

Short Sleeping Time and Job Stress in Japanese White-Collar Workers

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Abstract: The aim of this study was to clarify the association between sleeping time and job stress in male Japanese workers. Male workers at one manufacturing plant were surveyed about job stress and sleeping time using a self-completed questionnaire. A total of 274 white-collar daytime workers were analyzed. Job stress factors and stress response were assessed using the Job Stress Questionnaire. Sleeping time on working days was divided into ≤ 5 h, 6 h, 7 h, and ≥ 8 h, and associations between job stress factors and stress response were analyzed. Shorter sleeping time was related to overtime work; about a quarter of those with sleep of ≤ 5 h worked more than 15 h overtime per week. Workers with shorter sleeping time, particularly those with ≤ 5 h sleeping time, were more likely to have job stress factors of quantitative workload and interpersonal conflict as well as psychological stress responses, such as anger, fatigue, tension/anxiety, and depressive symptoms. With shorter sleep, in subjects ≤ 39 years, scores of activity and fatigue decreased or increased respectively, whereas in those ≥ 40 years, scores for tension/anxiety and depressive symptoms increased. Shorter sleeping time was related to overtime work and increased job stress in male white-collar workers. Depression symptoms may be more closely associated with shorter sleeping times in workers aged ≥ 40 . Adequate sleep duration is important for maintaining mental health.

Keywords: Sleeping time, Job stress, Overtime work, Quantitative workload, Depressive symptoms.

INTRODUCTION

Approximately 5 to 45% of daytime Japanese workers are reported to have insomnia, and that number is increasing [1]. Similarly, in the United States, approximately 30% of workers report insomnia [2]. Survey results in the United States show that the number of people with short sleeping time is increasing, and the proportion of people aged ≥ 18 years with a short sleeping time (< 6 h) increased from 7.6% in 1975 to 9.3% in 2006 [3]. In Japan, sleeping time is also decreasing. According to a 2010 Japan Broadcasting Corporation (NHK) survey in Japanese subjects, the weekday sleeping time of men aged ≥ 40 years decreased 20 to 40 min between 1995 and 2010. There are various reasons for this decrease in sleeping time, including diversification of work patterns and socioeconomic reasons. In particular, long working hours are said to be related to reduced sleeping time [3]. A shorter sleeping time has various mental and physical effects and is closely related to onset and progression of hypertension, diabetes, and dyslipidemia [4-9]. Obesity, a leading lifestyle-related disease, is also thought to be associated with short sleeping time [5, 8-15]. Moreover, previous research has shown that as sleeping time shortens, blood levels of C-reactive protein (CRP) and interleukin-6 (IL-6) increase 7% to 8% [16].

Job stress is thought to be strongly related to sleep in workers. A previous study of Japanese subjects showed that high job stress was related to short sleeping time, particularly in men [17]. In addition, job stress is reportedly related not only to sleeping time, but may also cause the quality of sleep to decrease [18, 19]. In particular, interpersonal conflicts, appropriateness of work, and social support have been shown to be related to sleep [20]. Similarly, our previous study [21] suggested that for workers, not getting sufficient sleep decreases work efficiency and may lead to safety problems. An association between short sleeping time and mental and physical symptoms is reported in the general adult population as well [22]. Getting enough sleep is therefore important.

Middle-aged white-collar workers may have high responsibility to manage subordinates and fulfill their duties. Among white-collar males as well, insomnia is reported to be connected with work-related stress responses [20]. However, there are few surveys of the association between sleeping time and job stress in Japanese white-collar workers. Hence, in the present study, we focused on sleeping time and investigated the association between short sleeping time and job stress in Japanese white-collar workers. Moreover, we compared associations between sleep times and job stress by age groups of ≤ 39 years and ≥ 40 years, because the 2011 patient survey by the Ministry of Health, Labour and Welfare have shown that the prevalence of depressed patients in males is higher in the age of 40-50's than in the 20-30's.

