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Original Article

Epidemiological Study on Relationship between Mental or Physical Health Status and Sleep Habits among University Students

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Abstract

With the recent transformation of Japan into an information society, a rise in suicides among university students due to stress has become a social issue. Being well-aware of your own physical and mental health is a key to developing an appropriate lifestyle as a human being. One relevant factor is that the human sleep cycle is conditioned by the circadian rhythm to follow a pattern of waking during the day and sleeping at night. This study surveyed 2,000 university students on their physical health, mental health, and sleep habits. It examined the relationships between physical or mental health, sleep and fatigue on the basis of gender and housing style.

The survey results indicated that the physical and mental health of male students was better than that of female students. Male students had a better sleep quality as compared to female students. Similarly, boarding students had a better sleep quality as compared to the students living at home. This study also found that university students sleep for about 6.5 hours a night on an average. Those who slept less than the average felt fatigued. Furthermore, students with more "positive factors" related to physical and mental health had a better sleep quality. Such findings suggest that practical intervention to educate university students about the importance of sleep would help them maintain their physical and mental health and that it is imperative to proactively intervene in order to improve students' sleep habits.

Key words : Fatigue, Physical and mental health status, Sleep habits, University students

I. INTRODUCTION

Recently, the social environment surrounding university students has become more nocturnal than in the past. Their sleep duration has shortened, and their daily rhythm has altered because of the changes in their social habits. University students are relatively free of any regulations regarding their daily routine. As a result, some students live erratic and arrhythmic lives. NHK's 2010 National Time-Use Study[1] reports that people in their twenties sleep for an average of 7 hours and 1 minute, but university students sleep less than 7 hours a day during the week. In addition, medical students on an average sleep less than 6 hours a day[2]. As this report shows, university students are less conscious of their sleep environment, sleep quality, and duration of sleep than are adults and junior-high and high-school students, who lead a relatively regulated lifestyle. It is thought that maintaining a fixed bedtime helps establish a strong circadian rhythm and is a key to having a good quality of sleep[3]; however, the sleep habits of adolescents are irregular[4, 5], and they do not follow a fixed bedtime. Many university students are insecure about their careers, which makes them vulnerable to mental stress and psychosomatic disorders. However, few studies have assessed how physical or mental health might be related to fatigue and sleep habits.

This study investigates the physical and mental health, fatigue, and sleep habits of university students and examines the relationships between these variables. This research aims to find practical ways to help university students in their adolescence develop a suitable lifestyle.

II. Method

1. Survey method

The questionnaire of the original survey titled "Survey of daily habits and lifestyle habits" (Table 1) was distributed to

the students of K university between April 7 and April 13 in 2011. Questions related to the following items were answered on a 10-point scale: Items regarding physical health were as follows: "stamina," "current health condition," and "health condition of the past year" (1 = bad to 10 =good); Items regarding mental health consisted of "positive factors" such as "level of success in achieving goals," "sense of purpose," and "mental strength" and "negative factors" such as "worrisome," "stress," and "troubled" (1 = weak or little to 10 = strong or many); Items regarding sleep habits were as follows: "duration of sleep," "depth of sleep," and "degree of sleep" (1 = unsatisfactory to 10 = satisfactory) and "I am making a conscious effort to get more sleep" (1 = no to 10 = yes). Other items included average duration of sleep and onset of sleep. Valid responses were collected from 1571 males and 525 females; these included 1591 students living at home and 505 boarding students.

Height, weight, BMI (Body Mass Index), and body-fat percentage of the university students were measured from 14-17 April, 2011. Body Mass Index (BMI) was calculated by weight in kg/(height in meters)^2; weight (kg) and body-fat percentage (%) were measured using TBF-310 body-fat monitors (TANITA Corporation).

2. Statistical analysis

Statistical analysis and significance tests were carried out using Windows JMP ver. 8.0.2 (SAS Institute Inc.). The students' t test was used for group comparisons, the χ^2 test was used for analyzing distribution, and a one-way ANOVA was used to compare fatigue and duration of sleep by categories. The significance level was set at $p < 0.05$.

