

CONTEXT OF THE FUNDAMENTAL KNOWLEDGE ABOUT DIURNAL RHYTHMS WITH MENTAL HEALTH OF ADOLESCENTS

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Abstract: *The objective of the study was to assess which of three types of lectures are most effective for shifting adolescents to morning-type. Control group to which no lectures were given were observed in parallel conditions. Together in the study 120 adolescents (60 girls, 60 boys) participated, which attended affiliated junior high school. The effects of the class were estimated by an integrated questionnaire on whether the adolescents could participate in the 7 items after the class and a questionnaire on diurnal rhythms (MEQ Torsvall and Åkerstedt, 1980). The questionnaires were administered twice: just before and 1 month after the class. One-by-one comparison of before-class data to after-class one showed that significantly higher increase in Morning-Evening scores and also higher decrease in the frequency to be depressed in the Type 3 class students, than that in the other three classes ($P < 0.05$ in both). Combination of classes of fundamental knowledge about the diurnal rhythms and sleep habits might be effective for preventing of the actual Japanese adolescents shifting to evening-type and for the mental health promotion of the adolescents.*

Key words: *adolescents, sleep habits; circadian preferences; mental health; intervention class; circadian typology, fundamental knowledge of wellness life style.*

1 Introduction

Epidemiological studies performed in 1996-2007 on diurnal rhythm and sleep habits of Japanese junior high school students and University students located in Kochi city (33N) reported that “extreme evening-typed” students newly appeared in part in the last several years in accompanying with 24h commercialization society going on (Harada & Takeuchi, 2001; Harada, 2008). Extremely evening-typed life promotes not only the shortage of sleep hours and lower sleep quality but also the worse mental health, e.g. states of angry, irritation, depression etc. (Takeuchi et al., 2002; Harada, 2004). Especially for female adolescents, extremely evening-typed life leads to irregular menstruation cycle, severe pain in accompanying with menstruation and severe PMS (Premenstrual Syndrome) (Takeuchi et al., 2005). Therefore, extremely evening-typed life by adolescents seems to be dangerous for

normal development of reproductive system and future reproductive function for female adolescents. In the current severe situation for keeping sleep, mental and reproductive functions, some intervention should be crucial for Japanese female junior high school students.

The intervention which is thought to be most effective to keep their health is the education in the school class and could promote them to control their own environmental factors leading to morning-typed life style by themselves. This study tries to evaluate the effectiveness of newly developed teaching materials and the new lecture in the class to promote sleep and mental health in the actual testing them and epidemiological evaluation.

Battery of Harada et al. (2008) for morning-type shifting includes 10 detailed items. This battery became a base, used in transformation form, for the intervention applications during the presented study.

The named battery includes totally 10 items:

1. Exposure to sunlight in the early morning;
2. Avoidance of light from fluorescent lamp in the evening;
3. Taking breakfast at regular time;
4. Nutritionally rich breakfast including Tryptophan and Vitamin B6;
5. Exposure to sunlight after taking breakfast;
6. Don't go to the shops (convenience store, rental video shop, internet café and so on) or restaurant opened after the sunset;
7. Home study early in the morning;
8. Avoidance of using mobile phone in the evening and night;
9. Avoidance of the usage of TV-game in the evening and night;
10. Avoidance of the watching TV in the evening and night.

In each detailed item, every 5 days of participation counts 1 index for the participation value. Therefore, the index of the participation value distributes from 0 to 50 (5 indices x 10 detailed items).

2 Objective, research questions

The objective of the study was to assess which of three types of lecture will be verified as the most effective for shifting of adolescents to morning-type.

As the main research question we proposed that: “Combination of classes on fundamental knowledge of diurnal rhythms and sleep will be shown as most effective for the shift to morning-type”.

3 Methods

3.1 Characteristics of samples

Together in the study 120 adolescents (60 girls, 60 boys) participated, which attended affiliated junior high school in the age 14-15.

3.2 Project characteristics, intervention method description

The intervention was realised in affiliated junior high school, in the time of last two month of the school year, before summer holidays. Follow three types of intervention lectures were applied during the presented research study:

Type 1: Continuous 2 classes (50min x 2) of lecture to explain the three reasons why morning-type life promotes high marks in the subjects: (1) Sufficient REM sleep which morning-type can get, leads to the fixation of new memories, (2) Well-coupling of the two oscillators in morning-type can promote better mental health, (3) Tryptophan taken from rich breakfast is transferred to serotonin (influence on the ability to keep concentration).