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METHODS

Study Subjects

Subjects were male employees of a manufacturing plant. Self-completed surveys were distributed to all 1,310 men at the time of a health checkup conducted in April and May 2005. The survey forms were collected from 1,118 men (collection rate 85.3%) who consented to this survey. After excluding people being treated for or with a history of psychiatric disease, shift workers, and management-level employees, there were 594 daytime workers aged ≤ 60 years. Of them, after excluding blue-collar workers, the final subjects for the present analysis included 274 white-collar workers, such as engineers and clerical workers (21-60 years old, mean age 41.1 ± 11.9 years).

This study was approved by the ethics review board of the Nagoya University School of Medicine.

Contents of Questionnaire Survey

Basic Attributes and Living Habits

The survey included items related to age, sex, work pattern (daytime work or shift work), living with other family members or not, type of work (white-collar or blue collar), overtime work (mean hours per week excluding weekend work), walking time during commute, mean sleeping time (mean hours on working days), whether or not the subject exercise regularly and if so the frequency (number of days/week), smoking status (nonsmoker, previous smoker, or smoker), alcohol consumption (mean number of days drinking alcohol per week), and subjective health status (good, somewhat good, somewhat poor, poor).

Job Stress

The Job Stress Questionnaire (JSQ), which was created in a study commissioned by the Japanese Ministry of Health, Labor and Welfare, was used in the present study [23]. The Questionnaire has been shown to have Cronbach α coefficient of 0.74 for job stress factors, 0.84 for psychological stress response, 0.81 for physical stress response, and 0.83 for support. The questionnaire includes 17 items to measure job stress factors. These are categorized as quantitative workload, qualitative workload, physical workload, job latitude, application of technology, interpersonal conflict, workplace environment, and appropriateness of work. Answers are given on a four-point scale of "agree," "somewhat agree," "somewhat disagree," and "disagree." The burden from stressors is considered to be higher with lower scores for job latitude and appropriateness of work, and with higher scores for all other items. Stress response can be measured as psychological and physical stress responses. The section on psychological stress response had 18 items to measure positive responses (activity) and negative responses (anger, fatigue, tension/anxiety, and depressive symptoms). The section to assess physical stress response had 11 items. The four choices for responses to questions about psychological and physical stress were "almost never," "sometimes," "often," and "almost all the time." Among psychological stress responses, lower scores for activity and higher scores for other items were considered to indicate higher stress

responses. Higher total scores for physical stress response were considered to indicate higher stress responses.

With respect to those questions, subjects were asked about sleeping time and psychological and physical stress responses which they experienced in the last one month.

Statistical Analysis

Sleeping time was divided into ≤ 5 h, 6 h, 7 h, and ≥ 8 h, and the χ^2 test and analysis of variance (ANOVA) were used to test for associations with basic attributes and living habits. ANOVA was used for mean scores for job stress factors and stress response with each sleeping time. Dunnett's test was used to compare shorter sleeping times with sleeping time ≥ 8 h. In addition, subjects were divided by age into ≤ 39 years and ≥ 40 years, and the mean score for job stress factors and stress response was investigated for each sleeping time by age group. SPSS 17.0 was used for statistical analysis.

RESULTS

Basic Attributes and Living Habits

Subjects with decreased sleeping time were significantly younger ($p < 0.01$, Table 1). With shorter sleeping times, there were also significantly more people who worked overtime ($p < 0.001$), and the mean overtime hours per week significantly increased ($p < 0.01$). Workers with sleeping time ≤ 5 h were more likely to work ≥ 15 overtime hours per week ($p < 0.05$). On the other hand, with longer sleeping times, more workers had a subjective health state of "good" or "somewhat good" ($p < 0.01$), and consumed alcohol ≥ 5 days a week ($p < 0.001$). No significant differences were found in body mass index (BMI), smoking habits, and exercise habits among sleeping time groups.

Sleeping Time and Job Stress Factors, Stress Response

In terms of mean scores for job stress factors for different sleeping times (Table 2), the scores for quantitative workload ($p < 0.001$) and interpersonal conflict ($p < 0.05$) were significantly higher with shorter sleeping times. Compared with the group with ≥ 8 h sleeping time, scores of quantitative workload were significantly higher in the groups with ≤ 5 h, 6h, and 7h sleeping time ($p < 0.001$, $p < 0.01$, and $p < 0.05$, respectively). The scores for interpersonal conflict were also higher in the group with ≤ 5 h sleeping time ($p < 0.05$).

