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Original Article

Sex Differences in Relationship between Stress Responses and Lifestyle in Japanese Workers

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ABSTRACT

Background: This study examined the relationships between stress responses and lifestyle, including sleeping and eating behaviors, in Japanese workers according to sex.
Methods: Questionnaires about stress responses and lifestyle were completed by 3,017 workers in a financial enterprise (41.5% men, 58.5% women). Data were collected in Japan in August 2011. Participants were classified into stress and nonstress groups. Relationships between stress responses and lifestyle were investigated using logistic regression analysis with stress response as a dependent variable.
Results: There were 254 (8.4%) participants in the stress group and 2,763 (91.6%) in the nonstress group. The results showed that sleeping for shorter periods [odds ratio (OR) = 2.97, 95% confidence interval (CI): 1.58–5.60] was associated with stress responses in women, whereas we found no relationship between stress responses and lifestyle among men. However, working overtime was associated with stress responses in men (OR = 2.71, 95% CI: 1.43–5.15). Eating at night was associated with stress responses in the univariate analysis (men: OR = 2.10, 95% CI: 1.16–3.80; women: OR = 1.61, 95% CI: 1.09–2.39).
Conclusion: This study showed that stress responses were related to lifestyle among women but not among men. Among women, stress responses were related to sleeping for shorter periods, whereas they were related to working long hours among men. In addition, stress responses were related to eating at night in the univariate analysis, although this relationship was not seen in the multivariate analysis, in either sex.

1. Introduction

Stress leads to serious conditions such as cardiovascular disease, gastrointestinal disease, and depression, as well as to poor quality of life and increased mortality in many countries [1–4]. Japan is no exception, and stress is a critical problem for Japanese workers. According to a report released by the Ministry of Health, Labor, and Welfare (MHLW), ~60% of workers feel intense stress [5], work-related claims for mental disorders have increased sharply, and the annual number of work-related suicides has also increased in recent years [6]. The MHLW mandated a specific health checkup to identify people with stress in recognition of the importance of stress management to efforts to prevent the harmful effects of stress.

The process of stress involves a perception that an external stimulus, a stressor, is a threat; this leads to a stress response. In other words, responses differ depending on whether a potential stressor is perceived as a threat, and each perception is affected by situational, psychological, and genetic factors. In addition, whether a stress response is produced depends on how one copes with the stimulus. Stress responses that occur frequently or continue for prolonged periods can lead to serious conditions [7].

It has been suggested that stress responses are associated with unhealthy lifestyles, and several studies have examined the relationship between stress responses and lifestyle. For example, smokers have higher stress levels than nonsmokers [8,9], and those who drink to excess report more stress compared with those who do not drink [9]. Moreover, those who report less physical activity are at a significantly greater risk for depression than are those who report more activity [10]. Studies have found a relationship between depression and sleeping disorders [11], in that those who

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reported insufficient sleep were more likely to develop depression than were those who reported sufficient sleep, regardless of time worked [12].

Sleeping is related to eating behaviors, as well as the stress responses. Specifically, eating breakfast and eating at night are related to sleeping. Some studies have shown that not eating breakfast and eating at night were associated with sleeping for short periods and sleep quality [13–16]. Relationships between higher stress levels and skipping breakfast and eating at night have also been observed [8,17–20]. However, these studies did not include sleeping habits. It is likely that skipping breakfast and eating at night have a negative effect on physical and psychological health, in addition to being related to obesity [15,18,21]. It is important to examine the relationship between stress and lifestyle, including sleeping habits and eating behavior.

In addition, working overtime is an important contributor to the stress and lifestyle of workers. Many studies have shown that working overtime is associated with mental health [22], including depression, and with physical health, including blood pressure [22], weight gain [22,23], and heart disease [24]. In addition, several previous studies have shown that working overtime is related to unhealthy lifestyles, such as short sleeping times, and unhealthy eating behaviors, such as finishing dinner shortly prior to bedtime, eating dinner late, and skipping meals. Therefore, it is important for research on the lifestyles of workers to consider the impact of working overtime. Thus, this study included this factor in its analyses.

