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Job Stress Factors, Stress Response, and Social Support in Association with Insomnia of Japanese Male Workers

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Abstract: The aim of the present study was to examine the relation of insomnia with job stress factors, stress response, and social support. A self-completed questionnaire survey was conducted in 212 male Japanese workers at a synthetic fiber plant. With regard to insomnia, subjects were asked the first 5 of the 8 questions on the Athens Insomnia Scale (AIS). Job stress factors, stress response and social support were assessed using the Job Stress Questionnaire. Multiple regression analyses showed that psychological job stress factors of poor appropriateness of work and high qualitative workload were associated with insomnia. The psychological stress response of depression and physical stress responses were also related with insomnia. Depression was also related to appropriateness of work. The present results showed that insomnia was closely related with the psychological job stress factor of appropriateness of work and the psychological response of depression. These mutual relationships between insomnia and poor mental health need be investigated further.

Key words: Job stress factors, Insomnia, The Athens Insomnia Scale, Depression

Introduction

Insomnia is considered to be related to hypertension and coronary artery disease[1, 2]. It is also thought to decrease the quality of people's lives[3] and affect them economically[4]. From a study of insomnia among approximately 3,000 people in the general Japanese population, it was reported that 21.4% had experienced insomnia within the previous month[5]. This prevalence is similar to data from other countries with different cultures. The usual prevalence of insomnia is thought to be 5–45% among workers who are not on alternating shifts[6]. In a survey of about 3,400 male day workers aged 35 yr or more, 12.3% had difficulty falling asleep, 20.4% had arousal during sleep, and 32.0% had problems of poor sleep quality. A low level of mental health was shown to be related to insomnia[7].

For workers, insomnia leads to drowsiness during work, decreased work efficiency, and problems of safety. Meanwhile, stress at work has been shown to be closely related to insomnia. In studies in other countries, the workload was positively related to stress, and negatively to autonomy in work[8]. In Japan a number of studies have surveyed the relation between workplace stress and insomnia. These studies showed, for example, that workplace stress, particularly stress from an imbalance between high work demands and low reward, is related to few sleeping hours and insomnia[9, 10]. Similarly, it is said that among male white collar workers, poor social support, low levels of work satisfaction, and interpersonal conflict are related to insomnia[11]. In addition, sleeping for a small number of hours is also related to physical symptoms; in particular, this has a negative relation with fatigue[12].

In the relation between sleeping condition and job stress, there are thought to be mutual effects from job stress factors, stress response, and social support. However, there have been very few studies in which the relations between insomnia and job stress factors, social

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support, and mental and physical health were examined simultaneously. In the present study, job stress factors, stress response, social support, and the quantity and quality of sleep in male workers were examined simultaneously using a self-completed questionnaire to investigate the relations among them.

Methods

Subjects

The subjects were 212 male workers in a synthetic fiber manufacturing plant who underwent a health examination in April 2007. All workers at the plant received this health examination. This plant has both daytime and shift workers. The working hours for daytime workers were 08:30–17:00. The shift workers are divided into four groups, who work on the three shifts: morning shift (07:00–14:00), afternoon shift (14:00–22:00), and night shift (22:00–07:00) (Table 1). Both daytime workers and shift workers included a mixture of office workers and plant workers. At the same time as the health examination, a questionnaire survey was conducted using a self-completed questionnaire on job stress and life style including sleeping status. The survey on sleep was conducted using the Athens Insomnia Scale (AIS)[13, 14], a tool that is used worldwide to assess insomnia. The questionnaire was distributed about one week before the health examination. On the day of the examination, the occupational health nurse collected the questionnaires after checking them for blank items or other missing information. The questionnaires were collected from workers who consented to participate in the study and signed an informed consent form. Questionnaires were collected from 210 workers, for a 99.1% collection rate. One hundred twenty-three subjects (58.6%) were daytime workers and 87 subjects (41.4%) were shift workers. Of the 210 workers, 72 (34.3%) were office workers and 138 (65.7%) were plant workers. Two of the 210 respondents had a history of psychiatric disorder and 4 were currently under treatment. After these 6 men were excluded, the analysis was conducted using the data for 204 men (aged 19–63 yr, mean age 38.9 ± 13.2 yr).

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

Survey content

Basic attributes and life style

Basic attributes and life style items investigated included age, work pattern, whether living with family, job type, overtime working hours, mean sleeping hours, regular exercise (and if so, frequency), smoking habit, and alcohol consumption. For mean sleeping hours, subjects were asked to give mean hours on working days. Daytime workers were asked mean sleeping hours on weekdays, and shift workers were asked mean sleeping hours when working on each of the shifts; morning shift (07:00–14:00), afternoon shift (14:00–22:00), and night shift (22:00–07:00), respectively (Table 1).