When the association between sleeping time and job stress factors was further investigated with two age groups of ≤ 39 years and ≥ 40 years, the scores for quantitative workload was significantly higher with shorter sleeping times in both groups ($p < 0.05$). No significant differences were found between sleeping times and other job stress factors. Moreover, in the Dunnett's test results, for subjects aged ≥ 40 , scores of quantitative workload were significantly higher in the groups with ≤ 5 h and 6h sleeping time than in the group with ≥ 8 h sleeping time ($p < 0.05$). No significant differences were found in subjects aged ≤ 39 .

In terms of stress response (Table 3), mean scores for all items other than activity were significantly higher with shorter sleeping times: anger ($p < 0.05$), fatigue ($p < 0.001$), tension/anxiety ($p < 0.05$), depressive symptoms ($p < 0.05$), and

Table 1. Results for Basic Attributes, Lifestyle, and Health Feeling

Characteristic	Sleeping Time				P for Trend
	≤ 5 h	6 h	7 h	≥ 8 h	
	n=37	119	94	24	
Age (year) ^a	38.2±10.4	39.8±11.8	42.8±12.2	45.0±12.4	0.005
BMI(kg/m ²) ^a	23.4± 2.8	24.3± 3.0	23.6± 3.1	23.0± 3.4	0.278
Overtime work ^b	31(86.1)	89(77.4)	62(67.4)	9(39.1)	<0.001
Overtime (h/week) ^a	9.9±10.7	7.7± 8.6	5.8± 6.2	2.7± 1.3	0.005
Overtime (≥15h/week) ^b	8(26.7)	12(13.6)	6(10.2)	0	0.020
Smoking ^b	15(40.5)	43(36.1)	34(36.2)	16(66.7)	0.151
No exercise ^b	27(73.0)	80(67.2)	59(62.8)	12(50.0)	0.062
Alcohol consumed ^b (≥5 days/week)	9(24.3)	39(32.8)	47(50.0)	14(60.9)	<0.001
Health feeling ^b (good, somewhat good)	26(70.3)	95(79.8)	81(86.2)	23(95.8)	0.005

^a mean ± SD, ^b n (%)**Table 2. Mean Values for Job Stress Factor for each Sleeping Time**

Characteristic	Sleeping Time				P for Trend
	≤ 5 h	6 h	7 h	≥ 8 h	
	n=37	119	94	24	
Quantitative workload	9.3±2.2 ***	8.7±2.2**	8.4±2.3*	7.0±2.1	<0.001
Qualitative workload	8.5±1.9	8.3±2.0	8.2±2.0	7.5±1.9	0.092
Physical workload	2.2±0.9	1.9±0.8	2.0±0.9	2.0± 0.9	0.595
Job latitude	8.6±1.6	8.4±1.9	8.8±2.0	9.3±2.1	0.063
Application of technology	2.2±0.8	2.1±0.8	2.0±0.8	2.3±1.0	0.937
Interpersonal conflict	6.8±2.0*	6.1±2.0	6.1±1.8	5.5±2.2	0.019
Workplace environment	2.1±0.9	1.8±0.8	1.8± 0.8	1.6±0.8	0.057
Appropriateness of work	5.7±1.3	5.5±1.4	5.6±1.3	6.0±1.2	0.353

***p < 0.001, **p < 0.01, *p < 0.05 by Dunnett's test (compared with sleeping time ≥ 8 h)

Table 3. Mean Values for Job Stress Response for each Sleeping Time

Job Stress Response	Sleeping Time				P for Trend
	≤ 5 h	6 h	7 h	≥ 8 h	
	n=37	119	94	24	
Psychological Stress Response					
Activity	6.5±2.4	6.5±2.1	7.1±2.2	6.6±2.5	0.204
Anger	6.5±2.3	6.1±2.3	5.8±2.1	5.3±2.4	0.027
Fatigue	6.4±2.1**	5.9±2.0**	5.5±2.0*	4.5±1.7	<0.001
Tension/Anxiety	6.4±1.8*	5.6±2.0	5.4±1.8	5.1±2.3	0.010
Depressive symptoms	9.9±3.6	9.5±3.4	9.0±2.8	8.3±4.0	0.026
Overall	37.5±9.5*	35.6±9.4	33.6±8.4	31.5±8.5	0.003
Physical stress response	18.9±5.3*	17.1±4.8	16.6±4.2	15.9±4.9	0.008

