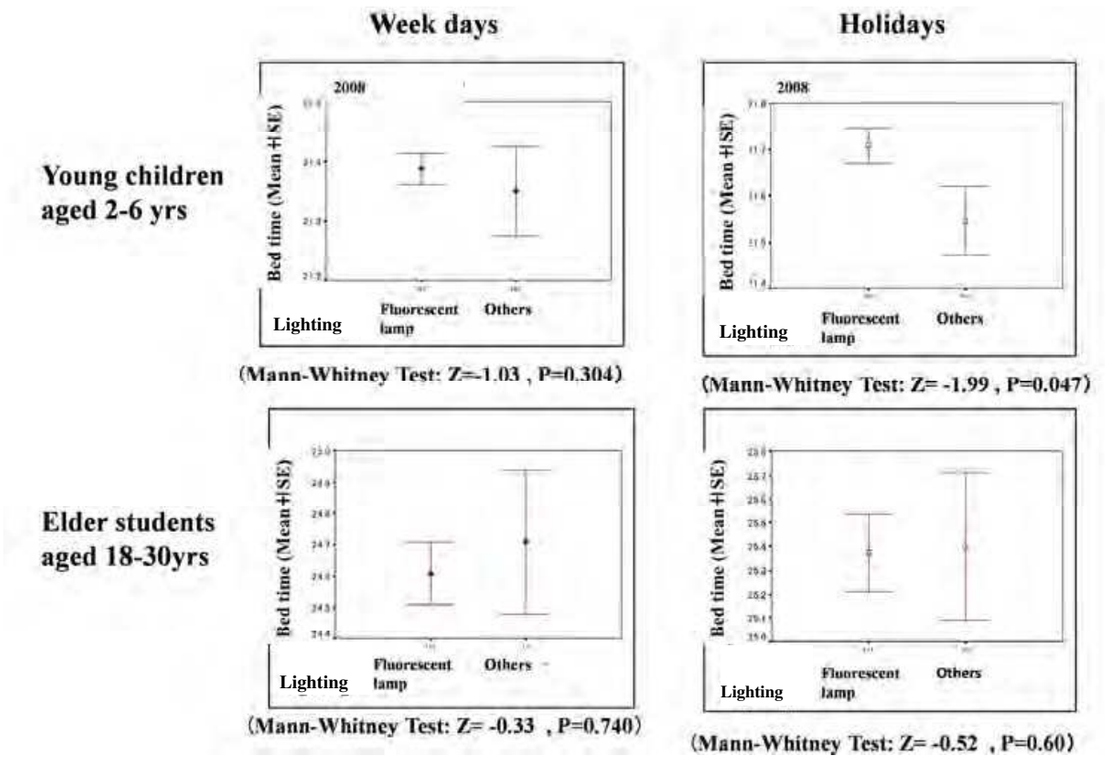


Fig. 9. Effects of evening lighting on circadian typology in young Japanese children and University students (2008).

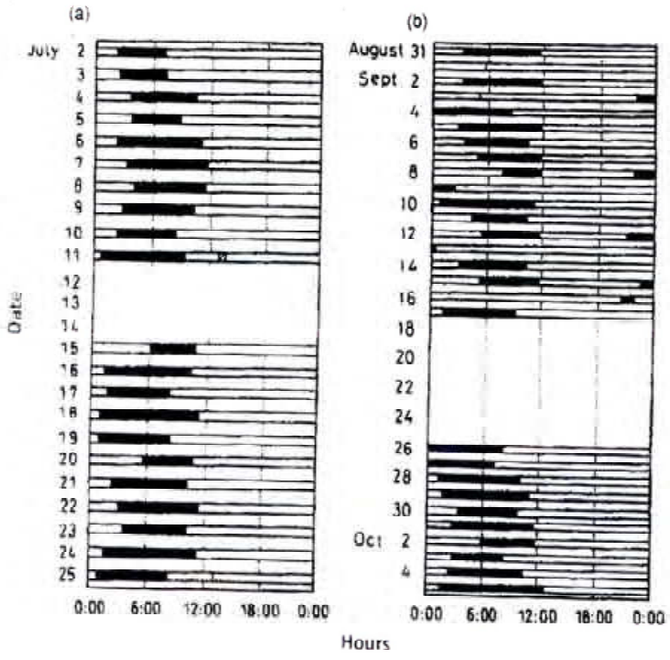


Fig. 10. Sleep-wake cycle of student A (a) before and (b) after changing to black-out curtains. Open bars: awakening, grey bars: nap and black bars: night sleep (Harada et al., 2003).

5. Environmental factors that promote evening-typed lifestyles 2 (Breakfast regularity and nutritional content)

Most young children eat breakfast at the same time everyday or almost every day. These children show significantly more morning-typed diurnal rhythms than children who frequently ate breakfast at irregular times. However, no clear relationship was observed between frequency of eating breakfast at a regular time and circadian typology in their parents (mostly mothers) (Figure 11).

Harada et al. (2007) calculated the amount of tryptophan consumed based on the tryptophan content of various food items and types of food eaten for breakfast, to create an index of estimated tryptophan intake. A significant positive correlation was seen between the tryptophan index and M-E scores (Figure 12 modified from Harada et al., 2007). Indices of tryptophan intake from supper did not differ among the three circadian types (morning type: 25% of the distribution, medium type: 50%, evening type: 25%), whereas the indices of tryptophan intake from breakfast were significantly higher in morning-type children than in medium- and evening-typed children (Figure 13).