Type 2: Continuous 2 classes (50min x 2) of lectures about 7 transformed items from the original Battery of Harada et al. (2008):

- Exposure to sunlight before and after taking the breakfast;
- Avoidance of light from fluorescent lamp in the evening;
- Taking breakfast at regular time;
- Nutritionally rich breakfast including Tryptophan and Vitamin B6;
- Don't go to the shops (convenience store, rental video shop, internet café and so on) or restaurant opened after the sunset;
- Home study early in the morning;
- Avoidance of using Visual Digital Terminal (TV-game) and watching TV at night.

Type 3: Continuous of 1 class of lecture to explain the three reasons and continuous another 1 class of lecture to recommend the 7 items (combination of lectures).

Control group to which no lectures were given were observed in parallel conditions.

Effects of the class were estimated by an integrated questionnaire on whether the adolescents could participate in the 7 items after the class and a questionnaire on diurnal rhythms (MEQ Torsvall and Åkerstedt (1980) version, sleep habits, ID No. etc.). Most of the questionnaire was administered twice: just before and 1 month after the class. One-by-one comparison of before-class data to after-class one showed that significantly higher increase in M-E scores and also higher decrease in the frequency to be depressed in Type 3 class students than that in the other three classes ($P < 0.05$ in both). The class was given to 120 adolescents (60 girls, 60 boys) who attended affiliated junior high school, Faculty of Education, Kochi University, located at Kochi (33 degree N), Japan in June and July, 2009.

3.3 Statistical analysis

The questionnaire data were statistically analysed with SPSS 12.0 statistical software. The analysis on E-E scores, sleep times, 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.

4 Results and discussions

One by-one individual comparison of before-class data to after-class one showed that significantly higher increase in M-E scores and also higher decrease in the frequency to be depressed were shown in Type 3 class students than that in the other three classes ($P < 0.05$ in both, see Table 1). The knowledge on "Morningness-Eveningness" was newly fixed in more students in Types 2 and 3 groups than those in Types 1 and 4 (see Table 1).

Table 1 Change in several parameters shown by students in three types intervention class

(Type 1-3) or in Type 4 with no intervention (Mean \pm SD)			
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)
<i>Kruskal-Wallis test:</i>			
<i>X²-value</i>	8.934	15.352	24.663
<i>df</i>	3	6	15
<i>P-value</i>	0.03	0.018	0.055

Table 2 Distribution of the participation value in the intervention program (Types 1-4)

Participation value	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

There were no significant differences in the participation degree index among students of Types 1-4 (see Table 2). Negative correlation between the participation degree index and wake-up time ($r=0.161$, $P=0.086$) and sleep hours duration ($r=0.238$, $P=0.011$, see Figure 1) was shown.

One-by-one comparison of before-class data to after-class one showed that significantly higher increase in M-E scores and also higher decrease in the frequency to be depressed in Type 3 class students than that in the other three classes ($P<0.05$ in both). Combination of classes on fundamental knowledge and detailed techniques to promote health of diurnal rhythms and sleep might be effective for preventing the shift of Japanese adolescents to evening-type and promoting sleep and mental health. However, there are no difference in the participation index between Type 3 students and the other 3 Types ones. Probably, not the “quantity” of participation but some psychological “quality” of that might be higher in the Type 3 students than the other ones.

5 Conclusions

The goal of the research study was realised successfully. It was verified the main research question: “Combination of classes on fundamental knowledge of diurnal rhythms and sleep will be shown as most effective for the shift to morning-type”. From the presented and discussed results we can conclude that for mental health promotion and for sleep habits optimizing in adolescence age just the combination of classes of fundamental knowledge might be effective for preventing of the shift of Japanese adolescents to the evening-type.

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6 References

Harada, T. (2004) Evening-typed life in the current Japan society and mental health. *Journal of Child Health* 63: 202-209.

Harada, T. (2008) Diurnal rhythm and sleep habits of Japanese infants, pupils and students aged 0-25 yrs. – focusing on life environmental factors including ones related to 24hrs commercialization society. *Journal of Chronobiology* 14: 36-43.

Harada, T. & Takeuchi, H. (2001) Epidemiological study on diurnal rhythm and sleep habits of Japanese pupils and students aged 10-25yrs. *Journal of Chronobiology* 7: 36-46.

Takeuchi, H., Oishi, T., Harada, T. (2005) Association between morningness-eveningness preference and mental/physical premenstrual symptoms in Japanese females 12 to 31 years of age *Chronobiology International*, 22: 1055-1068.

Takeuchi, H., Morisane, H., Iwanaga, A., Hino, N., Matsuoka, A. & Harada, T. (2002) Morningness-Eveningness preference and mood in Japanese junior high school students. *Psychiatry and Clinical Neurosciences*, 56: 227-228.

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