Tohoku J. Exp. Med., 2013, **231**, 37-43

Anxiety and Its Related Factors at Bedtime Are Associated with Difficulty in Falling Asleep

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Insomnia is a sleep disorder that is marked by difficulty in falling asleep, difficulty in maintaining sleep, and/or early morning awakening. Difficulty in falling asleep is particularly common in young adults, and sleep onset is affected by psychological factors. The purpose of the present study was to identify the physical and mental factors related to the subjective evaluation of falling asleep among Japanese university students. The participants were 366 students, including 197 (53.8%) females, with a mean age of 20.6 ± 1.7 years. The questionnaire battery mainly covered items about sleep onset, sleep quality, trait anxiety, and general mental state. Sleep onset was categorized as "easy to achieve" for 121 (33.1%) subjects, "difficult" for 38 (10.4%), and "intermediate" for 207 (56.6%). For example, "difficult" was defined as taking a longer time to fall asleep. The subjects with difficult sleep onset reported significantly higher awareness of the smell and noises in the bedroom, body sensations such as a heavy stomach feeling and frequent rolling over, mental agitation and excitement, unstable mental state, negative state, and strain. The subjects with difficult sleep onset also showed less sleep comfort and less recovery from fatigue. A multinominal logistic regression analysis revealed that each of body sensation, sleep comfort, unstable mental state, and fatigue influenced whether an individual had the difficult type. Anxiety-related factors at bedtime, in particular, may delay the sleep onset. The results of the present study indicate that many university students may be at risk of sleep-onset insomnia.

Keywords: insomnia; mental state; physical state; sleep onset; university students
Tohoku J. Exp. Med., 2013 September, **231** (1), 37-43.

Introduction

Insomnia is a sleep disorder that is marked by difficulty in falling asleep, difficulty in maintaining sleep, and/or early morning awakening. In a population-based study, it was reported that 21.4% of Japanese adults had experienced more than one of the above three types of insomniac symptoms during the prior month (Kim et al. 2000). A nationwide representative survey revealed that the prevalence of insomnia among Japanese junior and senior high school students was 23.5% (Kaneita et al. 2006). These data suggest that sleep problems have become rather common, with at least one in four to five Japanese individuals exhibiting sleep-related problems.

The three types of insomnia are correlated with age. According to Liu et al. (2000) and Walsh and Engelhardt (1994), young adults more often complain of difficulty in falling asleep, whereas difficulty in maintaining sleep and early morning awakening are more often found in midlife and elder adults. Insomnia marked by difficulty in falling asleep is characterized by prolonged sleep onset. In a cross-sectional study, university students were found to be the most commonly characterized as "*night owls*" and "*sleepyheads*" among other groups of the same age in Japan (Hayashi et al. 1997). Yamamoto and Nomura (2009) reported that university students who had difficulty falling asleep reported the worst sleep states among several insomniac types and showed higher daytime dysfunction according to the Global Pittsburgh Sleep Quality Index. Carskadon (1990) mentioned that the freer university students were from restraints, the more their sleep phase was delayed. University students tend to have irregular lifestyles due to the high flexibility of their daily schedules, as they control their class schedules themselves, often perform part-time jobs that involve shift work, and experience decreased interference from their parents and teachers compared to their high school years.

Takeuchi et al. (2000) pointed out that there was a possibility for young people to experience sleep problems caused by maladjustment in shifting from an irregular and chronically nocturnal lifestyle to a regular social life after university graduation. People who have maladaptively learned poor sleep habits may suffer from an occasional, neurologically based poor night of sleep long before developing serious insomnia (Hauri and Fisher 1986). It is possible that the above factors lead to some types of sleep dis-

Received May 2, 2013; revised and accepted August 21, 2013. Published online September 5, 2013; doi: 10.1620/tjem.231.37.
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orders, such as psychophysiological insomnia, paradoxical insomnia, idiopathic insomnia, circadian rhythm sleep disorders, and inadequate sleep hygiene. In fact, a 2005 population-based study found that the prevalence of self-reported insomnia among Japanese people around 20 years of age was 20%-30% (Kayukawa et al. 2005). A correlation between poor sleep quality and depressive symptoms was also revealed, and epidemiological studies have shown that sleep problems represent a significant risk factor for healthy young adults in the later development of depression (Morphy et al. 2007; Franzen and Buysse 2008; Paterson et al. 2009).