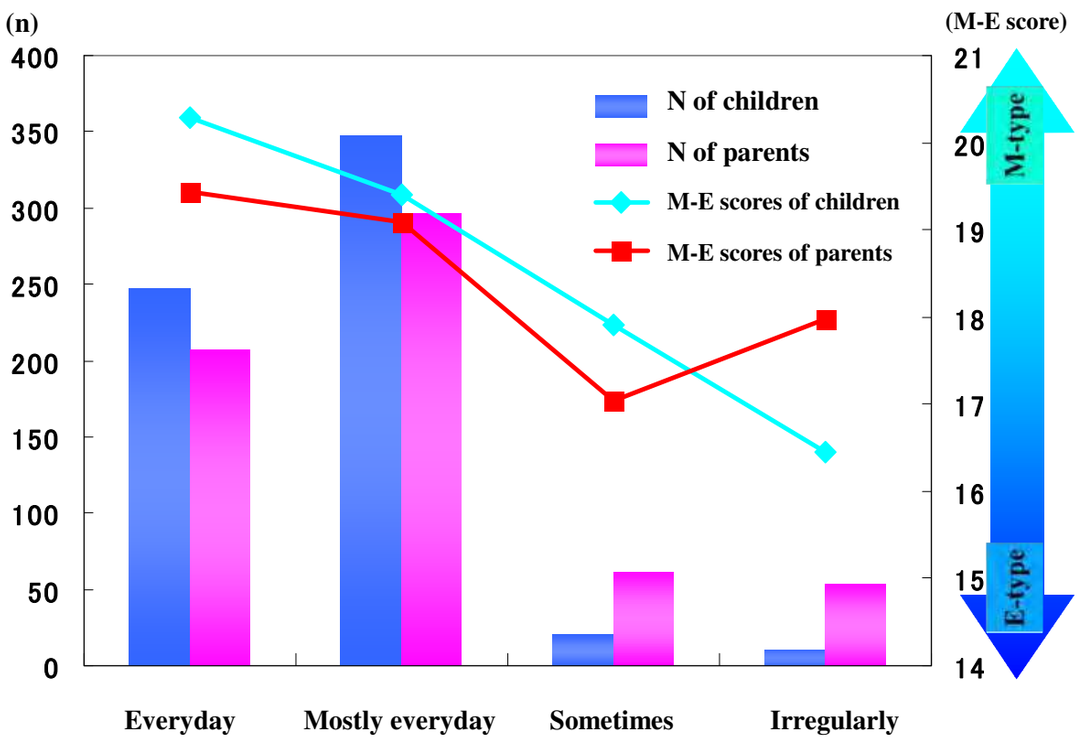


Fig. 11. Relationship between the frequency of having breakfast at regular times and circadian typology of Japanese children aged 2-6years and their mothers living in Kochi (33°N). Questionnaires were administered in June-July in 2004.

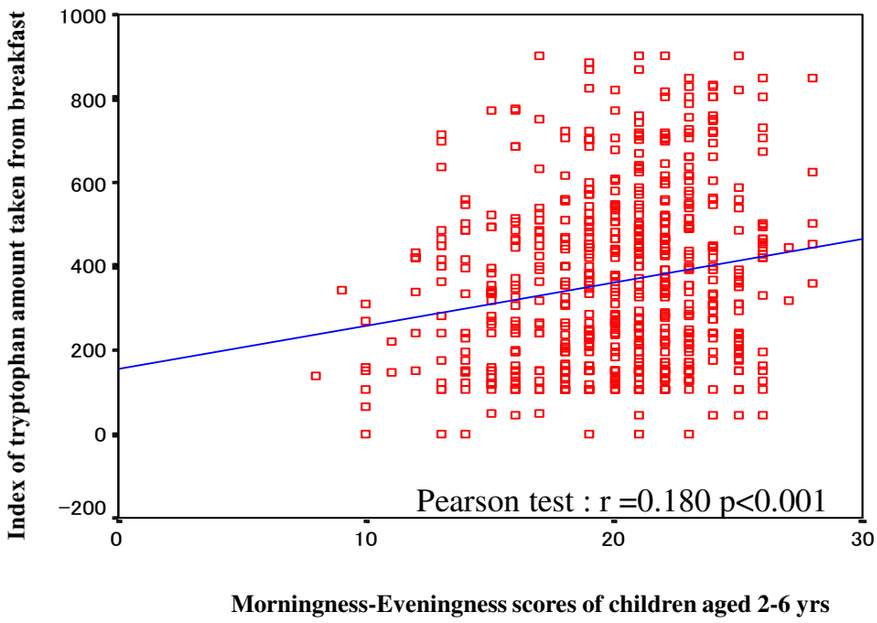
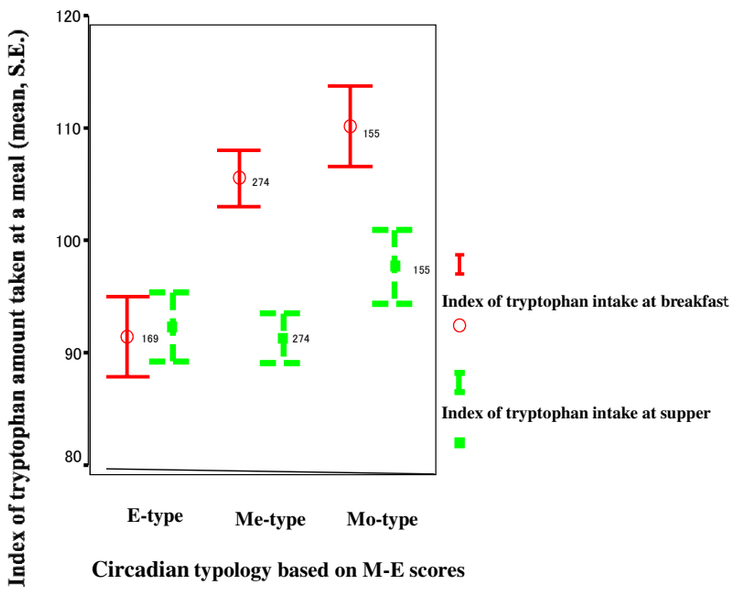