3. Ethical consideration

This study was conducted under the approval of the ethical committee of Kinki University's Faculty of Pharmacy, and the survey remained anonymous, keeping in mind informed

Table 1 Questionnaire entitled survey on lifestyle habits

1. Age _____year
2. Gender ☐ Male ☐ Female
3. Residence form ☐ Commuter ☐ Lodger

Physical health status

4. Fatigue in the past month
☐ No ☐ Yes, 1 - 2 times ☐ Yes, 3 - 4 times ☐ Yes, more than 5 times
5. Illness in the past month
☐ No ☐ Yes, take over-the-counter medicine ☐ Yes, go to the hospital ☐ Yes, hospitalization
6. Allergies
☐ No ☐ Yes, but take no medicines ☐ Yes, and take medicines sometimes ☐ Yes, and always take medicines
7. Select 5 or 6 normally

Stamina	Bad	1	2	3	4	5	6	7	8	9	10	Good
Current health condition	Bad	1	2	3	4	5	6	7	8	9	10	Good
Health condition of the past month	Bad	1	2	3	4	5	6	7	8	9	10	Good

Mental health status

8. Select 5 or 6 normally

Level of success in achieving goals	Weak	1	2	3	4	5	6	7	8	9	10	Strong
Sense of purpose	Weak	1	2	3	4	5	6	7	8	9	10	Strong
Mental strength	Weak	1	2	3	4	5	6	7	8	9	10	Strong
Worrisome	Little	1	2	3	4	5	6	7	8	9	10	Many
Stress	Little	1	2	3	4	5	6	7	8	9	10	Many
Troubled	Little	1	2	3	4	5	6	7	8	9	10	Many

Sleep habits

9. Bedtime ☐ P.M. ☐ A.M. At about____ Wake-up time ☐ A.M. ☐ P.M. At about____
10. Duration of sleep About _____hours
11. Onset of sleep About _____minutes
12. Select 5 or 6 normally

Duration of sleep	Unsatisfactory	1	2	3	4	5	6	7	8	9	10	Satisfactory
Depth of sleep	Unsatisfactory	1	2	3	4	5	6	7	8	9	10	Satisfactory
Degree of sleep	Unsatisfactory	1	2	3	4	5	6	7	8	9	10	Satisfactory
13. Conscious effort to acquire sleep	No	1	2	3	4	5	6	7	8	9	10	Yes

consent and privacy protection. Participants were told that all the collected data would be used only for anti-aging and lifestyle-related disease prevention studies, participation in the survey was voluntary, and their privacy was well-protected.

III. Results

1. Age and physical structure

The physical characteristics of the university students' age, height, weight, BMI, and body-fat percentage by gender are shown in Table 2. The average age of male and female students was 18.3 ± 0.8 years and 18.2 ± 0.5 years, respectively. The height and weight measurements were 171.4 ± 5.8 cm and 63.7 ± 10.9 kg, respectively, for male students and 159.0 ± 5.3 cm and 52.2 ± 7.1 kg, respectively, for female students. The body-fat percentage and BMI were 17.2 ± 5.8 % and 21.7 ± 3.4 kg/m^2 for male students and 25.4 ± 5.5 % and 20.6 ± 2.5 kg/m^2 for female students.

2. Fatigue, illness, and allergies

Survey questions regarding the items "fatigue in the past month," "illness in the past month," and "allergies" were answered on a 4-point scale; the results are shown in Table 3. A significant difference was found between males and females for the following items: a higher percentage of female students was prone to fatigue and illness and was taking medications for allergies as compared to male students. On the other hand, on the basis of the type of residence, the only significant difference was in "fatigue in the past month," with more boarding students reporting feeling tired four or more times in the past month as compared to the students living at home.

Table 2 Physical characteristics of university students in different gender

Physical characteristics	Male (n=1571)	Female (n=525)
Age (year)	18.3 ± 0.8	18.2 ± 0.5
Height (cm)	171.4 ± 5.8	159.0 ± 5.3
Weight (kg)	63.7 ± 10.9	52.2 ± 7.1
Body fat percentage (%)	17.2 ± 5.8	25.4 ± 5.5
BMI (kg/m^2)	21.7 ± 3.4	20.6 ± 2.5

3. Physical and mental health

Questions about physical health factors such as "stamina," "current health condition" and "health condition of the past year" were answered on a 10-point scale (1 = bad to 10 = good). The total values for "positive factors" and "negative factors" of mental health are shown in Table 4. The results indicate a significantly higher score in "physical health" and "positive factors" for male students than for female students. No significant difference was found on the basis of the different types of residence.