Yamamoto and Nomura (2009) asserted that the symptom of difficulty falling asleep was a particularly important issue with regard to the sleep problems of university students. However, only a few studies have investigated the correlations between psychological states and sleep quality, especially in terms of difficulty with sleep initiation (Komada et al. 2001; Babson et al. 2008; Yang et al. 2010). Babson et al. (2008) mentioned that relatively little is known about subjective reports of sleep-onset latency. In order to better understand the sleep problems of university students, it is important to focus on the detailed features of their sleep habits. The purpose of the present study was to clarify the relationship between experiencing difficulty falling asleep and the physical and mental states of Japanese university students.

Materials and Methods

Participants

A total of 473 undergraduate students at Hosei University, located in Tokyo, completed the questionnaire battery. Of these, 107 participants were excluded because they failed to answer all of the questions. The available response rate was 77.4%, and the final research sample comprised 366 students: 197 (53.8%) females, 169 males (46.2%), mean age 20.6 years (S.D. = 1.7). The survey was administered to students in four different classes (two morning classes and two afternoon classes) in order to minimize potential class time differences in sleep habits, and scheduled so as to avoid the university's 2-week exam period. The averages of the students' reported total sleep times, bedtimes and wake-up times of the last sleep were 6.5 hours (S.D. = 1.6), 1:48 (S.D. = 1.9), and 8:10 (S.D. = 1.9), respectively. The average bedtime and wake-up time are expressed in terms of the 24-hour clock, and the S.D. is expressed in hours.

No financial remuneration or course credit was offered as an incentive to participate. The students were informed of the purpose of the study, and if they chose not to participate, they could simply return an incomplete questionnaire without any penalty. This study was approved by the Human Research Ethics Committee of the Department of Psychology of Hosei University.

Questionnaire

The test battery included the questionnaires described below. The Japanese standard rating scale used to estimate sleep onset (sleep onset questionnaire: SOQ) was also used for the subjective evaluation of the sleep onset period (Yamamoto et al. 2003). This measure has been used for assessing the ease or difficulty of initiating sleep in various situations, such as in testing the quality of bedding materials, e.g., a pillow (Tanaka 2008). The SOQ consists of two parts, one of which was completed before sleeping and the other after sleeping. Only the part taken after sleeping was used in the study. This part included questions about initiating sleep (9 items) and the sleep environment (11 items). Each item was scored on a 4-point scale, including "1 = that is very true," "2 = that is somewhat true," "3 = that is somewhat false" and "4 = that is not true at all."

The 9 items about initiating sleep mainly ask about the respondent's psychological evaluation of his or her sleep onset period, providing potential answers such as "I fall asleep quickly," "I was dreaming during the onset of sleep," "It took a longer time to fall asleep," "I didn't recognize when I fell asleep" and "I was struck with sleepiness right after lying down." The 11 items about the sleep environment include descriptions of the bedroom environment that can influence sleep onset such as "I was nervous about the temperature and humidity of the bedroom," "I was nervous about the brightness of the bedroom," "I was nervous about the noise and vibration from outside the bedroom," "I was nervous about the sounds inside the bedroom" and "I was nervous about the smell of the bedroom."

The Oguri, Shirakawa and Azumi (OSA) standard rating scale (MA: middle age and aged version) was used to estimate the participants' sleep profiles (Yamamoto et al. 1999). The OSA-MA was shortened from the original version so that people in midlife and elderly people can respond more easily. The purpose of this questionnaire was not for an epidemiological study or for the screening of sleep states from the past to the present, but rather as the direct evaluation of the respondent's most recent sleep. The OSA-MA includes 16 items such as "Fatigue still remains," "I have the ability to concentrate," "I slept very well," "I have a feeling of release" and "I feel listless." Each item was scored on a 4-point scale, with "1 = that is very true," "2 = that is somewhat true," "3 = that is somewhat false," "4 = that is not true at all."

