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短 報

## Cross-Sectional Study on the Relationship between Insomnia and Other Conscious Physical and Mental Rational Symptoms in Male Employees of a Chemical Plant

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### Introduction

A universal desire of people is to lead a healthy and fulfilled life. Modern society is designed to bring about a pleasant living environment, but it also fosters many problems and disturbances for people. Among the major disturbances that plague people, insomnia has frequently been cited, and an increasing number of people have reported sleep-related disorders, such as insomnia, unwillingness to sleep, and hypersomnia. In the United States, there are far-reaching and ongoing campaigns to enlighten the public on the subject of insomnia (from a sociological viewpoint) and to promote early detection and treatment of these disorders<sup>1</sup>. In fact, a campaign named "Wake up, America" has been conducted to educate the public on sleep-related health problems.

In Japan also, there is a marked increase in the number of individuals suffering from insomnia due to changes in their life styles, such as a reversal of day and night hours and curtailment of hours spent in sleeping.<sup>2,3</sup> Consequently, accidents caused by insomnia are increasing. Many studies have been conducted on topics related to insomnia – e.g., disorders due to a 24-hour work schedule, the relationship between sleep apnea syndrome and insomnia, association between REM-sleep-related disturbances and social activities, sleep dysfunction among the aged, and drug-induced sleep disturbances.<sup>4-6</sup>

To treat these disorders, it is necessary to establish measures that include life-style improvements. To obtain basic data incorporating the factors related to an individual's life style, the current study was conducted to investigate the background of insomnia, including its relationship with daily stress factors, which may be responsible for or attributable to this disorder, as well as the physiological effects of these

disorder, on employees of a large business establishment.

### Method

#### 1 Subjects

The subjects were employees of a chemical plant located in Sakai, Osaka, Japan. Among the employees who received routine health examinations in 2000, those who satisfied the following 5 conditions were selected: 1) Employees between the ages of 20 to 59 years; 2) Those who did not require more detailed examinations other than the routine health examination; 3) Those who were not given a diagnosis of chronic disease at the routine examination (such as cardiac disease or diabetes mellitus); 4) Those who did not report an abnormality, such as fatigue or a common cold on the day of the routine health examination; 5) Those who were not workers on the 3 shifts on the production line.

Most operated computer-controlled equipment and were not at risk of being exposed to toxic chemicals. The number of individuals ultimately selected were 1077 men (with a mean age of  $39.9 \pm 10.3$  years).

#### 2 Informed consent and maintaining privacy for subjects

To protect the human rights of the participants, informed consent was obtained. On the same occasion, the purpose of the study was clearly described. They were also advised that the results would only be used to protect the health of the employees of the plant and the method; particulars of the questions posed and risks were thoroughly explained. The prospective respondents were urged to participate and told that their participation was completely voluntary, their privacy would be thoroughly respected, and the organizers of the study were prepared to answer any questions they might have about the survey.

To maintain the privacy of the respondents, a code was assigned to each individual for the statistical analysis. This would prevent identification of individu-

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als when restrictions on the data evaluation were lifted or the results were published.

### 3 Survey method for subjects

To conduct the survey, the questionnaire was distributed to the test subjects and the completed form collected from them on the day of a routine health examination. The recovery rate was 50.9%.

A multiple choice format was adopted. Individuals responded to the questions related to stress and mental health. There were 17 questions (e.g., "Do you have defecation-related problems, such as diarrhea or constipation?" and "Do you have a desire to drink alcoholic beverages in the morning?")

### 4 Statistical analysis

The subjects were divided into two groups: those who gave positive and negative responses to the question, "Do you often stay awake or are you readily aroused after having fallen asleep?" The two groups were stratified by age and the relationship between their responses and the psychological and physical factors represented by the 17 questions was analyzed by employing chi-square test.

For statistical analysis, the Macintosh Statview Ver. 5.0 Computer Program (SAS Institute Inc., Berkeley, USA) was used. Significance level was set at  $p < 0.05$ .

## Results

### 1 Percentage of individuals with insomnia

Table 1 shows the percentage of those with insomnia by age. Insomnia occurred in 15.7%.