4. Sleep habits

Table 5 shows the results of survey items "bedtime," "wake-up time," "duration of sleep," "onset of sleep," and "sleep quality." "Sleep quality" was calculated by adding the scores for the following three items, which were assessed by respondents on a 10-point scale: "duration of sleep," "depth of sleep," and "degree of sleep." The results showed a significant difference in "wake-up time" and "average duration of sleep" both between males and females and between commuters and lodgers. In addition, "sleep quality" was higher for male students than for female students and higher for lodgers than

Table 3 Physical health status of university students in different classification

	Physical health status	Male (n=1571)	Female (n=525)	p value	Commuter (n=1591)	Lodger (n=505)	p value
Fatigue	No	14.7	7.8	0.000 ***	12.2	15.4	0.030*
	Yes, 1 - 2 times	29.8	23.6		28.3	28.1	
	Yes, 3 - 4 times	22.4	27.4		25.0	19.4	
	Yes, more than 4 times	33.1	41.1		34.5	37.0	
Illness	No	88.5	82.5	0.003 **	86.5	88.7	0.539
	Yes, take over-the-counter medicine	7.5	11.8		8.9	7.5	
	Yes, go to the hospital	3.8	5.7		4.5	3.8	
	Yes, hospitalization	0.1	N.D		0.1	N.D	
Allergy	No	71.4	65.7	0.000***	69.6	71.1	0.765
	Yes, but take no medicines	16.5	15.0		16.7	14.7	
	Yes, and take medicines sometimes	9.7	16.4		11.3	11.7	
	Yes, and always take medicines	2.4	2.9		2.5	2.6	

N.D.: no data, *: p<0.05, **: p<0.01, ***: p<0.001

Table 4 Physical and mental health status scores of university students in different classification

Health status	Male (n=1571)	Female (n=525)	*p* value	Commuter (n=1591)	Lodger (n=505)	*p* value
Physical	18.1 ± 5.2	17.2 ± 5.0	0.000***	7.8 ± 5.2	18.0 ± 5.0	0.401
Stamina	5.0 ± 2.1	4.7 ± 1.9	0.002**	4.9 ± 2.1	4.9 ± 2.1	0.545
Current health condition	6.2 ± 2.2	6.0 ± 2.1	0.048*	6.2 ± 2.2	6.3 ± 2.2	0.375
Health condition of the past month	6.9 ± 2.2	6.5 ± 2.2	0.000***	6.7 ± 2.2	6.9 ± 2.2	0.089
Positive factors	16.5 ± 5.0	16.1 ± 4.8	0.184	16.3 ± 4.9	16.7 ± 5.0	0.077
Level of success in achieving goals	6.0 ± 2.0	5.8 ± 1.9	0.134	5.9 ± 2.0	6.0 ± 2.1	0.260
Sense of purpose	5.1 ± 2.1	5.2 ± 2.0	0.243	5.1 ± 2.0	5.3 ± 2.1	0.038*
Mental strength	5.4 ± 2.2	5.1 ± 2.1	0.006**	5.3 ± 2.2	5.4 ± 2.2	0.292
Negative factors	16.4 ± 5.6	17.3 ± 5.2	0.001**	16.7 ± 5.5	16.4 ± 5.6	0.335
Worrisome	6.2 ± 2.4	6.4 ± 2.4	0.154	6.3 ± 2.4	6.1 ± 2.4	0.119
Stress	5.1 ± 2.2	5.6 ± 2.0	0.000***	5.3 ± 2.1	5.2 ± 2.2	0.694
Troubled	5.1 ± 2.2	5.3 ± 2.0	0.037*	5.1 ± 2.2	5.1 ± 2.3	0.737