The widely used Japanese version of the State Trait Anxiety Inventory (STAI) was used to measure state anxiety (A-state) (Shimizu and Imae 1981). The state scale is composed of 20 items such as "My mind was calm," "I was at peace," "I felt nervous," "I felt regret" and "I felt relieved," and was scored on a 4-point scale, including "1 = that is very true," "2 = that is somewhat true," "3 = that is somewhat false," and "4 = that is not true at all." In this survey, respondents were asked to describe their feelings at bedtime, and a higher score indicated increased levels of state anxiety.

In order to evaluate other emotional states, a 41-item survey was used; most of these items were selected from the Japanese translation of the Profile of Mood States (POMS) (Yokoyama et al. 1990) such as "I was happy to be socializing," "I felt hopeless," "I felt overwhelmed with grief," "I was tired" and "I was not worthy of being praised." They were scored on a 5-point scale, including "1 = not at all," "2 = a little," "3 = moderately," "4 = quite a bit," and "5 = extremely." In this measurement, each item asked the respondent to evaluate his or her general feelings during the previous week.

There were also several general lifestyle questions such as queries regarding the amount of time spent sleeping the previous night, smoking and drinking habits, exercise habits, and the regularity of the respondent's bedtime and rising times. Some of these items were scored on a 4-point scale according to which respondents rated each item. In this research, sleep-related questions asked respondents to answer by remembering their previous night's sleep. Items that overlapped with items on other questionnaires were excluded so that the

burden on respondents was reduced.

Data analysis

The first analysis examined the factor structure of each questionnaire through the use of an exploratory factor analysis, because modified questionnaires were used. The exploratory factor analysis was conducted by means of the principal factor method with promax rotation, and the criteria for determining the number of factors to retain were examined by eigenvalues and the visual scree test. The following two criteria were used to identify the preliminary factor structure: (a) retaining items with factor loadings of greater than 0.40, and (b) retaining factors that have a minimum of 3 items loaded onto them.

In order to classify the respondents with regard to the difficulty they had in falling asleep, the score for introspection regarding initiating sleep in the SOQ (9 items, ranging from 9 to 36) was used. A higher score corresponds to a better ability to fall asleep, and the respondents were categorized three falling-asleep types by the score. An analysis of variance (ANOVA) was conducted as a second analysis for each factor on the three falling asleep types. The third analysis examined the influence of each factor on an individual's subjective evaluation of sleep-initiating difficulty by means of a multinominal logistic regression analysis. The association between factors obtained from questionnaires and the three styles of falling asleep was analyzed. All statistical analyses were carried out with SPSS for Windows (version 20), and p-values < 0.05 were considered significant.

Results

Correlation of variables associated with falling asleep

The first analysis examined the factor structure of each questionnaire through the use of an exploratory factor analysis, which can reduce a large number of observed variables into fewer numbers of unobserved variables (factors). A factor includes relevant items, but some irrelevant items in a questionnaire could be excluded by this analysis. The results showed 11 items related to the sleep environment in the SOQ with a factor loading equal to or higher than 0.40, corresponding to two factors, each with more than three items. The first factor obtained by factor analysis was named Awareness of the Bedroom Environment (Environment). It was composed of items reflecting concerns about one's bedroom environment such as noise, temperature, and smell. The second factor was Body Sensation (Sensation) and consists of items reflecting sensations of the body such as a heavy stomach feeling and frequent rolling over. These factors' coefficient alphas (which indicate how closely a set of items in a factor are related) were 0.85 and 0.65, respectively; these are acceptable values in this case.