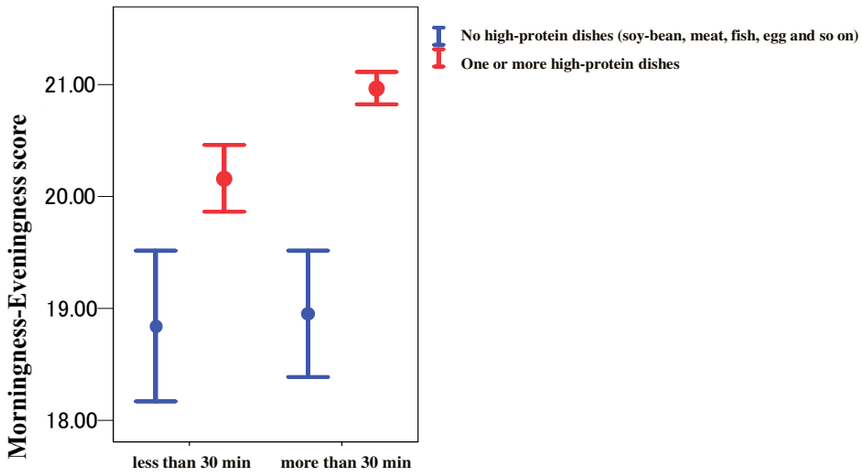
Fig. 12. Significant positive correlation between index of tryptophan intake from breakfast and circadian typology in young Japanese children living in Kochi (33°N). Questionnaires were administered in June-July, 2004. (Harada et al., 2007)



(Kruscal-Wallis U-test: Breakfast, χ^2=18.505, df=2, p<0.001,
Supper, χ^2=2.054, df=2, p=0.358)

Fig. 13. Relationship between circadian typology of Japanese children aged 2-6years and tryptophan intake at breakfast or supper. E-type, Me-type and Mo-type mean evening-type, medium type and morning-type, respectively. Morning-typed children show significantly higher tryptophan intake at breakfast but not at supper.

Nakade et al (2009) showed that children who ate one or more dishes including high amounts of protein were significantly more morning-typed than those who did not. Moreover, morning-type-promoting effects of sun exposure after the breakfast were shown only in children who ate high protein meals (Figure 14 from Nakade et al., 2009).



(**Mann-Whitneys U-test:** Effect of sunlight exposure on M-E scores, no high-protein dish(es) at breakfast, z=-0.098, p=0.922; high-protein dish(es), z=-2.293, p=0.022)

Fig. 14. Effect of sunlight exposure after breakfast on circadian typology depending on whether high-protein dish(es) is(are) included in children's dishes at breakfast. (Nakade et al., 2009).

Regular timing of breakfast could be an effective zeitgeber for circadian oscillators in preschool and kindergarten aged children. High intake of tryptophan at breakfast followed by exposure to sunlight may promote serotonin synthesis in the morning, and the accompanying high peak of extra-cellular brain concentration of serotonin may be a good internal zeitgeber for human circadian clocks.

6. Environmental factors that promote evening-typed lifestyles 3 (24-hour commercialization of society: mobile phones, 24-hour convenience stores, video games, late night television)

Partial results of an integrated analysis on the effects of using mobile phones, frequenting convenience stores and watching late night TV (starting at 11:00 p.m.) are shown in Figures 15, 16, and 17. Figure 15 shows that circadian typology in Junior high school students depends on the duration of each instance of mobile phone usage. This dependence is extreme in girls. Figure 16 demonstrates that a high frequency of visiting convenience stores leads to evening-typed diurnal rhythms in both girls and boys.

In contrast, boys who frequented convenience stores every day were significantly more morning-typed than those who did not. This result may seem odd, but can be explained as phase-advancing effect of bright light (1000-1500 lux) inside the store in the morning before school.

(Kruskal-Wallis test: boys, χ^2=5.040, df=3, p=0.167, girls, χ^2=16.838, df=3, p=0.001)

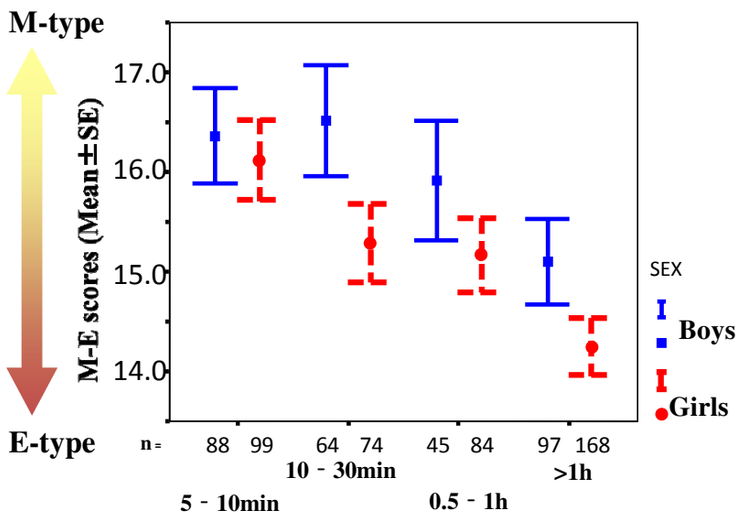


Fig. 15. Relationship between duration when mobile phone was once used and circadian typology in Japanese junior high school students living in Kochi (33°N). Questionnaires were administered in 2003-2006.