*: $p<0.05$, **: $p<0.01$, ***: $p<0.001$

Table 5 Sleep habits of university students in different classification

Sleep habits	Male (n=1571)	Female (n=525)	*p* value	Commuter (n=1591)	Lodger (n=505)	*p* value
Bed time	0.4 ± 1.0	0.4 ± 1.0	0.261	0.4 ± 1.0	0.3 ± 1.0	0.106
Wake-up time	6.9 ± 1.0	6.6 ± 0.9	0.000***	6.7 ± 1.0	7.2 ± 1.0	0.000***
Duration of sleep (hr)	6.4 ± 1.1	6.1 ± 1.1	0.000***	6.2 ± 1.1	6.7 ± 1.0	0.000***
Onset of sleep (min)	19.0 ± 16.1	19.5 ± 17.9	0.569	19.1 ± 16.7	19.1 ± 16.2	0.957
Sleep quality	17.0 ± 5.8	15.8 ± 5.4	0.000***	16.5 ± 5.6	17.3 ± 6.0	0.005**
Duration of sleep	5.1 ± 2.3	4.5 ± 2.2	0.000***	4.7 ± 2.2	5.5 ± 2.4	0.000***
Depth of sleep	6.2 ± 2.3	5.9 ± 2.3	0.003**	6.2 ± 2.3	6.1 ± 2.3	0.584
Degree of sleep	5.7 ± 2.1	5.4 ± 2.2	0.008**	5.6 ± 2.1	5.7 ± 2.2	0.185
Conscious effort to acquire sleep	6.3 ± 2.2	6.2 ± 2.1	0.485	6.2 ± 2.2	6.6 ± 2.2	0.000***

: $p<0.01$,*: $p<0.001$

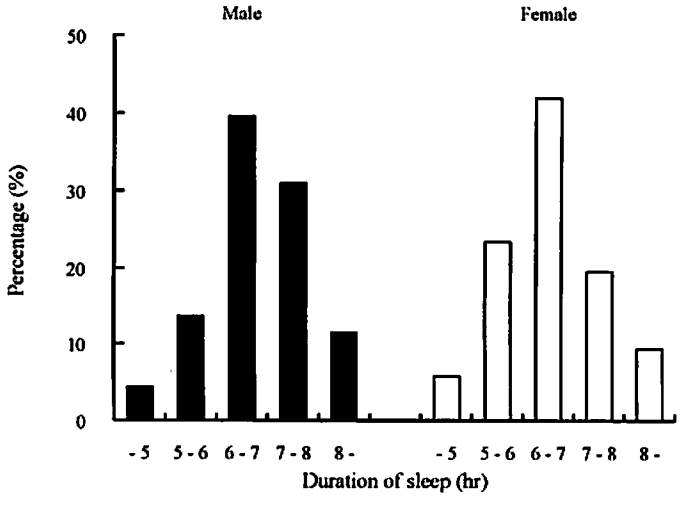

Fig. 1 Duration of sleep of university students in different gender

for commuter students. Furthermore, Fig. 1 shows the results for the university students' average duration of sleep. These results have been organized into several groups: 5 or less, 5-6, 6-7, 7-8, and 8 hours or more. The majority of students fell under the 6-7 hours of sleep or less group, but male students had a tendency to sleep longer than female students.

5. Relationship between fatigue and duration of sleep

Figures 2 and 3 show the results found for the relationship between the average duration of sleep and fatigue for males and females and for commuters and lodgers. A shorter duration of sleep yielded a significantly higher percentage of fatigued students (male students: $p < 0.001$, students living at home: $p < 0.001$, and boarding students: $p < 0.05$). On the other hand, although the

difference was not significant, a higher percentage of female students also felt fatigued as a result of shorter sleep duration.

6. Relationship between fatigue and physical or mental health

Table 6 shows the relationship between fatigue and physical or mental health status for males and females and for commuters and lodgers. Students who experienced fatigue reported a significantly lower mean score on "physical health" and "positive factors" and a higher mean score on "negative factors." The relationship between fatigue and "positive factors" was not significant for female students and lodgers; however, the mean scores for "positive factors" were more likely to be lower.

7. Relationship between sleep quality and physical or mental health

Figure 4 or 5 show the relationship between sleep quality and physical or mental health for males and females and for commuters and lodgers, respectively. The higher scores for "physical mental health" and "positive factors" were associated with better sleep quality, and higher scores for "negative factors" were associated with worse sleep quality.

IV. Discussion

1. Physical structure test

According to the 2008 Physical Fitness and Physical Ability Test Report[6] prepared by the Ministry of Education, Culture, Sports, Science and Technology, the average height and weight for male students were