The results of the factor analysis showed 16 OSA-MA items that had a factor loading equal to or higher than 0.40, corresponding to two factors, each with three or more items. The first factor can be labeled Recovery from Fatigue (Recovery). This factor comprised items reflecting the recognition of one's well-being right after waking up, such as clear-headedness, liveliness, and a fatigue-free feeling. The second factor was Sleep Comfort (Comfort) and consists of items reflecting the number of disturbances of the maintenance of sleep such as nightmares, mid-arousal, and shallow sleep. The coefficient alphas for these factors were 0.76 and 0.73, respectively.

The results of the factor analysis showed 20 STAI items with a factor loading equal to or higher than 0.40, corresponding to three factors, each with three or more items. The first factor was Mental Agitation and Excitement (Excitement), composed of items reflecting one's state of excitement at bedtime, such as nervousness, confusion, and ill-temper. The second factor can be labeled Mental Lability (Lability), which represented the unstable mind, and it consisted of items reflecting a tendency to have unrelievable states such as unbalanced and unsatisfied feelings. The third factor, Negative State (Negative), was composed of items reflecting a tendency to be negative and somber, for example by experiencing unhappiness and diffidence. The coefficient alphas for these three factors were 0.91, 0.91, and 0.81, respectively.

The results of the factor analysis showed 41 items related to emotional estimation based on the POMS with a factor loading equal to or higher than 0.40, corresponding to four factors, each with more than three items. The first factor, Unsoundness of Mind (Unsoundness), was composed of items such as self-evaluation of worthlessness, powerlessness, and hopelessness. The second factor can be labeled Mental Fatigue (Fatigue) and was composed of items such as exhaustion and laziness. The third factor was Indications of Strain (Strain). This factor consisted of items reflecting tension and strain such as sleeplessness due to a tense mind or due to fear. The fourth factor was named Affinity with Others (Affinity) and was composed of items such as having fun with a social disposition, and being able to trust others. The coefficient alphas for these four factors were 0.95, 0.89, 0.75, and 0.67, respectively. The correlations of all factors are shown in Table 1.

Comparison of variables among three falling asleep types

In order to classify the respondents with regard to the difficulty they had in falling asleep, the score for introspection regarding initiating sleep in the SOQ (9 items, ranging from 9 to 36) was used. A higher score corresponds to a better ability to fall asleep. The mean score was 26.3 (S.D. = 4.73), and the respondents were categorized into three falling-asleep types based on their introspection scores. The median and mode were 26 and 23, respectively. In light of the descriptive statistics for this score, the cut-off points were determined as follows. A score > 28 represented the ease in falling asleep (Easy) type (n = 121; 33.1%), a score < 21 represented the difficulty falling asleep (Difficult) type (n = 38; 10.4%), and all scores in between (i.e., 21 to 28) represented the intermediate type (n = 207; 56.6%). The total sleep time, bedtimes and wake-up times of the last sleep were not significantly among different these three groups of respondents.

Table 1. Matrix of correlation coefficients among factors obtained by the factor analysis and the Sleep Onset score.

	1	2	3	4	5	6	7	8	9	10	11
1. ENVIRONMENT											
2. SENSATION	.44**										
3. RECOVERY	.07	−.01									
4. COMFORT	−.37**	−.32**	.20**								
5. EXCITEMENT	.35**	.37**	−.07	−.43**							
6. LABILITY	.10	.13*	−.38**	−.26**	.38**						
7. NEGATIVE	−.13*	−.08	−.31**	.04	−.11*	.54**					
8. UNSOUNDNESS	.07	.20**	−.24**	−.32**	.49**	.34**	.21**				
9. FATIGUE	.01	.15**	−.38**	−.18**	.31**	.17**	.18**	.57**			
10. STRAIN	.21**	.31**	−.06	−.40**	.59**	.19**	−.07	.61**	.43**		
11. AFFINITY	−.06	−.08	.16**	.14**	−.19**	−.36**	−.30**	−.29**	−.14**	−.10	
12. Sleep Onset Score	−.22**	−.25**	.06	.36**	−.28**	−.35**	−.12*	−.17**	.04	−.25**	.15**

The correlations between each factor obtained by the factor analysis and the Sleep Onset score are shown. The correlation coefficient indicates the degree to which two variables are linearly related. The number varies from −1.0 (a perfect negative correlation) to +1.0 (a perfect positive correlation). The higher the Sleep Onset score, the better the respondent's ability to fall asleep. *$p < 0.05$ and **$p < 0.01$.