(Kruskal-Wallis test, boys, χ^2 =15.457, df=3, p=0.001, girls, χ^2=15.421, df=3, p=0.001)

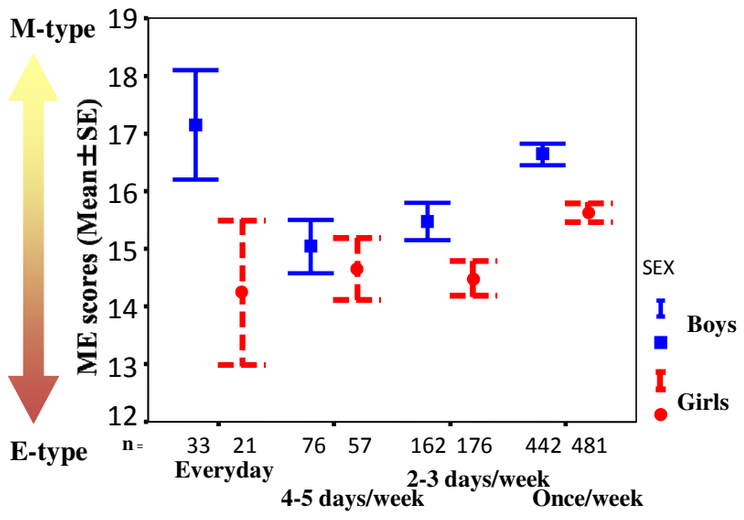


Fig. 16. Relationship between frequency of using convenience stores and circadian typology in Japanese junior high school students living in in Kochi (33°N). Questionnaires were administered in 2003-2006.

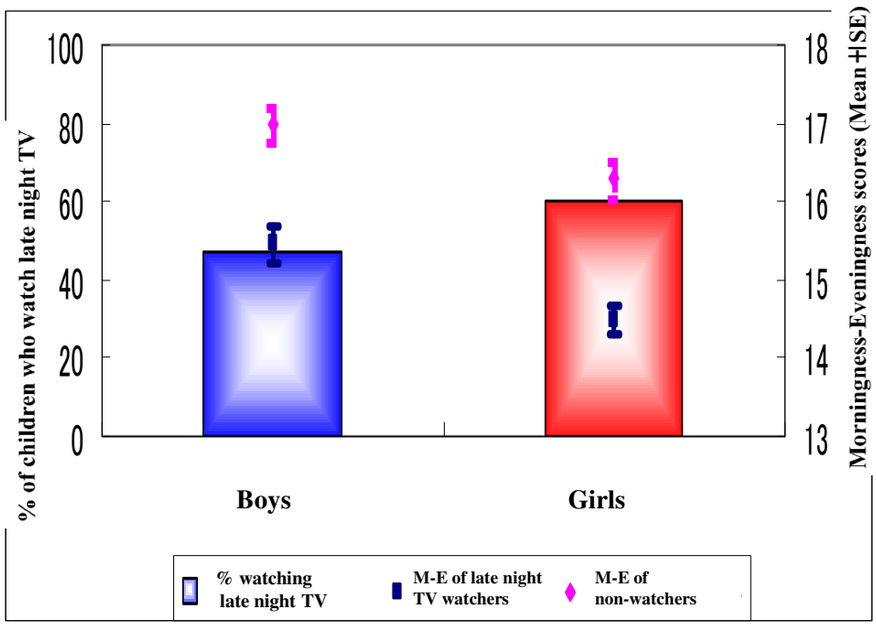


Fig. 17. Watchers of late night TV (from 11:00 p.m.) were much more evening-typed than non-watchers among both boys and girls attending a junior high school in Kochi (33°N). (Mann-Whitney U-test: boys, z=-4.92, p<0.001; girls, z=-6.14, p<0.001)