This study examined the relationship between stress responses and lifestyles of Japanese workers, considering overtime work. Behaviors do not operate independently [25,26]; therefore, this study examined a comprehensive set of lifestyle-related behaviors (e.g., eating breakfast, eating at night, and sleeping habits). This study differentiated between men and women because stress responses have been reported to occur more frequently in women than in men [27], and because the relationships between stressors and lifestyle [28,29] and between stress responses and lifestyle [9] differ in men and women.

2. Materials and Methods

2.1. Study participants

A self-administered questionnaire was mailed to the homes of 4,462 workers at a financial enterprise in August 2011. The questionnaires included forms to apply for standard medicine-chest items, as well as self-addressed envelopes. Participants were asked to return the questionnaires and application forms to the health insurance union within 1 month. The applicant identification on the questionnaire was used by the health insurance society to identify the health insurance member, and the authors received only the questionnaires and identification. We explained the academic value of the results and the purpose of this study to the health insurance union, which then agreed to participate. This study was approved by the Ethics Review Committee of Ochanomizu University, Tokyo, Japan.

2.2. Content of the questionnaire

2.2.1. Demographic characteristics

The questionnaire asked about age, sex, living situation (“with family” or “alone”), marital status (“married” or “not married”), employment status (“management or higher”, “regular employee”, or “nonregular employee”), visiting a doctor regularly (“yes” or “no”), and taking medication (“yes” or “no”). Body mass index (BMI) was calculated from height and weight (kg/m^2).

Table 1
Demographic characteristics, job characteristics, and health status of participants*

Characteristic	Overall (n = 3,017)		Men (n = 1,251)		Women (n = 1,766)	
	n	(%)	n	(%)	n	(%)
Demographic characteristics						
Age (y) (n = 2,899)						
20–29	634	(21.9)	191	(16.5)	443	(25.4)
30–39	864	(29.8)	317	(27.4)	547	(31.4)
40–49	920	(31.7)	354	(30.6)	566	(32.5)
≥50	481	(16.6)	296	(25.6)	185	(10.6)
Living situation (n = 2,997)						
With family	2,368	(79.0)	960	(77.2)	1,408	(80.3)
Alone	629	(21.0)	283	(22.8)	346	(19.7)
Marital status (n = 2,980)						
Married	1,587	(53.3)	949	(76.0)	638	(36.8)
Not married	1,393	(46.7)	299	(24.0)	1,094	(63.2)
Employment status (n = 2,983)						
Management and higher	551	(18.5)	537	(43.8)	0	(0.0)
Regular employee	1,791	(60.0)	580	(47.3)	1,211	(69.4)
Nonregular employee	641	(21.5)	108	(8.8)	533	(30.6)
Health status						
BMI (n = 2,596)						
<25	2,226	(85.7)	925	(77.7)	1,301	(92.5)
≥25	370	(14.3)	265	(22.3)	105	(7.5)
Visit a doctor regularly (n = 2,723)						
No	1,760	(64.6)	716	(64.5)	1,044	(64.7)
Yes	963	(35.4)	394	(35.5)	569	(35.3)
Take medication (n = 2,735)						
No	2,114	(77.3)	818	(73.4)	1,296	(80.0)
Yes	621	(22.7)	297	(26.6)	324	(20.0)

* Missing values were excluded for each item.