Table 2. Means (M) and standard deviations (S.D.) among types of difficulty of falling asleep for factors and variables.

	Easy (n = 121)		Intermediate (n = 207)		Difficult (n = 38)		F	p
	M	S.D.	M	S.D.	M	S.D.		
ENVIRONMENT	4.90	1.63	5.78	2.53	5.97	2.53	6.59**	.002
SENSATION	5.03	1.71	5.82	2.06	6.16	2.35	7.67**	.001
RECOVERY	13.45	3.72	14.05	3.05	11.97	2.84	6.77**	.001
COMFORT	17.69	2.34	16.29	2.87	15.03	3.05	17.19**	.000
EXCITEMENT	13.17	4.68	16.14	6.15	16.32	6.62	10.96**	.000
LABILITY	15.75	5.10	18.31	4.92	20.90	4.36	19.15**	.000
NEGATIVE	9.47	2.20	9.59	2.29	10.50	2.18	3.17*	.043
UNSOUNDNESS	47.55	17.82	51.28	17.45	54.32	19.06	2.74	.066
FATIGUE	16.01	5.52	15.41	4.76	15.42	6.03	0.55	.579
STRAIN	10.56	3.54	12.32	4.40	12.89	5.63	7.80**	.000
AFFINITY	13.37	3.04	12.32	2.84	12.66	3.06	4.94**	.008

The descriptive statistics and the results of the analysis of variance (ANOVA) for each factor obtained by the factor analysis are shown. The participants were classified into three types of falling asleep based on their SOQ scores. Respondents with a score above 28 were classified as the easy (to fall asleep) group; those with a score below 21 were classified as the difficult type, and all scores in between (21 to 28) were classified as the intermediate type. *$p < 0.05$ and **$p < 0.01$.

The ANOVA (a statistical procedure used to test differences between two or more means) performed as a second analysis found differences among the three groups in some factors (Table 2). The mean Environment scores differed significantly (F (2, 363) = 6.59, $p < 0.01$). Bonferroni's post hoc analysis (a statistical method used to reveal differences among means) indicated that the difficult-type respondents reported higher awareness of the bedroom environment compared to the easy-type respondents, and the intermediate types also reported higher awareness than the easy types.

The mean Sensation scores also differed significantly (F (2, 363) = 7.67, $p < 0.01$). Bonferroni's post hoc analysis revealed that the difficult types and intermediate types showed higher body sensation scores than the easy types. The mean Recovery scores differed significantly among the types (F (2, 363) = 6.77, $p < 0.01$), and Bonferroni's post hoc analysis showed that the difficult types experienced less of a feeling of recovery from fatigue than the other types. The mean Comfort scores also differed significantly (F (2, 363) = 17.19, $p < 0.01$), and Bonferroni's post hoc analysis showed that the difficult types reported less comfortable sleep than the other types.

The mean scores for Excitement were significantly different among the types (F (2, 363) = 10.96, $p < 0.01$). Bonferroni's post hoc analysis revealed that the difficult types and intermediate types exhibited higher excitement than the easy types. The mean Lability scores were also

Table 3. Influence of each factor on the difficult type of sleep onset, according to the multinominal logistic regression analysis.

	Factor	Regression coefficient	Wald(χ^2)	Exp (B)	95% CI	*p*
Difficult type	ENVIRONMENT	.077	.54	1.08	.88 - 1.33	.462
	SENSATION	.230	3.85*	1.26	1.00 - 1.58	.050
	RECOVERY	−.127	2.23	.88	.75 - 1.04	.135
	COMFORT	−.285	10.69**	.75	.63 - .89	.001
	EXCITEMENT	−.018	.12	.98	.88 - 1.09	.731
	LABILITY	.181	7.48**	1.20	1.05 - 1.37	.006
	NEGATIVE	.148	1.09	1.16	.88 - 1.53	.297
	UNSOUNDNESS	.004	.04	1.00	.96 - 1.03	.845
	FATIGUE	−.163	8.15**	.85	.76 - .95	.004
	STRAIN	.132	3.64	1.14	1.00 - 1.31	.056
	AFFINITY	.070	.80	1.07	.92 - 1.25	.372