Quality of sleep

The first 5 of the 8 questions on the Athens Insomnia Scale (AIS), a common global measure of insomnia, were used to assess insomnia. The full eight-item version (AIS-8) has been developed for a clinical setting, while the brief five-item version (AIS-5), can be used for the assessment of sleep difficulties with regard to sleep quantity and quality[13]. The first five questions (AIS-5) are used to assess difficulty with sleep induction (sleep induction), awakenings during the night, early morning awakening (final awakening), total sleep time (total sleep duration) and overall quality of sleep (sleep quality). The last three items in the AIS-8 refer to daytime symptoms which often result from sleep disorders rather than insomnia, such as narcolepsy and obstructive sleep apnea in insomniac patients[13].

According to the AIS-5 questions, subjects were asked if they had experienced sleep difficulty more than three times a week in the last one month. The items were rated on a four-point scale: not a problem (0 points), slight problem (1 point), considerable problem (2 points), could not sleep at all (3 points). In the full version of the AIS-8, the total score of less than 4 points is taken to be no problem, a score of 4 or 5 to indicate that consultation with a physician may be necessary (some suspicion of insomnia), and 6 or more to indicated that a physician consultation is necessary (suspected insomnia). Since the

Table 1. Shift schedules

Schedule	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Group 1	A	A	A	A	—	M	M
Group 2	N	N	—	—	A	A	A
Group 3	M	—	N	N	N	N	—
Group 4	—	M	M	M	M	—	N

M: morning shift (7:00–14:00), A: afternoon shift (14:00–22:00), N: night shift (22:00–7:00), —: not at work (holiday).

first 5 questions (AIS-5) were used in this study, subjects were divided into 3 groups with a total score of 0 considered to be "no sleeping problems", a score of 1 or 2 to be "some sleeping problems", and a score of 3 or more to be "considerable sleeping problems".

Job stress

The Job Stress Questionnaire which was made in a study commissioned by the Japanese Ministry of Health, Labor and Welfare, was used in the present study[15]. 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 consists of three main parts, the job stress factors of psychological workload, psychological stress response, and stress mitigation factors. The questions include a total of 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-step scale of "agree", "somewhat agree", "somewhat differ", and "differ". The burden from stressors is considered to be higher with lower scores for job latitude and compatibility, 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 has a total of 18 items to measure positive responses (activity) and negative responses (anger, fatigue, tension/anxiety, and depression). The section to assess physical stress response has a total of 11 items. Stress mitigation factors were measured by nine items incorporating support in the family and workplace and 2 items on satisfaction with workplace and family. Nine items in the family and workplace are factors of social support. 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. For social support, lower scores indicate lower levels of support.

Analysis

Subjects were divided into three groups by total AIS score and examined using a χ^2 test and analysis of variance (ANOVA) for basic attributes and life style. Similarly, an examination was done using ANOVA for job stress factors and stress response in the three groups divided by total AIS score. Multiple regression analyses were further conducted to investigate the association of insomnia with job stress factors and stress response.

SPSS 12.0 was used in the analysis.

Results

AIS, basic attributes, and life style

Basic attributes and life style were investigated in the three groups divided by total AIS score. The results show that mean sleeping time was 6.7 ± 1.0 h in the group with total AIS score of 0, 6.4 ± 0.9 h in the group with total AIS score of 1 or 2, and 6.1 ± 1.0 h in the group with total AIS score of 3 or more (Table 2). Thus, mean sleeping hours decreased significantly with rising total AIS score (trend p=0.001). No significant differences were seen with items including age, BMI, work pattern, smoking, exercise habits, drinking habits, and overtime work.

Table 2. Analyses of variance (ANOVA) in basic attributes and lifestyle among 3 groups according to total AIS score

Item	Total AIS score			
	0 (n=53)	1–2 (n=81)	≥3 (n=70)	p for trend
Age (yr)	40.1 ± 13.8	37.1 ± 12.5	40.0 ± 13.4	0.914
Weight (kg)	68.4 ± 13.0	70.2 ± 13.9	67.3 ± 10.6	0.546
BMI (kg/m^2)	23.7 ± 3.9	24.1 ± 4.4	23.2 ± 3.3	0.406
Shift worker	21 (39.6)	33 (40.7)	33 (47.1)	0.385[a]
Smoker	32 (60.4)	55 (67.9)	37 (52.9)	0.323[a]
No exercise	28 (52.8)	46 (56.8)	40 (57.1)	0.649[a]
Drink alcohol ≥5 days wk	16 (30.2)	22 (27.2)	18 (25.7)	0.589[a]
Overtime work	31 (58.5)	56 (69.1)	41 (58.6)	0.901[a]
Overtime (h/wk)	4.2 ± 4.3	3.3 ± 3.0	3.9 ± 3.5	0.867
Mean sleeping hours (h)	6.7 ± 1.0	6.4 ± 0.9	6.1 ± 1.0	0.001

[a]by χ^2 test.

