



Sleep duration and its association with sleepiness and depression in “ronin-sei” preparatory school students



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ABSTRACT

Purposes: The Japanese word “ronin-sei” refers to a student who has failed their university entrance examination and is preparing to re-take the examination in the following year. We aimed to determine how sleep duration is associated with daytime sleepiness or depression in *ronin-sei* because impaired daytime performance is known to result from sleep deprivation.

Methods: The participants in this cross-sectional study were 1075 *ronin-sei* and 285 university students. Sleepiness and depressive symptoms were assessed using the Epworth Sleepiness Scale (ESS) and the Center for Epidemiologic Studies Depression Scale (CES-D), respectively.

Results: *Ronin-sei* had significantly shorter sleep duration and earlier bed- and rise-times than university students. There was no significant difference in CES-D between the groups; however, the ESS score of university students was significantly higher than that of *ronin-sei*. *Ronin-sei* who slept for 5 to <6 h had higher ESS scores than those who slept for 6 to <7 h. The mean CES-D score in *ronin-sei* who slept <5 h was significantly higher than in those who slept for 5 to <6 h, from 6 to <7 h, and from 7 to <8 h. *Ronin-sei* who slept for more than 8 h also had higher depression scores.

Conclusions: Sleep deprivation appears to be common among *ronin-sei*. Furthermore, a U-shaped relationship was found between sleep duration and depressive symptoms, revealing that *ronin-sei* who had too little or too much sleep were more likely to exhibit an increase in depressive symptoms.

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1. Introduction

“Ronin” is a term that was originally used in feudal Japan to describe the masterless *Samurai* class, which waned with the introduction of the system of modern government at the close of the 19th century. In modern Japanese society, the term *ronin* refers to a person who has failed the entrance examination to a university or company in a particular year and is preparing to re-take the examination in the next year without holding a fulltime job. The precariousness and instability of the lives of the modern *ronin* are why they have been likened to the masterless *Samurai*.

Many Japanese students who have failed university entrance examinations go to preparatory school after graduating from high school, and spend their days as modern *ronin-sei* (*ronin* students). A substantial number of adolescents remain as *ronin-sei* for many years to gain entrance to the leading universities and medical schools in Japan. As a result of cramming for the entrance examinations and the precariousness of their future prospects, *ronin-sei* are commonly under considerable psychosocial stress.

There has been a dearth of research examining the sleep status of *ronin-sei*. Sakurada and colleagues (1999) reported that 72.7% of *ronin-sei* typically slept for 6 h per night or less and the percentage increased to 83.1% at 1 month prior to an examination. It has also been reported that sleep duration of 6 h or less per night is approximately 6 times more common among *ronin-sei* than new employees (Sakurada et al., 1999). Therefore, *ronin-sei* appears to be more likely to experience shortened sleep.

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Compared with university students in European nations, those in Asian countries, especially in Japan, are known to have short sleep durations (Stepptoe et al., 2006). Although sleep duration in early adulthood averages 7–8.5 h per night, the duration in Japanese university students reported by Steptoe and associates (2006) was 6.2 h for men and 6.1 h for women. Students with short sleep duration are more likely to have depressive symptoms (O'Brien and Mindell, 2005; Kawada et al., 2007; Pasch et al., 2010). It has been reported that sleep loss in students increases the incidence of excessive daytime sleepiness and nodding in the classroom, and leads to low grades (Kelly et al., 2001; Ohida et al., 2004; Pallos et al., 2004; Bahammam et al., 2012; Dewald et al., 2010; Wolfson and Carskadon, 1998, 2003). Thus, it is important to explore the relationship between sleep duration and daytime functioning in *ronin-sei* in order to maximize their productivity.

A recent study using the functional magnetic resonance imaging paradigm demonstrated that objectively-measured irregular weekday-weekend sleep schedules in healthy adolescents contribute to dysfunction of reward-related neuronal circuits, which is thought to contribute to depression (Hasler et al., 2012). Despite advances in the understanding of sleep patterns in adolescents, the association between sleep duration and depression in *ronin-sei* remains unclear. Given that 100,000 high school students become *ronin-sei* every year in Japan; it is important to determine the amount of sleep needed to ensure the optimal physical and mental development of these adolescents (Ministry of Education, Culture, Sports, Science and Technology, 2012). Competition for university placement is fierce in Japan as well as in Taiwan, China, Korea, and Singapore; thus the issue of sleep loss among students preparing for university entrance examinations should be of interest to many psychiatrists and sleep researchers in East Asian countries. Therefore, we aimed to explore the relationship between sleepiness, depression and sleep duration in *ronin-sei*.