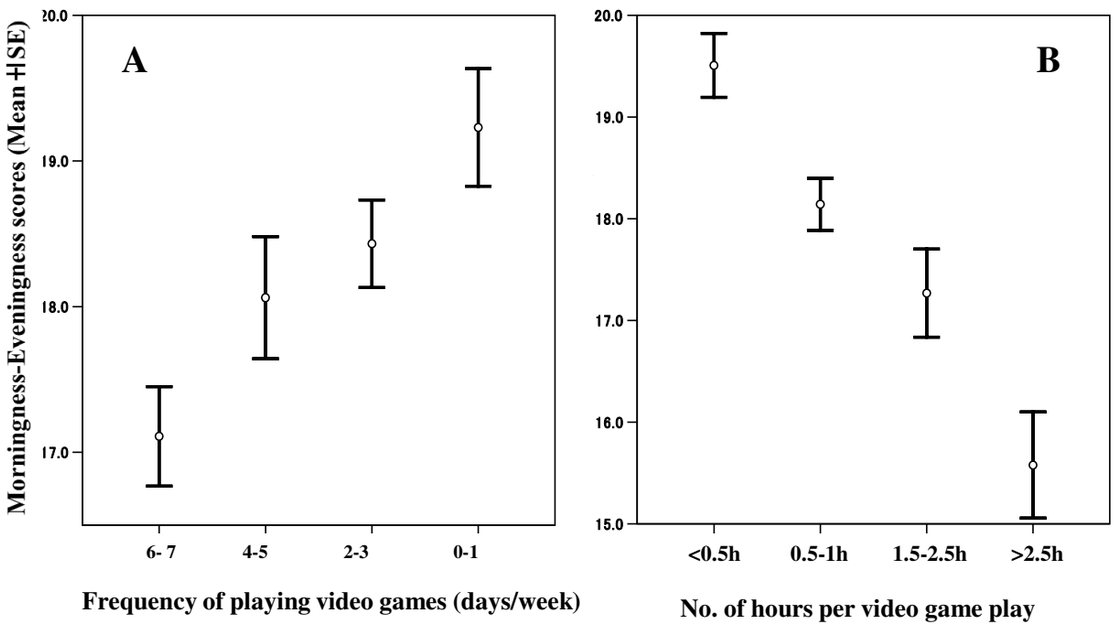


Fig. 18. Relationship between circadian typology and frequency of playing video games (A) and number of hours per instance of video game playing (B) in students attending an elementary school in Kochi (33ºN).Questionnaires were administrated to all the students in 2007, and 560 students responded (response rate of about 70%).

Among Japanese adolescents, 60% of girls watch late night TV, while only 48% of boys do so (Figure 17). Junior high students who watch late night TV show much lower M-E scores (1.5-1.8 points lower) than those who do not, irrespective of gender (Figure 17). Figure 18 shows a clear negative correlation between circadian typology (M-E scores) and frequency of playing video games on a gaming device, and between typology and duration of each instance of playing video games, in elementary school students living in Kochi, Japan. These clear correlations suggest that Japanese elementary school students play video games mainly in the evening. Krejci et al. (2011) recently reported that Japanese children aged 2-6 years and Czech children aged 2-8 years mainly played video games from 6:00 to 9:00 p.m. in June, and from 3:00 to 6:00 p.m. in November, respectively, and usage shifted children in both countries to evening typology.

7. Intervention programs to promote morning-typed lifestyles and better mental health in kindergarten children (Kondo et al., unpublished)

The objective of this intervention program was to assess whether a newly produced month-long intervention program which consists of 9 intervention items is effective for shifting diurnal rhythms of Japanese children aged 2-6years to morning-type.

The first 2 items consisted of letting children affix stickers of "NO TV BOY"(Intervention-1) or "NO VIDEO GAME GIRL"(Intervention-2) to a mount if they did not watch TV or play videogames that day. A leaflet for changing to a morning-typed lifestyle was written by Harada et al (unpublished) and included 7 advices to parents:

1. Expose your child to early morning sunlight (Intervention-3)
2. Avoid using fluorescent lamps during the first half of subjective night (Intervention-4)
3. Give your child a nutritionally rich breakfast at the same time every day (Intervention-5)
4. Expose your child to sunlight after breakfast to increase efficiency of serotonin synthesis (Intervention-6)
5. Enforce bedtime discipline (Intervention-7)
6. Shift your own diurnal rhythms (as the parent) to morning-type (Intervention-8)
7. Avoid bringing your child to shops or restaurants after sunset (Intervention-9)

These 9 interventions were administered to 1367 children who attended one of 11 nursery schools or 1 kindergarten in Kochi for 1 month in June, 2008. Effects of the interventions were estimated using an integrated questionnaire on how many days in the 30-day period they could administer each of the 9 intervention items and an anonymous questionnaire on diurnal rhythms (including an M-E questionnaire that Torsvall and Åkerstedt (1980) constructed and questions on sleep habits, depression, anger, and other topics). The questionnaires were administered immediately preceding the start of the intervention period and 2 months after the end of the intervention period. Increasing number of items in which a child could participate for more than 20 days correlated to greater morningness ($p<0.01$) (Figure 19), higher quality sleep ($p<0.01$) and better mental health ($p=0.01$) (Figure 20).

	r	*P* (both)	N
Intervention3 (Morning light)	−0.30	0.00	460
Intervention4 (Fluorescent L	−0.13	0.00	463
Intervention5 (Breakfast)	−0.24	0.00	471
Intervention6 (Sunlight)	−0.16	0.00	459
Intervention7 (Descipline)	−0.29	0.00	468
Intervention8 (MtypeParents	−0.32	0.00	467
Intervention9 (No nightstore	0.03	0.47	471
Intervention1(NoTV Boys)	−0.15	0.00	464
Intervention2(No Game Girls)	−0.11	0.02	453

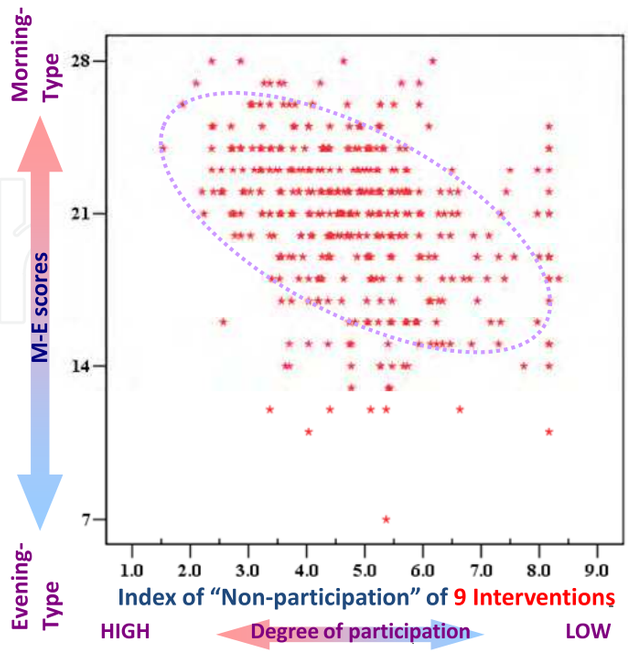


Fig. 19. Total scores of non-participation of Interventions 1-9 and M-E scores (Correlation analysis: r=0.348, p<0.01).