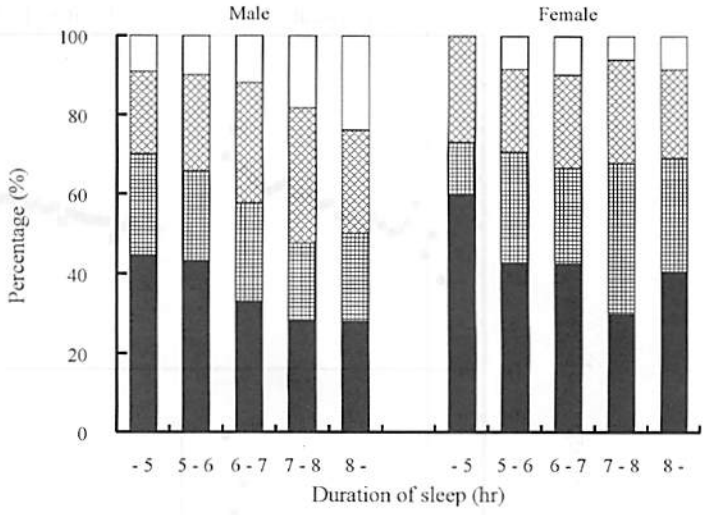

Fig. 2 Relationship between fatigue and duration of sleep of university students in different gender
□ : No, ▨ : Yes, 1 − 2 times, ▩ : Yes, 3 − 4 times, ■ : Yes, more than 5 times

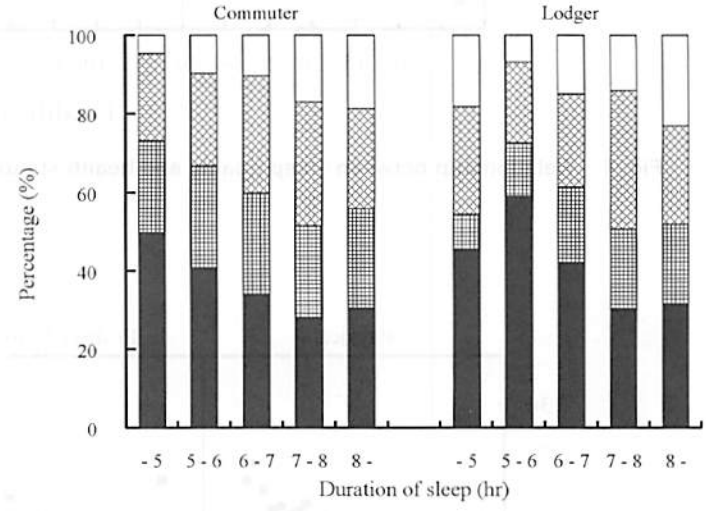

Fig. 3 Relationship between fatigue and duration of sleep of university students in different residence form
□ : No, ▨ : Yes, 1 − 2 times, ▩ : Yes, 3 − 4 times, ■ : Yes, more than 5 times

Table 6 Physical and mental health status scores of university students by degree of fatigue : Significant interrelation

Classifications	Healthstatus	No	Yes, 1-2 times	Yes, 3-4 times	Yes, more than 5 times	*p* value
Male	Physical	20.3 ± 5.2	18.7 ± 4.8	18.1 ± 4.8	16.6 ± 5.4	0.000***
	Positive factors	18.0 ± 5.2	16.6 ± 4.6	16.3 ± 4.8	15.7 ± 5.3	0.000***
	Negative factors	13.8 ± 5.7	15.5 ± 5.0	16.7 ± 5.1	18.1 ± 5.8	0.000***
Female	Physical	19.6 ± 5.5	18.5 ± 4.3	16.9 ± 4.9	16.0 ± 5.0	0.000***
	Positive factors	16.9 ± 4.7	16.4 ± 4.2	15.8 ± 4.1	16.0 ± 5.5	0.459
	Negative factors	14.1 ± 5.4	15.4 ± 4.8	18.3 ± 4.2	18.3 ± 5.5	0.000***
Commuter	Physical	20.3 ± 5.2	18.6 ± 4.7	17.9 ± 4.8	16.2 ± 5.5	0.000***
	Positive factors	17.9 ± 5.2	16.5 ± 4.5	16.2 ± 4.5	15.6 ± 5.4	0.000***
	Negative factors	14.0 ± 5.7	15.5 ± 5.0	17.2 ± 4.8	18.3 ± 5.7	0.000***
Lodger	Physical	19.8 ± 5.3	18.9 ± 4.6	17.3 ± 5.1	17.0 ± 4.7	0.000***
	Positive factors	17.7 ± 5.0	17.1 ± 4.8	16.2 ± 4.9	16.3 ± 5.2	0.127
	Negative factors	13.5 ± 5.6	15.5 ± 4.7	17.4 ± 5.2	17.9 ± 6.0	0.000***