The reference category is the *Easy* type. "Exp. B" is the exponential of the estimated coefficient B and represents the odds ratios for factors in the *Difficult* type to be in the group compared to the reference group. The initial log likelihood ratio test is −2logL = 567.93 ($\chi^2(22) = 108.01$, $p < 0.001$) and Nagelkerke $R^2 = .303$ as the measures which determine how well the model fits the data. This result means that the contribution ratio is not high, but this model is acceptable because the initial log likelihood ratio test is significant. *$p < 0.05$ and **$p < 0.01$.

significantly different (F (2, 363) = 19.15, $p < 0.01$), and Bonferroni's post hoc analysis found that the difficult types showed more unstable states than the other groups, and that the intermediate types showed more unstable states than the easy types. The mean Negative scored differed significantly among the groups (F (2, 363) = 3.17, $p < 0.05$), and Bonferroni's post hoc analysis revealed that the difficult types reported higher negative feelings than the easy types.

The mean Strain scores differed significantly (F (2, 363) = 7.80, $p < 0.01$), and Bonferroni's post hoc analysis found that the difficult types and intermediate types showed greater tension and strain than the easy types. The mean Affinity scores were also significantly different among the types (F (2, 363) = 4.94, $p < 0.01$). Bonferonni's post hoc analysis indicated that the intermediate type reported lower affinity than the easy type.

The only factor that had a significant interaction between gender and the types of difficulty in falling asleep was Fatigue. The subsequent analysis of simple main effects revealed that male participants in the difficult-sleep group showed significantly higher fatigue than females in the same group (mean squared error = 26.25).

Factors associated with difficulty in falling asleep

The third analysis examined the influence of each factor on an individual's subjective evaluation of sleep-initiating difficulty by means of a multinominal logistic regression analysis. The easy type was fixed as a reference, and the statistical comparison of the difficult type against the reference is shown in Table 3. The difficult type was 1.26 times (95% CI: 1.00-1.58) more sensitive than the easy type to somatic feeling, 0.75 times (95% CI: 0.63-0.89) more likely than the easy type to sleep comfortably, 1.20 times (95% CI: 1.05-1.37) more likely than the easy type to have mental lability, and 0.85 times (95% CI: 0.76-0.95) more likely than the easy type to feel fatigue.

Discussion

The aim of the present study was to determine the relationships among the ease of falling asleep, physical-mental states, and subjective evaluations of sleep quality. The results uncovered several elements relevant to difficulty in falling asleep as observed in Japanese university students. Anxiety-related factors at bedtime in particular were shown to cause sleep onset difficulty. The findings are consistent with the suggestion of Yamamoto and Nomura (2009) that the factors influencing sleep onset evaluation do not directly depend on a lack of regularity in sleep habits, the quality of sleep during the previous night or the daytime physical-mental state, but rather they depend on the individual's physical-mental state at bedtime.

Komada et al. (2001) found a correlation between sleep-onset difficulty and personality traits such as depression, inferiority, and nervousness, by means of the Yatabe-Guilford personality inventory. Similarly, in the present study no significant difference was observed in the regularity of bedtime and rising time and other general lifestyle items among the three sleep-initiating types, but individuals categorized as the difficult type exhibited higher levels of agitation and excitement, mental lability, negative states, and strain. As a result of the multinominal logistic regression analysis, a higher odds rate was shown in the difficult type for mental lability, which is one of the factors in STAI. This finding supports the correlation between sleep-initiating problems and anxiety, which has been mentioned in previous studies.