### 2 Relationship between insomnia and factors related to mental health

Table 2 shows the correlation between insomnia and the responses to the 10 questions on mental health-related factors. Compared with those with no sleep-related problems, the percentage of those with sleep problems and giving positive responses to questions on "nervousness," "constant irritability," "many sad experiences," "general indifference," "many anxiety experiences," and "tendency to stay at home on holidays" was statistically high. Conversely, the percentage of those with insomnia (in contrast to those without) who responded positively to being satisfied with their current life status was low, the difference between the two groups being statistically significant. Among the subjects with insomnia, a large percentage

**Table 1** The percentage of male employees with subjective symptoms of insomnia

Age (years)	Male	
	Number of subjects	Subjects with subjective symptoms of insomnia
		n (%)
20-29	250	41 (16.4%)
30-39	223	35 (15.7%)
40-49	398	64 (16.0%)
50-59	206	29 (14.1%)
Total	1077	169 (15.7%)

**Table 2** The correlation between subjective symptoms of insomnia and the responses to the 10 questions on mental health-related factors in male employees

Age at entry	20-29 (n=250)			30-39 (n=223)			40-49 (n=398)			50-59 (n=206)		
	subjective symptoms of insomnia			subjective symptoms of insomnia			subjective symptoms of insomnia			subjective symptoms of insomnia		
	Yes (%)	No (%)	p value	Yes (%)	No (%)	p value	Yes (%)	No (%)	p value	Yes (%)	No (%)	p value
Are you nervous?	61.0	30.6	0.000*	62.9	38.3	0.007*	73.4	47.9	0.000*	75.9	42.0	0.001*
Do you always get angry with it?	41.5	26.3	0.050*	51.4	25.0	0.002*	46.9	30.0	0.009*	55.2	21.7	0.000*
Are you satisfied with your life currently?	9.8	38.0	0.001*	22.9	47.8	0.006*	23.8	47.9	0.000*	55.6	51.4	0.690
Do you have many sad experiences?	22.0	9.6	0.036*	34.3	5.3	0.000*	28.1	6.0	0.000*	34.5	8.0	0.000*
Do you have many anxiety experiences?	53.7	24.9	0.000*	60.6	21.9	0.000*	60.9	23.7	0.000*	58.6	24.3	0.000*
Are you satisfied with relations with family and relatives?	70.7	76.1	0.475	71.4	78.5	0.359	57.8	78.9	0.000*	72.4	67.8	0.620
Do you have general indifference?	12.2	2.4	0.004*	20.0	2.1	0.000*	50.0	50.0	0.000*	13.8	4.6	0.083
Do you stay at home on holidays?	31.7	13.9	0.006*	28.6	11.2	0.006*	33.3	17.1	0.005*	44.8	16.5	0.001*
Are you interested in the opposite sex?	2.4	1.4	0.661	8.6	2.7	0.084	6.5	5.4	0.737	13.8	5.7	0.147
Do you dislike that they meet another person?	17.1	9.1	0.129	14.3	10.6	0.394	43.5	21.9	0.001*	24.1	17.7	0.411

\* : significant

**Table 3** The correlation between subjective symptoms of insomnia and the responses to the 7 questions on physical stress-related factors in male employees

Questions	20-29 (n=250)			30-39 (n=223)			40-49 (n=398)			50-59 (n=206)		
	subjective symptoms of insomnia			subjective symptoms of insomnia			subjective symptoms of insomnia			subjective symptoms of insomnia		
	Yes (%)	No (%)	p value	Yes (%)	No (%)	p value	Yes (%)	No (%)	p value	Yes (%)	No (%)	p value
Do you have constipation or diarrhea?	29.3	12.4	0.006*	17.1	5.9	0.021*	26.6	7.2	0.000*	13.8	4.5	0.048*
Do you have constant fatigability?	58.5	25.4	0.000*	48.6	21.3	0.001*	50.8	22.9	0.000*	48.3	17.7	0.000*
Do you have excessive fatigue affecting appetite?	17.1	4.8	0.004*	14.7	4.3	0.017*	10.9	3.3	0.007*	0	0.6	0.685
Do you have a sense of fatigue starting in the morning?	63.4	21.5	0.000*	51.4	16.0	0.000*	39.1	12.9	0.000*	34.5	8.0	0.000*
Are you busy every day?	34.1	21.6	0.085	28.6	25.0	0.657	31.3	21.6	0.104	39.3	14.2	0.001*
Do you have a recent loss of body weight of more than 5kg?	14.6	5.3	0.050*	14.3	4.3	0.020*	7.9	3.3	0.086	3.6	1.1	0.320
Do you have stiffness of the neck and shoulders?	58.5	36.8	0.010*	68.6	37.8	0.001*	56.3	44.0	0.072	72.4	44.3	0.005*

\* : significant

of them stated that they have many reasons to be sad or apprehensive, while a few professed to be satisfied with their current status in life. It was noted that those with insomnia are under psychological stress.

### 3 Relationship between insomnia and physical stress factors

Table 3 shows the correlation between insomnia and the responses to the 7 questions related to physical stress factors. Compared with those enjoying normal sleep, the percentage of those who were suffering from insomnia and gave affirmative responses to questions on "constipation," "constant fatigability," "excessive fatigue affecting appetite," "sense of fatigue starting in the morning," "a recent loss of body weight of more than 5kg," or "stiffness of the neck and shoulders" was high, the difference having statistical significance. The difference from the group without insomnia was particularly notable for those who admitted to easy fatigability or having a sense of fatigue at the start of the day. The finding indicated that those individuals with insomnia are more exhausted and generally in poor physical condition.