2.2.2. Lifestyle

The lifestyle questionnaire, which was based on the 2007 National Health and Nutrition Survey in Japan [30] and discussions with several professionals, asked about breakfast, eating 2 hours prior to bedtime, smoking, frequency of alcohol consumption, amount of alcohol consumed, sleeping habits, and physical activity. According to a report released by the Japan Labor, Health, and Welfare Organization, the average worker’s bedtime is after 11:30 PM. [31]. This study defined eating at night as eating 2 hours prior to bedtime. The question about eating 2 hours prior to bedtime could be answered using “very rarely”, “2–3 times/week”, and “over 4 times/week”. Regarding eating breakfast, “skip” indicated missing this meal at least once per week, and “eat every day” referred to eating breakfast every day. Responses to the question about smoking were selected from “never smoked”, “ex-smoker”, or “smoker”. Frequency of alcohol consumption was scored as “very rarely”, “1–3 times/month”, “1–2 times/week”, “3–4 times/week”, or “almost every day”. Responses to the question about alcohol consumption were selected from “under 20 g/day”, “20–40 g/day”, “40–60 g/day”, or “over 60 g/day”. This division was based on the recommendation of MHLW, which

Table 2
Numbers in stress and nonstress groups

Group	Overall		Men		Women	
	n	(%)	n	(%)	n	(%)
Stress group	254	(8.4)	85	(6.8)	169	(9.6)
Fatigue only	47	(18.5)	13	(15.3)	34	(20.1)
Anxiety only	12	(4.7)	3	(3.5)	9	(5.3)
Depression only	102	(40.2)	30	(35.3)	72	(42.6)
Fatigue and anxiety	0	(0)	0	(0)	0	(0)
Fatigue and depression	29	(11.4)	11	(12.9)	18	(10.7)
Anxiety and depression	30	(11.8)	13	(15.3)	17	(10.1)
Fatigue and anxiety and depression	34	(13.4)	15	(17.6)	19	(11.2)
Nonstress group	2,763	(91.6)	1,166	(93.2)	1,597	(90.4)
Total	3,017	(100.0)	1,251	(100.0)	1,766	(100.0)

Table 3
Demographic characteristics, job characteristics, and health status of stress and nonstress groups*

Item	Overall					Men					Women				
	Nonstress		Stress		p	Nonstress		Stress		p	Nonstress		Stress		p
	n = 2,763		n = 254			n = 1,166		n = 85			n = 1,597		n = 169		
	n	(%)	n	(%)		n	(%)	n	(%)		n	(%)	n	(%)	
Demographic characteristics															
Age (y)					0.001					0.003					0.318
20–29	573	(21.6)	61	(24.7)		174	(16.1)	17	(21.5)		399	(25.4)	44	(26.2)	
30–39	784	(29.6)	80	(32.4)		295	(27.3)	22	(27.8)		489	(31.1)	58	(34.5)	
40–49	832	(31.4)	88	(35.6)		321	(29.7)	33	(41.8)		511	(32.5)	55	(32.7)	
≥50	463	(17.5)	18	(7.3)		289	(26.8)	7	(8.9)		174	(11.1)	11	(6.5)	
Living situation					0.707					0.328					0.879
With family	2,172	(79.1)	196	(78.1)		898	(77.5)	62	(72.9)		1,274	(80.2)	134	(80.7)	
Alone	574	(20.9)	55	(21.9)		260	(22.5)	23	(27.1)		314	(19.8)	32	(19.3)	
Marital status					0.002					0.138					0.120
Married	1,475	(54.1)	112	(44.1)		890	(76.5)	59	(69.4)		585	(37.4)	53	(31.4)	
Not married	1,251	(45.9)	142	(55.9)		273	(23.5)	26	(30.6)		978	(62.6)	116	(68.6)	
Job characteristics															
Employment status					0.008					0.046					0.132
Management or higher	518	(18.9)	33	(13.3)		504	(44.1)	33	(40.2)		–	–	–	–	
Regular employee	1,619	(59.2)	172	(69.1)		533	(46.6)	47	(57.3)		1,086	(68.9)	125	(74.9)	
Nonregular employee	597	(21.8)	44	(17.7)		106	(9.3)	2	(2.4)		491	(31.1)	42	(25.1)	
Health status															
BMI					0.292					0.199					0.389
<25	2,033	(85.5)	193	(88.1)		859	(77.3)	66	(83.5)		1,174	(92.7)	127	(90.7)	
≥25	344	(14.5)	26	(11.9)		252	(22.7)	13	(16.5)		92	(7.3)	13	(9.3)	
Visit a doctor regularly					0.003					0.645					0.001
No	1,638	(65.4)	122	(55.5)		672	(64.7)	44	(62.0)		966	(92.5)	78	(52.3)	
Yes	865	(34.6)	98	(44.5)		367	(35.3)	27	(38.0)		498	(7.5)	71	(47.7)	
Take medication					0.002					0.371					<0.001
No	1,959	(78.0)	155	(68.9)		767	(73.7)	51	(68.9)		1,192	(81.1)	104	(68.9)	
Yes	551	(22.0)	70	(31.1)		274	(26.3)	23	(31.1)		277	(18.9)	47	(31.1)	