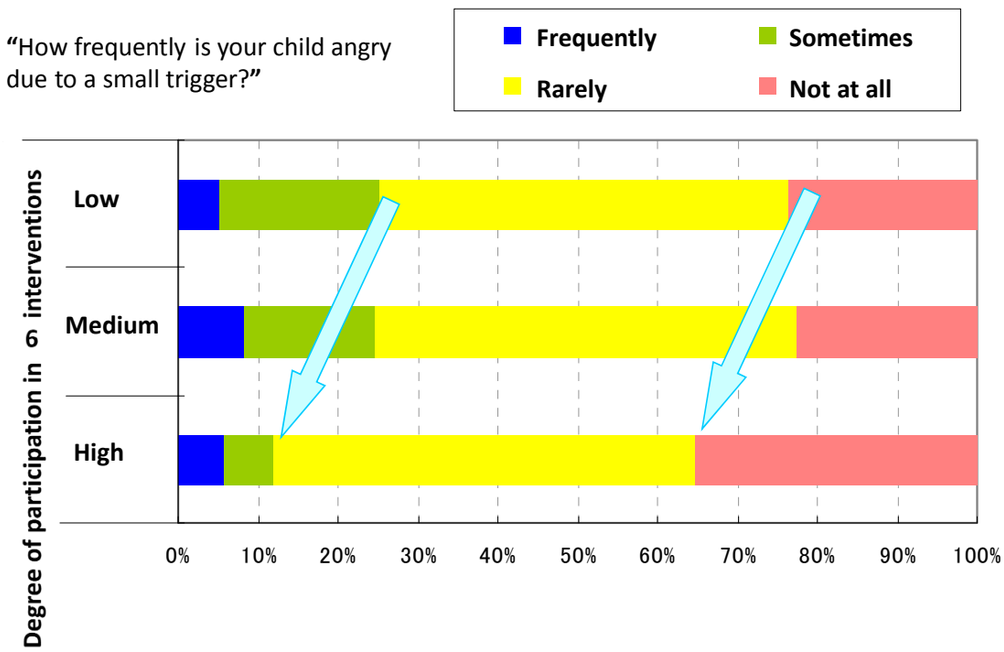


Fig. 20. High degree of participation of 9-Interventions leads to better mental health (frequency of anger triggered by something small) in Japanese children aged 1-6 years (p=0.012).

8. Intervention programs to promote morning-typed lifestyles and better mental health in elementary and junior high school students (Kondo et al., unpublished)

Girls are at a particular risk, as extremely evening-typed lifestyle leads to irregular menstruation cycle, severe pain accompanying menstruation and severe symptoms of premenstrual syndrome (PMS) (Takeuchi et al., 2005). Therefore, extremely evening-typed lifestyle in adolescent girls may impede normal development of the reproductive system and future reproductive function. In the current extreme situation, interventions are essential for maintaining better sleep, mental health and reproductive functioning in female junior high school students in Japan.

The type of intervention that is thought to be the most effective for maintaining their health is education in school classes that could help them control their own environmental factors by themselves to make their lifestyle more morning-typed. This intervention study attempted to evaluate the effectiveness of newly developed teaching materials and new lectures in class to promote better sleep and mental health by actual testing them and evaluating them from an epidemiological point of view.

The intervention project aimed to assess which of three following types of lectures is most effective for shifting adolescents to morning-type.

Type 1: Two back-to-back 50-minute lectures to explain the three following reasons why morning-type life styles lead to better grades:

1. Morning-types get adequate REM sleep which leads to the fixation of new memories,
2. Morning-types have better coupling of their two oscillators, which may promote better mental health, and
3. Tryptophan intake from a nutritionally rich breakfast is transformed into serotonin (that increases concentration).

Type 2: Two back-to-back 50-minute lectures to recommend 7 methods (Harada et al., unpublished) for changing to a morning-type:

1. Morning sunlight exposure before breakfast,
2. Avoidance of fluorescent lamps at night,
3. Nutritionally rich breakfast including tryptophan and vitamin B6,
4. Morning sunlight exposure after breakfast,
5. Avoidance of going to shops at night (convenience stores, video rental shops, 24-hour internet cafés, etc.),
6. Early morning study at home, and
7. Avoidance of using Visual Digital Terminals (video games) or watching TV at night

Type 3: One lecture to explain the three above reasons followed by one lecture to recommend the 7 above methods (combination lectures).

Type 4: Control group which received no lectures (no lectures).

Lectures were given by A. Kondo to 120 adolescents (60 girls, 60 boys) who attended a junior high school affiliated with the Faculty of Education of Kochi University, located at Kochi in June and July, 2009. Impact of the lessons was estimated using an integrated

questionnaire on whether the adolescents could participate in the 7 methods after the lecture, a questionnaire on diurnal rhythms (including an M-E questionnaire that Torsvall and Åkerstedt (1980) constructed and questions on sleep habits, ID no., etc.) and a questionnaire about their understanding of "Morningness-Eveningness". Most questionnaires were administered immediately preceding the lectures and 1 month after the lectures. One-to-one comparisons of before-lecture data to after-lecture data were used for the statistical analysis.