**p < 0.01, *p < 0.05 by Dunnett's test (compared with sleeping time ≥ 8 h)

Table 4. Mean Values for Job Stress Response for each Sleeping Time (≤ 39 Years, ≥ 40 Years)

Job Stress Response	Sleeping Time				P for Trend
	≤ 5 h	6 h	7 h	≥ 8 h	
≤ 39 Years Psychological Stress Response	n=24	65	42	8	
Activity	6.4 \pm 2.8	6.4 \pm 1.8	7.5 \pm 2.2	7.6 \pm 2.3	0.010
Anger	6.8 \pm 2.3	6.4 \pm 2.3	6.0 \pm 2.4	6.6 \pm 2.5	0.328
Fatigue	7.1 \pm 2.2	6.6 \pm 2.0	5.8 \pm 2.2	6.1 \pm 1.7	0.017
Tension/Anxiety	6.3 \pm 1.8	5.8 \pm 2.1	5.4 \pm 1.9	6.6 \pm 2.6	0.364
Depressive symptoms	10.2 \pm 3.4	10.0 \pm 3.7	9.1 \pm 3.1	11.0 \pm 6.1	0.571
Overall	38.9 \pm 9.5	37.5 \pm 9.7	33.7 \pm 9.6	37.6 \pm 12.0	0.087
Physical stress response	19.5 \pm 5.5	17.4 \pm 4.8	16.3 \pm 4.4	18.3 \pm 6.5	0.061
≤ 40 years Psychological stress response	n=13	54	52	16	
Activity	6.7 \pm 1.6	6.6 \pm 2.3	6.8 \pm 2.1	6.0 \pm 2.5	0.603
Anger	6.1 \pm 2.3	5.7 \pm 2.3	5.7 \pm 1.8	4.7 \pm 2.1	0.106
Fatigue	5.1 \pm 1.3	5.0 \pm 1.7	5.3 \pm 1.8	3.6 \pm 1.0	0.111
Tension/Anxiety	6.4 \pm 1.9	5.3 \pm 1.9	5.4 \pm 1.7	4.3 \pm 1.7	0.018
Depressive symptoms	9.5 \pm 4.0	8.8 \pm 3.0	8.8 \pm 2.7	6.9 \pm 1.1	0.030
Overall	34.7 \pm 9.2	33.2 \pm 8.5	33.5 \pm 7.3	28.5 \pm 3.9	0.075
Physical stress response	17.8 \pm 4.9	16.8 \pm 4.8	16.8 \pm 4.1	14.7 \pm 3.6	0.104

total score for psychological stress responses ($p < 0.01$). Total score for physical stress response was also significantly higher with shorter sleeping times ($p < 0.01$). Compared with the group with ≥ 8 h sleeping time, the scores of fatigue were significantly higher in the groups with ≤ 5 h, 6h and 7h sleeping time ($p < 0.01$, $p < 0.01$, and $p < 0.05$, respectively). The scores of tension/anxiety, total scores of psychological stress responses, and physical stress response were respectively significantly higher in the group with ≤ 5 h sleeping time than in the group with ≥ 8 h sleeping time ($p < 0.05$).

In the subjects aged ≤ 39 (Table 4), scores for activity significantly decreased ($p < 0.05$), and those for fatigue significantly increased with shorter sleeping times ($p < 0.05$). In the subjects aged ≥ 40 , scores for tension/anxiety and depressive symptoms increased significantly ($p < 0.05$).

DISCUSSION

This study showed that shorter sleeping time was related to overtime work, as well as the job stress factors of quantitative workload and interpersonal conflict. Furthermore, psychological stress responses, such as anger, fatigue, tension/anxiety, and depressive symptoms were shown to increase with shorter sleeping time, particularly in subjects who slept ≤ 5 h per day. In addition, in subjects aged ≤ 39 , the scores of activity and fatigue decreased or increased, respectively, whereas in subjects aged ≥ 40 , the scores for tension/anxiety and depressive symptoms increased. Shorter sleep duration was more closely associated with depressive symptoms in workers aged ≥ 40 .