### Discussion

Currently, the public is exhibiting an interest in sleep to a level that has never been witnessed. Two reasons are given to explain such a high level of interest: a gradual recognition of the importance of sleep owing to advances in neuroscience; and modern society promoting types of activities that force one to sacrifice sleep, which ultimately causes diverse ill effects. Consequent to the research on sleep, there is a mounting interest in answers to question such as what life pattern should be chosen to maintain one's health based on scientific evidence. In view of this

situation, the current epidemiological study was conducted on the insomnia of employees working in a large business establishment.

#### 1 Morbidity of insomnia

In the United States, various types of insomnia are found in 35.0% of the adult population,<sup>7</sup> and in Finland<sup>8</sup> and England,<sup>9</sup> 6.0 to 24.0% report some insomnia. In this country, however, no detailed surveys have been conducted on the prevalence or morbidity of these disorders. Ishitsuka et al.<sup>10</sup> conducted a survey on the sleep status of inhabitants of a certain area of Kofu City and reported that 24.3% had suffered from insomnia and that 12.6% were experiencing some problems related to sleep at the time of the survey.

Another survey was conducted in 1994 and 1995 at 11 general hospitals throughout the country on the status of insomnia for newly registered ambulatory patients over the age of 3 years. It was found that 19.6% of them (18.7% males, 20.3% females) suffered from insomnia.<sup>11</sup>

The results of the present study indicated that 15.7% of men were affected by insomnia. It was concluded that about 20.0% of the population in Japan experience some type of sleep disorder.

It has been reported that sleep is largely dependent on one's age—both qualitatively and quantitatively. Between the adolescent and adult stages, the total number of hours of sleep tends to decrease, while during middle and advanced age, the quality of sleep deteriorates as one ages. Most of the earlier studies on insomnia centered around aged individuals: Furuta et al.<sup>12</sup>, who conducted one of these studies, reported that insomnia was found in 16.0%; among the subjects surveyed, females dominated over males. The current study found morbidity to be around 15.0% for all ages,

which came close to the results of the aforementioned study, in which aged individuals were investigated.

An epidemiological study was conducted on physicians, nurses, and other personnel in health care-related occupations to find the incidence of sleep disorders by occupation.<sup>13</sup> The study indicated the incidence to be 20.0, 18.0, and 14.0% for physicians, nurses, and other health care personnel, respectively. The business organization where the current study was conducted operated on 3 shifts: the incidence of sleep disorders was 15.6%, which approximated that for the other health personnel. According to another study by the present authors, about 16.0% of the test subjects slept less than 6 hours per night.

### 2 The effects of stress factors on insomnia

It has been reported that when sleep disorders are classified according to their causes, 46.5% report difficulty in falling asleep because of the presence of stress factors (so-called "insomnia").<sup>14</sup> According to a survey conducted by the Ministry of Health and Labor, 29.1% reported that sleep was disturbed by mental anguish or stress. In explaining the mechanism leading to the development of sleep disorders, restful sleep is induced when the balance between the arousal and sleep centers is achieved in the brain, whereas when a stress factor upsets this balance, resulting in dominance of the arousal center, the individual stays awake. The results of the present study indicated that those suffering from insomnia are under various psychological stress factors (such as sadness, anxiety, and dissatisfaction with one's life). In particular, the percentage of those facing various events that provoked anxiety was 53.7 and 24.9% for the groups with and without sleep disorders, respectively. If even the subjects in this study, who are not working under irregular shifts, report insomnia and associated fatigability and physiological changes including weight losses in some frequency, workers on irregular shifts such as medical staffs are considered to have those symptoms with much more frequency and severity. It would be important to take measures to relieve these unhealthy conditions for employees in order to prevent accidents in their places of work.

### 3 The effects of physiological factors on insomnia

It is also known that insomnia occurs very frequently among shift workers and a large number of them complain about drowsiness during the day.<sup>15</sup> It is known that when irregular work schedules are imposed on workers for an extended period, they are likely to experience a chronic systemic fatigue sensation, tiredness, and insomnia, reducing their work efficiency and causing them to make errors at work.

Insomnia is very frequently noted among nurses and others engaged in providing health care services.

The results of the current study also indicated that those with insomnia frequently suffer from physical dysfunctions such as easy fatigability, a sensation of being tired in the morning, and a loss of body weight by more than 5 kg. In other words, these individuals with insomnia are physically fatigued or readily affected by fatigue, which may be a potential cause for accidents.

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