Seven recommendations (Harada et al., unpublished) for changing to a morning-type included 10 detailed points:

1. Exposure to sunlight in the early morning.
2. Avoidance of light from fluorescent lamps in the evening.
3. Having breakfast at the same time each day.
4. Having a nutritionally rich breakfast including tryptophan and vitamin B6.
5. Exposure to sunlight after breakfast.
6. Avoidance of shops (convenience stores, rental video shops, internet cafés and so on) or restaurants open after sunset.
7. Home study early in the morning.
8. Avoidance of using mobile phones in the evening and at night.
9. Avoidance of playing video games in the evening and at night.
10. Avoidance of watching TV in the evening and at night.

In each detailed point, every 5 days of participation counts as 1 index for the participation score, so that the participation index distribution is from 0 to 50 (5 indices x 10 detailed items). The questionnaire data was statistically analyzed with SPSS 12.0 statistical software. The analysis of M-E scores, bedtimes, wake-up times, and sleep duration was standardized to non-parametric tests of Mann-Whitney U-test and Kruskal-Wallis-test, as such variables did not always show normal distribution. The other items of analysis which were measured along an ordinal scale were subject to chi-square tests and Fisher's test meta-analysis.

One-to-one individual comparisons of before-lecture data to after-lecture data showed a significantly higher increase in M-E scores and a significantly higher decrease in frequency of depression in Type 3 students compared to the other types ($p<0.05$ for both) (Table 2). Understanding of "Morningness-Eveningness" was gained in more students in the Type 2 and 3 groups than in the Type 1 and 4 groups (Table 2).

There were no significant differences in the participation index among students in Type 1-4 groups (Table 3). A negative correlation was seen between the participation index nd difference in bed times ($r=-0.161$, $p=0.086$) and sleep duration ($r=-0.238$, $p=0.011$, Figure 21) (value-before-lecture minus value-1month-after-lecture) between before and 1month after the lecture.

The improvements in Type 3 students suggest that a combination of classes on fundamental knowledge and detailed techniques to promote health including diurnal rhythms and sleep may be effective for preventing the shift of Japanese adolescents to evening-type and for promoting better sleep and mental health. However, no differences were seen in the participation index between Type 3 students and students in the other groups. While there was no difference in the "quantity" of participation, it is likely that psychological "quality" may have been higher in the Type 3 students compared to students in the other groups.

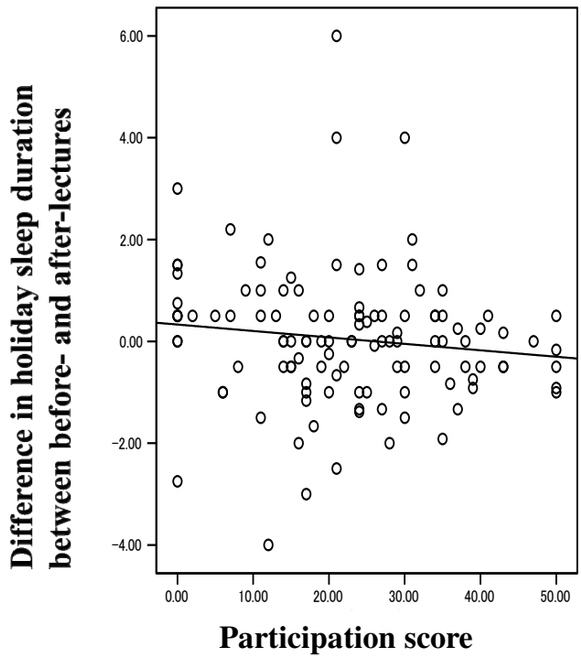


Fig. 21. Negative correlation between difference in sleep duration on holidays between before- and after-lectures (sleep-duration-before-lecture minus sleep-duration-1month-after-lecture) and participation score in the one-month period following the lecture (one-to-one analysis).

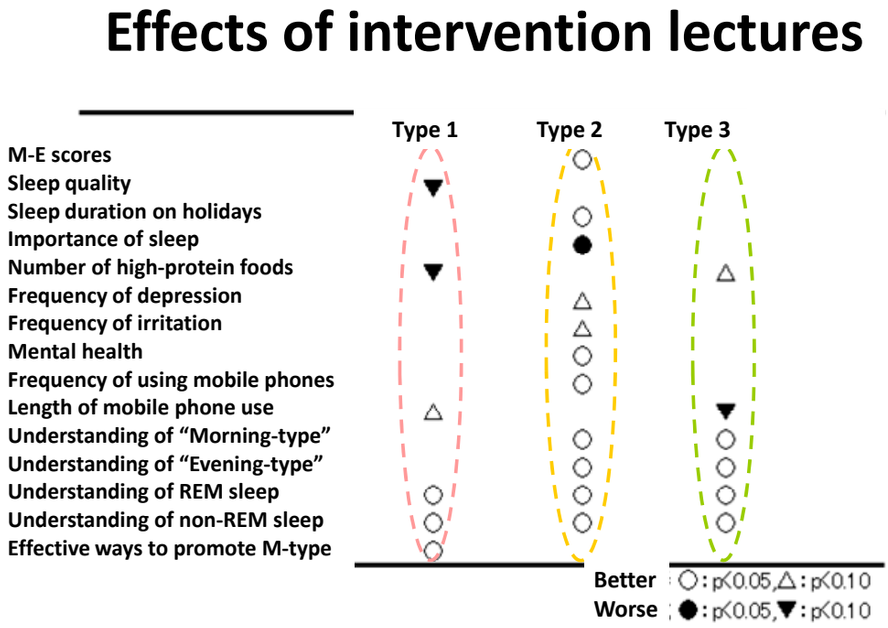


Fig. 22. Effects of intervention lectures consisting of Types 1-3.