For example, Coursey et al. (1975) hypothesized that particularly anxiety-provoking or unpleasant thoughts con-

tributed directly to the etiology and maintenance of sleep-onset insomnia, and that anxious, depressed, and worried states accounted for 73% of the variance in sleep difficulty in their factor analytic study. Babson et al. (2008) examined the role of anxiety sensitivity in moderating the expected relation between sleep anticipatory anxiety and the subjective evaluation of sleep-onset latency. A correlation that was not high but significant ($r = -.35$) between the sleep onset score and mental lability as a factor of STAI was found in the present study. These results emphasize the importance of the relationship between pre-sleep psychological conditions, particularly anxiety and the subjective experience of delayed sleep onset.

Kuo et al. (1994) defined sleep anticipatory anxiety as anxious apprehension with regard to sleep and suggested the existence of two components of sleep anticipatory anxiety: physical concerns (e.g., "when I try to fall asleep at night, my heart is beating rapidly") and cognitive concerns (e.g., "when I try to fall asleep at night, I cannot stop my mind from racing"). Interestingly, in the present study, the level of body sensation such as a heavy-stomach feeling at bedtime was significantly higher among the individuals categorized as the difficult type compared to the other two types. The increased body sensations of the difficult-type respondents may have been caused by their sleep anticipatory anxiety.

Psychophysiological insomnia is a major insomnia whose main complaints include sleep-onset difficulty due to anxiety at bedtime. According to the Internal Classification of Sleep Disorders (American Academy of Sleep Medicine 2005), the basic features of psychophysiological insomnia include having chronic somatic strain (such as an impatience and muscle tension) and pre-sleep concerns about initiating sleep due to continuous exposure to an inability to fall asleep. Thus, a history of difficulty in falling asleep can be a risk factor for suffering sleep-onset insomnia with the passage of time. Moreover, sleep-related problems may lead to daytime sleepiness and cognitive dysfunction (Takeuchi et al. 2000), and some studies have suggested a correlation between sleep habits and academic performance (Eliasson et al. 2010; Besoluk et al. 2011). There may be students who study until midnight before an exam and experience test anxiety, which interferes with their ability to fall asleep and leads to sleepiness during the exam.

The limitations of this study include the following. First, the participants in this research were not a general population. There may be considerable sampling bias because of the use of a limited survey population. Research about sleep habits has revealed that university students in Japan tend to have a delayed sleep-wake cycle, irregular sleep patterns, daytime sleepiness because of chronic sleep deficiency, and evening preference (Asaoka et al. 2007). The results may imply that our sampling of university students, including evening-type cases, meant that the subjects experienced less fatigue at night, which led to difficulty in falling asleep. Second, there were no objective data such as parameters obtained from actigraphy or polysomnography in this study. Further studies with objective parameters are required to provide an evaluation of the efficacy of interventions for sleep problems.

Taken together, the findings indicated that difficulty in falling asleep was greatly affected by mental lability and body sensation at bedtime, and had a correlation with whole sleep quality. These results were partially consistent with the features of psychophysiological insomnia, which suggests that some of the current respondents may develop psychophysiological insomnia in the near future. Carskadon (1990) asserted the usefulness of the combined education of children, parents, teachers, and pediatricians about the fundamental principles of proper sleep hygiene. Sleep hygiene should be intensively covered in Japanese general education; otherwise, this modern society in which people preferentially sacrifice their sleep may not change.

Viens et al. (2003) regarded generalized anxiety as a predominant factor in sleep onset insomnia, and reported that anxiety management training could be an efficient therapy. In addition, cognitive behavioral therapy for insomnia has been developed (Morin et al. 2009; Munezawa and Mishima 2009). Each intervention has efficacy in treating insomnia in some way; however, some of their treatment mechanisms, i.e., exactly how the intervention works, remain unclear. It is very important to identify the factors related to sleep-onset difficulty when considering methods of appropriate practical support that can help prevent and reduce the risk of insomnia and increase students' quality of sleep and life.

Acknowledgements

The author sincerely thanks both Professor Toshiharu Takahashi for providing carefully considered feedback and valuable comments, and all of the study participants for their cooperation.

Conflict of Interest

The author declares no conflict of interest.

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