Table 3. Analyses of variance (ANOVA) in job stress factors among 3 groups according to total AIS score

Job stress factors	Total AIS score			
	0 (n=53)	1–2 (n=81)	≥3 (n=70)	*p* for trend
Quantitative workload	7.8 ± 2.2	8.4 ± 1.8	8.4 ± 1.8	0.163
Qualitative workload	7.8 ± 1.7	8.2 ± 1.8	8.3 ± 1.7	0.142
Physical workload	2.5 ± 1.0	2.8 ± 1.0	2.8 ± 0.9	0.128
Job latitude	8.8 ± 1.4	8.4 ± 1.8	8.2 ± 1.8	0.031
Application of technology	2.4 ± 0.8	2.2 ± 0.7	2.3 ± 0.8	0.840
Interpersonal conflict	5.9 ± 1.7	5.8 ± 1.4	6.7 ± 1.4	0.002
Workplace environment	2.4 ± 1.1	2.5 ± 1.0	2.7 ± 1.0	0.143
Appropriateness of work	5.9 ± 1.1	5.6 ± 1.4	4.9 ± 1.3	<0.001
Social support	27.3 ± 4.2	27.4 ± 4.6	25.2 ± 5.0	0.007

AIS and job stress factors

Mean score for job stress factors was investigated in the three groups divided by total AIS score. The results showed that appropriateness of work decreased significantly with higher AIS scores (trend $p<0.001$) (Table 3). The mean score for job latitude and social support also declined significantly as total AIS score increased (trend $p=0.031$ and $p=0.007$, respectively). Conversely, score for interpersonal conflict increased significantly with rising AIS score (trend $p=0.002$). No significant differences were seen in the mean scores for quantitative and qualitative workload between the three AIS groups, although there was a tendency for the mean score to increase with higher AIS scores.

Multiple regression analysis between insomnia and job stress factors (Table 4) showed that insomnia was significantly related with appropriateness of work ($p<0.001$) and qualitative workload ($p<0.05$). Interpersonal conflict tended to be associated with insomnia ($p=0.055$). No significant differences were seen in any other items.

AIS and stress response

Mean stress response score was investigated in the three groups divided by total AIS score. The results showed that among the psychological stress responses there were significant increases in fatigue (trend $p<0.001$), tension/anxiety (trend $p<0.001$), depression (trend $p<0.001$), anger (trend $p=0.002$), and overall (trend $p<0.001$) as total AIS score increased (Table 5). The score for activity decreased significantly as total AIS score increased (trend $p=0.005$). The score for physical stress response increased as total AIS score increased (trend $p<0.001$). Further multiple regression analysis (Table 6) showed significant associations of insomnia with depression ($p=0.003$) and physical stress responses ($p=0.010$).

Table 4. Standardized correlation coefficient (β) in multiple regression analysis between total AIS score and job stress factors, adjusting for age and work pattern

Item	β	*t*	*p* value
Quantitative workload	–0.023	–0.278	0.782
Qualitative workload	0.162	2.045	0.042
Physical workload	0.040	0.524	0.601
Job latitude	0.084	1.072	0.285
Application of technology	–0.053	–0.738	0.461
Interpersonal conflict	0.157	1.928	0.055
Workplace environment	–0.034	–0.395	0.694
Appropriateness of work	–0.365	–4.418	<0.001
Social support	–0.050	–0.640	0.523

Job stress factors and stress response

The relation between job stress factors and psychological and physical stress responses was examined using Spearman's correlation coefficient. A negative correlation was encountered between the job stress factor of appropriateness of work and depression ($r=–0.381$, $p<0.01$). Physical stress response was also significantly related with appropriateness of work ($r=–0.213$, $p<0.01$). No such relations were found between qualitative workload and depression or physical stress response.

Discussion

In the present study insomnia was assessed using the AIS-5, with questions on difficulty with sleep induction, awakenings during the night, early morning awakening, total sleep time and overall quality of sleep. The present multiple regression analyses showed that insomnia was associated with psychological job stress factors of appropriateness of work and qualitative workload and psychological stress response of depression and physical stress

Table 5. Analyses of variance (ANOVA) in psychological and physical stress response among 3 groups according to total AIS score

Job stress response	Total AIS score			
	0 (n=53)	1–2 (n=81)	≥3 (n=70)	*p* for trend
Psychological stress response				
Activity	7.5 ± 2.4	7.3 ± 2.1	6.4 ± 1.9	0.005
Anger	5.7 ± 1.9	5.9 ± 2.0	6.8 ± 2.0	0.002
Fatigue	5.1 ± 1.5	6.0 ± 2.4	6.6 ± 1.9	<0.001
Tension/anxiety	4.9 ± 1.6	5.4 ± 1.8	6.4 ± 1.7	<0.001
Depression	8.3 ± 2.4	9.2 ± 2.8	11.6 ± 3.1	<0.001
Overall	31.5 ± 7.1	34.2 ± 8.6	39.9 ± 7.4	<0.001
Physical stress response	15.7 ± 3.6	16.5 ± 4.4	19.9 ± 4.4	<0.001