***: $p<0.001$

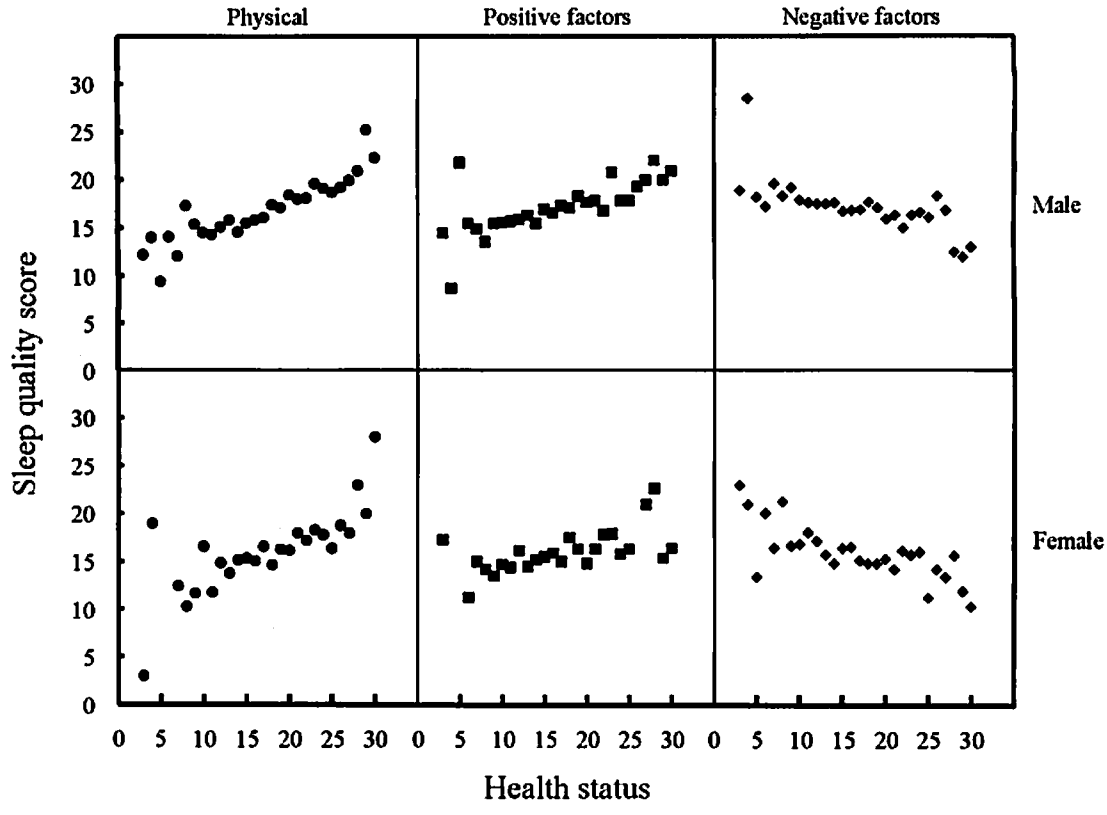

Fig. 4 Relationship between sleep quality and health status in different gender

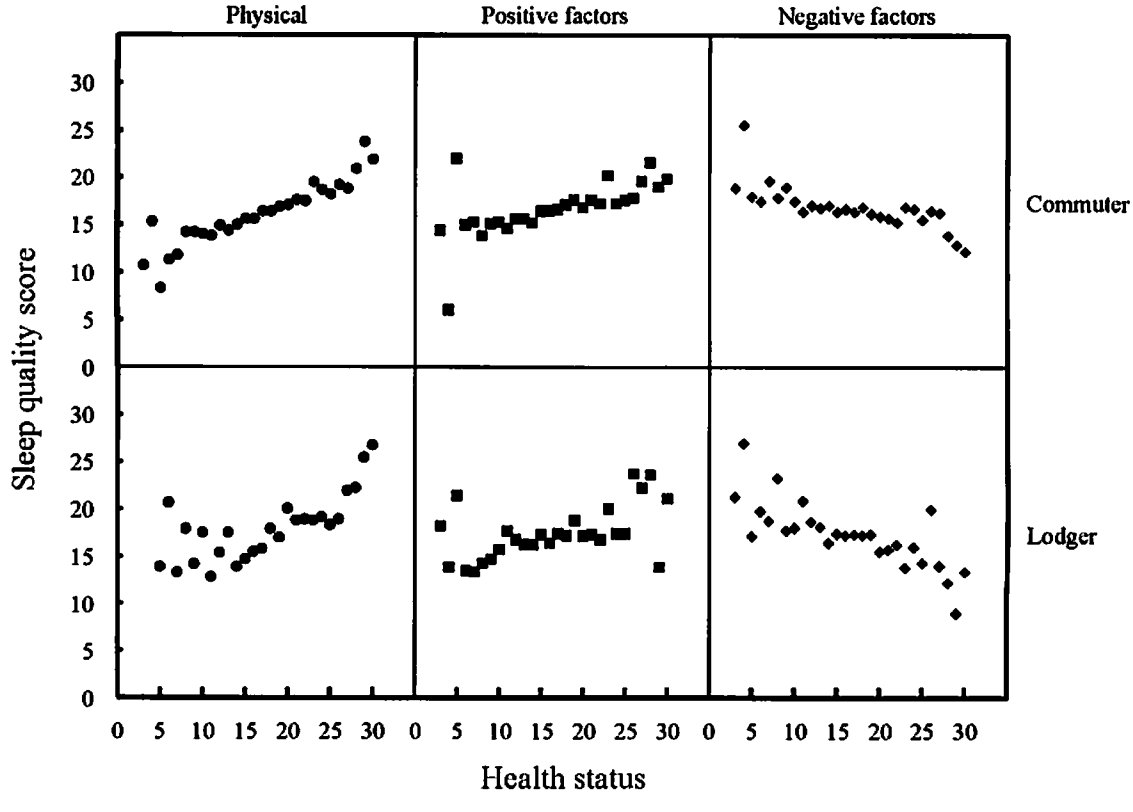

Fig. 5 Relationship between sleep quality and health status in different residence form

171.4 cm and 63.2 kg, respectively, and 158.2 cm and 51.9 kg, respectively, for female students. Data from this study comfortably were same the data obtained in our previous study. BMI and body-fat percentage were also within a standard range.

2. Physical and mental health

Fatigue is known to be a useful health index in adolescents[7]. As shown in Table 3, only 14.7% of male students and 7.8% of female students answered that they "do not feel tired" regarding "fatigue in the past month," which indicates that a high percentage of university students feel tired in their daily lives. Since a high level of physical health can be maintained by incorporating regular exercise [8,9], it may be necessary to encourage proactive exercising habits. On the other hand, items regarding illness and allergies showed trends similar to those for feelings of fatigue and can be used as a part of comprehensive index for physical health.

Since the period of late adolescence involves building identity and mental independence, adjustment disorders and mental disorders such as anthrophobia and suicide are witnessed commonly. Of these disorders, depression is especially responsible for increasing the risk of suicide. According to the 2011 Children and Youth Book[10], most suicides reported were committed by university students; 507 suicides out of 3792 suicides were committed by adolescents. This data suggests that we must pay more attention to mental care than to physical problems in adolescents. Since physical health seems to be related to mental health[11], it is meaningful to regulate both physical and mental health. As seen in Table 4, physical and mental health differed more significantly between males and females than between commuters and lodgers. The female students also showed a significantly lower mean score in "physical health" and "negative factors" than male students did; this suggests that they may have more physical and mental problems and troubles. For this reason, it became clear that attention must be paid not only to physical health but also to mental health, which cannot be directly observed. Furthermore, a system to enable students to lead healthy and fulfilling lives needs to be constructed.

3. Sleep habits

The time when individuals wake and fall asleep and the duration of sleep differ by age groups. Students in junior high and high school shift to a night-oriented lifestyle and begin to fall asleep around midnight. This trend is related to human development; that is, maturity allows individuals to become night owls[12]. The average bedtime for university students also becomes late after midnight, and their average duration of sleep is shorter than 6.5 hours. In addition, the percentage of students sleeping for less than 5-6 hours on an average was third highest in male students and second highest in female students; this shows that these students do not get enough sleep. Sleep deprivation in adults is reported to affect daily function[13-15], health[16], metabolism and endocrine function[17,18], and weight[19]. We think it is imperative to educate university students to get to bed earlier than they usually do and sleep longer.