Long working hours may lead to shorter sleeping times [3]. Working for ≥ 11 h per day, or 55 h per week, can reportedly increase the risk of having sleeping time of < 7 h per day nearly two times compared with people who work 35 to 40 h per week [24]. In the present study, about one quarter of people with sleeping times ≤ 5 h worked more than 15h of overtime per week. Overtime work of > 15 h per week could be equivalent to working ≥ 11 h per day in the case of a 5-day week, which might increase the risk of acute heart disease [25]. In addition, overtime work was also associated with a greater quantitative workload of job stress factors, which might also contribute to a decrease in sleeping time. These findings were in accordance with an earlier study showing an association between high job stress factors and short sleeping time [17].

As shown in Table 3, mean scores for job stress responses of anger, fatigue, tension/anxiety, depressive symptoms and physical stress response increased with shorter sleeping time. Depression scores have been shown to be related to long working hours and short sleeping time [26]. The risk of depression was about 1.73 times greater in people working > 10 h per day than for those working 6 to 8 h per day. Similarly the risk was 1.62 times higher in persons who slept < 6 h than in those who slept 7 to 8 h. The combined risk for depression was 2.69 times greater in persons working > 10 h who slept < 6 h, compared with those working 6 to 8 h who slept > 6 h. Moreover, a previous study of Japanese people reported that 19 of 22 people who committed suicide had worked ≥ 11 h per day and were also depressed [27]. In the present results, shorter sleeping time

was associated with long working hours and depressive symptoms together with anger, fatigue, tension/anxiety and physical stress response. The Subjective sense of well-being was also lower in persons with shorter sleeping times. Thus, short sleeping time can be associated with both physical and mental health, including an increased risk of depressive symptoms and a decreased sense of well-being [28].

The present study also showed that there were age differences in the stress responses associated with shorter sleeping time. With shorter sleeping time, the scores for tension/anxiety and depressive symptoms increased in people aged ≥ 40 years. On the other hand, in persons aged ≤ 39 years, significant trends were found in activity and fatigue, but not depression. These findings suggest that short sleep duration may be more closely associated with depressive symptoms among middle-aged workers. This might be presumed to be associated with a decline in physical and mental function and greater job demands including management tasks in middle-aged workers, or other factors. The 2011 patient survey by the Ministry of Health, Labor and Welfare reported that the prevalence of males with mood disorders that are mainly constituted by depression is the highest in men in their 40's. It may be necessary for middle-aged male workers to be more careful about depressive symptoms and mental health as well as adequate sleep duration.

In this study, mean sleeping time was 6.5 ± 1.0 h for people aged ≥ 40 versus 6.2 ± 0.9 h for those aged ≤ 39 . It was shorter in the younger generation. Similar results were shown in a previous study [29]. Sleeping time of younger workers may be influenced by factors other than work such as.

There were some limitations of this study. First, the present study was a cross-sectional study using a self-completed questionnaire. Hence, this study cannot show a causal relationship. Second, we focused on sleeping time and job stress. Assessing quality of sleep as well as sleeping time is important in the evaluation of sleep. However, we did not examine sleep quality in this study. Third, we did not inquire about daytime sleepiness, caffeine intake, or other xanthine beverages, which might affect sleep. With regard to medication, respondents with psychiatric disorders under treatment were excluded in the present analyses. Fourth, depressive symptoms were assessed using JSQ of self-reported questionnaire surveys, which was not a questionnaire specific for depression. Our study may be indicative of depressive symptoms milder than clinical depression. Lastly, study subjects were male white-collar workers at a single manufacturing plant, excluding management level workers. Further studies will be needed with larger numbers of people in other types of work, shift workers, women, and persons in other areas of business.

CONCLUSION

This study showed that shorter sleeping time on working days was related to overtime work and increased quantitative workload in male white-collar workers. Shorter sleep duration was more closely associated with depressive symptoms and tension/anxiety in workers ≥ 40 and activity and fatigue in those < 40 years. It may be necessary for middle-aged male workers to be more careful about

depressive symptoms as well as sleeping an adequate number of hours per night.

CONFLICTS OF INTEREST

The authors confirm that this article content has no conflicts of interest.

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