2. Methods

2.1. Procedure

This study was conducted as the “Ronin-sei Study 2011” (Koyama et al., in press) at 2 preparatory schools for university entrance examination and 4 universities (Kumamoto University, Teikyo University, Osaka University, and Osaka University of Economics). The staff of the two preparatory schools handed out the questionnaire to the *ronin-sei*. In one school, all of the students were asked to participate in this study in a lecture room, and in the other, the participants included only students who lived in the school dormitory. For comparison with the *ronin-sei*, university students who attended a lecture related to mental health were asked to enroll as controls. The participants were 1075 *ronin-sei* and 285 university students. Thirty-nine questionnaires which were missing the answers to more than half the questions were excluded from the statistical analysis. We confirmed that none of the students had examinations scheduled during the surveillance period of the study. The Human Subjects Committee of Kumamoto University approved the study protocol. Completion of the questionnaire by the subjects, after the aims of the study had been explained, was construed as consent to participate in the study.

2.2. Measurements

Bedtime was assessed based on the question “during the past month, what time have you usually gone to bed at night?” with responses categorized as 21:00–23:59, 24:00–01:59, 02:00–06:00. Wake up time was assessed based on the question “during the past

month, what time have you usually gotten up in the morning?” with responses categorized as 3:00–5:59, 6:00–7:59, 8:00–9:59, 10:00 and later. Sleep duration was calculated from the responses to the questions about bedtime and wake up time and categorized as 299 min or less (<5 h), 300–359 min, 360–419 min, 420–479 min, and 480 or more minutes (≥ 8 h).

Daytime sleepiness was assessed using the Japanese version of the Epworth Sleepiness Scale (ESS) (Johns, 1991; Takegami et al., 2009). The ESS has been shown to have good reliability and validity (Takegami et al., 2009). The internal consistency of the ESS in the present study was good (Cronbach's $\alpha = 0.70$). Scores for this instrument range from 0 to 24 points, with higher scores indicating greater sleepiness; students who had an ESS score of 11 points and over were considered to be those with excessive daytime sleepiness according to previous studies in Japan (Ishimaru et al., 2012; Okamura et al., 2012). Depressive symptoms were measured using the Japanese version of the Center for Epidemiologic Studies Depression Scale (CES-D). The CES-D also has been shown to have good reliability and validity (Shima et al., 1985; Radloff, 1977, 1991), and internal consistency adequate for the present study (Cronbach's $\alpha = 0.72$). We considered a CES-D score of 16 points or more to be indicative of depressive symptoms.

2.3. Statistical analysis

We calculated the percentage and compared descriptive and categorical variables between the *ronin-sei* and university students using the χ^2 test and Fisher's exact test. Analysis of covariance (ANCOVA) was used to compare continuous variables; e.g., sleepiness and depression scores adjusted for gender and the number of years for *ronin-sei*. For ANCOVA, in case of a P -value <0.05, post hoc multiple comparisons were made using the Sidak method. To evaluate the association between sleepiness, depressive symptom, and sleep duration, logistic regression analyses were conducted with depressive symptom or sleepiness as the dependent variable and gender, the number of years as a *ronin-sei*, and sleep duration as independent variables was conducted. All statistical analyses were performed using IBM SPSS Statistics 20.0.0.1 statistical software. A 2-tailed P value of <0.05 was considered as significant.

3. Results

The characteristics of the participants, sleep habits, excessive daytime sleepiness and depression are summarized in Table 1. The percentage of males among the *ronin-sei* (67.5%) was significantly higher than among the university students (46.9%). In our sample, 61.5% of *ronin-sei* lived in a school dormitory, whereas most university students lived with their parents (53.8%) or alone (41.2%). Regarding sleep habits, the percentage of students who went to sleep by midnight was higher among the *ronin-sei* (33.9% vs. 14.8% among university students; $\chi^2 = 136.2$, $P < 0.001$), and a higher percentage of students in the *ronin-sei* group woke by 06:00 (17.7% vs. 6.5% for university students; $\chi^2 = 269.0$, $P < 0.001$). The percentages of subjects who had <6 h of sleep per night were 32.0% of the *ronin-sei* and 20.7% of the university students; the difference in sleep duration was statistically significant ($\chi^2 = 172.7$, $P < 0.001$). Although sleep duration was shorter for the *ronin-sei* than the university students, the latter reported having excessive daytime sleepiness more frequently than did the *ronin-sei* ($\chi^2 = 4.6$, $P = 0.034$). There was no significant difference in CES-D scores between the *ronin-sei* and university students.

Because the *ronin-sei* and university students differed significantly with respect to the distribution of gender, we compared sleep habits, sleepiness, and depression between the 2 groups using ANCOVA adjusted for gender (Table 2). Compared to the

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