Table 6. Standardized correlation coefficient (β) in multiple regression analysis between total AIS score and psychological and physical stress response, adjusting for age and work pattern

Item	β	t	p value
Psychological stress response			
Activity	–0.020	–0.289	0.773
Anger	0.030	0.401	0.689
Fatigue	0.035	0.401	0.689
Tension/anxiety	0.021	0.242	0.809
Depression	0.307	3.042	0.003
Physical stress response	0.196	2.584	0.010

responses. Depression was also related to appropriateness of work.

A review of 24 past reports on Japanese workers revealed that the prevalence of insomnia was 5–45% among daytime workers and 29–38% among shift workers[6]. In the present survey, 70 (34.3%) of the total 204 workers had total AIS score of 3 or more, including 37 (31.6%) daytime workers and 33 (37.9%) shift workers. There was no difference between the work patterns. In the United States, about 30% of day workers are thought to have insomnia[16], a prevalence that is similar to that in earlier studies in Japan as well as the present results.

With regard to sleep and health problems, males who sleep 7–8 h have low mortality from heart disease, cancer, and stroke. Mortality is said to be 1.7 times higher in men who sleep fewer than 6 h or more than 9 h[17]. In similar findings, the mortality rate is though to be low with sleep of 7–8 h, but the mortality risk increases with short sleeping time of less than 7 h[18]. Results in Japan have also shown increased mortality with sleeping time of less than 7 h or more than 10 h in comparison with sleep of 7–8 h[19]. In the present study the men with total AIS score of 3 or more had low average sleeping hours of 6.1 ± 1.0 h, and mean sleeping hour decreased significantly as AIS score increased (Table 2). With regard to the relationship to disease, results from a study of Japanese workers indicate that insomnia gives a higher risk of hypertension[1]. As shown in the preceding, insomnia is thought to have a large effect on health status.

In the present study, insomnia was associated with psychological job stress factors of appropriateness of work and qualitative workload. Workers with poor sleep quality and insomnia reportedly have low interest or satisfaction in their work[10, 16, 20, 21]. Another study indicated that poor sleepers had the feeling of higher job difficulty and lower achievement on the job[22]. Thus, a close relation is shown between insomnia, job satisfaction and job difficulty, leading to impaired job performance. These findings are in accordance with the present results, as people who feel low appropriateness of work are thought to have low job satisfaction as well, and the feeling of high qualitative workload may reflect a feeling of high job difficulty. The psychological job stress factors of appropriateness of work and qualitative workload in this study may be regarded as a kind of job stress response.

With regard with job stress responses, insomnia was closely associated with psychological stress response of depression and physical stress response. The close relationship between depression and insomnia has been shown in many earlier studies[10, 23, 24]. Fatigue has also been reported to be related to insomnia[24, 25]. However, the present study showed a closer relationship of insomnia to depression than to fatigue. In this study, depression was also related to appropriateness of work. Insomnia can be an early sign of depression and a risk for depression[26]. A study in white color workers reported that people with insomnia tended to have lower physical and mental health as well as problems at work and in personal relations[20]. Insomnia can be associated with depression and poor mental health. This association can

lead to a vicious cycle. To prevent insomnia, mental health management may be necessary in the workplace. Dealing with insomnia might contribute to a decrease of depression in the workplace[10].

The present findings showed a close relation between insomnia, job stress factors of appropriateness of work and psychological responses of depression. However, this survey was a cross-sectional study and did not conclude the cause-and-effect relationship. Many studies have indicated relations between work demands and insomnia[9, 22, 27, 28], although some showed no relation between them[10]. Job stress such as overtime work is reportedly related to depression and physical symptoms[29–31]. In the present study, some psychological job stress factors were associated with insomnia, while no significant relation was seen with quantitative workload. This survey was conducted in a synthetic fiber manufacturing plant, where overtime working hours were on average 3–5 h a week. Such working conditions may affect the present results.

The present study had the following limitations. First, as mentioned above, the present study design was a cross-sectional study, and therefore could not address such questions as the causal relationship between insomnia and depression. Second, this study was conducted using a self-administered questionnaire, although it used the AIS-5, a global measure of insomnia. Finally, the subjects in the present study were workers from a single workplace, and the number was not so great. We also did not inquire about caffeine, which might affect sleep[32]. With regard to medication, respondents with psychiatric disorders under treatment were excluded in the present analyses. Further studies will be required to investigate the causal relationship.

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