A leaflet for changing to a morning-typed lifestyle produced by Harada et al (unpublished) and included 9 recommendations

1. Exposure to early morning sunlight **(Intervention-1)**
2. Avoidance of fluorescent lamps during the first half of subjective night **(Intervention-2)**
3. Having a nutritionally rich breakfast at the same time each day **(Intervention-3)**
4. Exposure to sunlight after having breakfast for efficient synthesis of serotonin **(Intervention-4)**
5. Bedtime discipline for young children aged 2-8 yrs **(Intervention-5)**
6. Diurnal rhythms of parents shifted to morning-type **(Intervention-6)**
7. Parents should not bring their children when they go to stores that are open after sunset **(Intervention-7)**
8. Making cram school classes earlier in the early evening and recommendation of studying at home early in the morning **(Intervention-8)**
9. Avoidance of watching TV, playing video games, working on computers and using mobile phones at night **(Intervention-9)**

Fig. 23. Nine recommendations to promote greater morningness in children which can promote better mental health.

Type	Change in M-E scores	Change in the knowledge on M-E	Change in depression
1	0.45 (2.45)	0.21 (0.64)	-0.03 (0.91)
2	0.47 (2.35)	0.39 (0.50)	0.15 (0.71)
3	1.88 (3.38)	0.31 (0.67)	-0.32 (0.96)
4	-0.11 (2.56)	0.26 (0.44)	-0.26 (0.67)
	Kruskal-Wallis test	*χ^2-test*	
χ^2-value	*8.934*	*15.352*	*24.663*
df	*3*	*6*	*15*
p-value	*0.03*	*0.018*	*0.055*

Table 2. Change in several parameters shown by students in three types of intervention lectures (Type 1-3) or in Type 4 with no intervention (Mean ± SD).

Participation score	*N in total (%)*	*Type 1(%)*	*Type 2(%)*	*Type 3(%)*	*Type 4(%)*
0	11(8.6)	1(3.0)	3(11.1)	6(20.7)	1(3.7)
1-10	19(16.2)	3(8.8)	1(3.7)	2(6.9)	2(7.4)
11-20	34(29.0)	10(29.4)	9(33.3)	6(20.7)	9(33.3)
21-30	34(29.0)	10(29.4)	9(33.3)	8(27.6)	7(25.9)
31-40	20(17.1)	7(20.6)	3(11.1)	4(13.8)	6(22.2)
41-50	10(8.5)	3(8.8)	2(7.5)	3(10.3)	2(7.4)
Kruskal-Wallis test					
X^2-value= 2.497					
df=3					
p=0.476					

Table 3. Distibution of scores for participation in the intervention program (Types 1-4).

9. Conclusions: How can we change the environmental conditions surrounding children to promote better mental health?

Figure 23 shows nine recommendations for promoting morning-typed lifestyles in children. The first recommendation is to induce a circadian phase advance by morning exposure to sunlight, while the second recommendation is to prevent the phase delaying effects of blue light emitted from fluorescent lamps in the first half of subjective night (Honma & Honma, 1988). The third and fourth recommendations are effective methods for inducing serotonin synthesis in the morning (Harada et al., 2007; Nakade et al., 2009). The fifth and sixth recommendations act as social zeitgebers for circadian clocks in children. The seventh to ninth recommendations help children avoid exposure to blue light emitted from strong fluorescent lamps in the evening on the roofs of cram schools for entrance examinations to high school and convenience stores, and the displays of mobile phones, televisions and computers in Japan.

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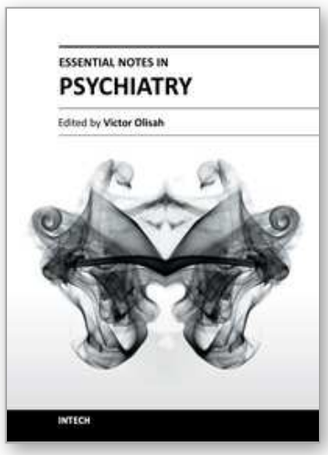

Essential Notes in Psychiatry

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Psychiatry is one of the major specialties of medicine, and is concerned with the study and treatment of mental disorders. In recent times the field is growing with the discovery of effective therapies and interventions that alleviate suffering in people with mental disorders. This book of psychiatry is concise and clearly written so that it is usable for doctors in training, students and clinicians dealing with psychiatric illness in everyday practice. The book is a primer for those beginning to learn about emotional disorders and psychosocial consequences of severe physical and psychological trauma; and violence. Emphasis is placed on effective therapies and interventions for selected conditions such as dementia and suicide among others and the consequences of stress in the workplace. The book also highlights important causes of mental disorders in children.

InTech Europe
University Campus STeP Ri
Slavka Krautzeka 83/A
51000 Rijeka, Croatia
Phone: +385 (51) 770 447
Fax: +385 (51) 686 166
www.intechopen.com

InTech China
Unit 405, Office Block, Hotel Equatorial Shanghai
No.65, Yan An Road (West), Shanghai, 200040, China
中国上海市延安西路65号上海国际贵都大饭店办公楼405单元
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