More students than ever go away from their homes to attend universities, and about 25% of the participants in this study were boarding students. The type of residence presumably can affect health and sleep habits; however, bedtime was not much different for males and females or for lodgers and commuters, and they usually fell asleep around 12:18 and 12:24 a.m. On the other hand, the wake-up time for female students was found to be 30 minutes earlier than for male students, and that for commuters was 50 minutes earlier than for lodgers. These differences may arise because male students supposedly require less time to get ready in the morning, and lodgers do not face a long commute to school.

Meanwhile, according to Nakamura[11], "duration of sleep" does not necessarily increase "sleep satisfaction" proportionately. "Depth of sleep" and "degree of sleep" were significantly different for males and females, but not for commuters and lodgers; this suggests that "sleep quality" is not affected by irregular sleep habits of commuters and lodgers, but by habits related to differences between males and females. On the other hand, more lodgers as compared to commuters answered that they were "making a conscious effort to get more sleep." Lodgers are typically thought to have poor sleep habits, but this study found that these students were practicing suitable sleep habits. From such data it can be understood that the irregular lifestyles of university students can change the duration of sleep, lead to irregular sleeping styles, and negatively affect the depth and degree of sleep, ultimately worsening "sleep quality."

4. Relationship between physical and mental health and sleep quality

Recently, university students have tended to be active in part-time jobs, games, and the Internet until late in the night. This lifestyle may possibly be further affecting their physical and mental health. As seen in Table 6 and Figures 4 and 5, "fatigue," "physical and mental health," and "sleep quality" are all correlated with each other. There have been proactive efforts to educate students on eating and exercising habits; however, this study also suggests that it may be difficult to produce results using interventions that target the entire body. Instead, it might be better to construct a system for individual support, since fatigue and physical and mental health differ

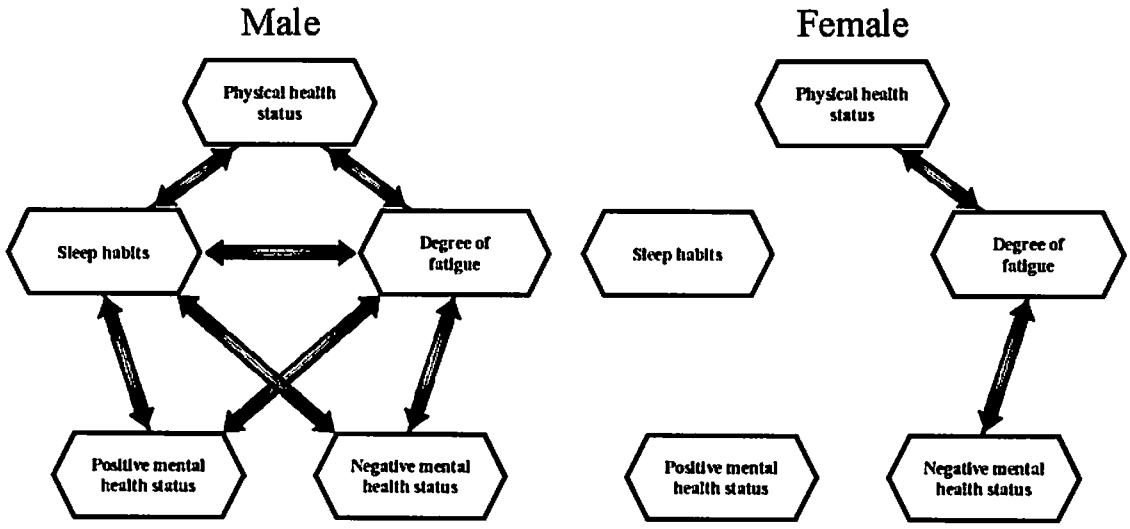

Fig. 6 Relationship among health status, sleep habits, and degree of fatigue of university students in different gender

⟷ : Significant interrelation

greatly between individuals. Furthermore, relationships between fatigue, physical or mental health, and sleep habits are shown in Figure 6. These three items showed a strong and significant correlation, especially in male students.

V. Conclusion

The university students were surveyed for their fatigue, physical and mental health status, and sleep habits. Results suggested that many students were fatigued and that their physical and mental health status and sleep habits were far from excellent. In the future, it will be necessary to conduct cross-sectional research such as a comparative investigation by grade levels or further follow-up research. Moreover, given that university students are still in a developmental stage of adolescence, a practical form of intervention based on these study results may be needed. Currently, a study of how much intervention might improve university students' daily habits has been planned and will be carried out by means of assessments both before and after intervention.

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