* Missing values were excluded for each item.

recommended the consumption of a maximum of 20 g ethanol per day; the questionnaire noted that 20 g is equivalent to 180 mL Japanese sake, 500 mL beer, 240 mL wine, and 60 mL whisky [32]. Responses to average time spent sleeping each night during the past month were selected from among “6 hours or more”, “5–6 hours”, and “5 hours or less”. In terms of physical activity, participants were asked “Do you walk more than 1 hour per day?” and responded “yes” or “no”. In addition, the number of overtime hours worked during the past month was included in the questionnaire.

2.2.3. Overtime work

The total number of hours of overtime worked per month was determined by the following question: “How many hours of overtime did you work last month?” This study divided the participants into two categories: “45 hours and less/month” and “46 hours and more/month”. This classification was based on guidelines issued by the MHLW [33], which recommends no more than 45 hours of overtime work per month. The MHLW showed that more than 45 hours of overtime work per month was strongly associated with the occurrence of cardiovascular and cerebrovascular disease [34].

2.2.4. Stress response

This study used a scale called the “Symptoms and Disorders Related to Stress” (hereafter referred to as “stress responses”) developed by the National Institute of Occupational Safety and Health of Japan [35]. A previous study targeting > 4,000 adults in Japan showed the reliability and validity of the scale. The internal consistency (Cronbach’s α) of this questionnaire was 0.91 [36]. Regarding validity, those who were in the high-stress group answered that they did not recover from their fatigue, that they felt that their physical health was very poor, that they often could not sleep, and that they had mental health issues [36].

This study examined two kinds of stress responses: physical and psychological. Although stress responses encompass physical, psychological, and behavioral reactions, most questionnaires about stress responses focus on psychological and physical responses [37]. The questionnaire used in this study consisted of three subscales of stress: fatigue, as a physical response, and anxiety and depression, as psychological responses, with three items in each subscale. The respective scores for fatigue, anxiety, and depression were calculated and analyzed. Each item was rated on a four-point scale ranging from “almost always” to “very rarely” during the past month. Participants with a fatigue score of 12 points, an anxiety score of at least 11 points, or a depression score of at least 10 points were considered to have high levels of stress. Persons who met the criteria for a high stress response in relation to any of the three variables were placed in the stress group; all others were placed in the nonstress group.

2.3. Statistical analysis

Relationships between stress responses, lifestyle, and specific characteristics (demographic, job-related, and health-related) in the stress and nonstress groups were investigated as follows. The χ^2 test was used to determine differences between the stress group and nonstress group. Relationships between stress responses and lifestyle and overtime work were investigated with univariate and multivariate logistic regression analyses using stress responses as dependent variables and lifestyle and overtime work as independent variables. Univariate analysis was performed using forced-entry selection, and the multivariate analysis was performed using stepwise selection. We examined two models using multivariate analysis: Model 1 included lifestyle and stress responses adjusted for age, living situation, marital status, employment status, visiting a doctor regularly, taking medication, and BMI, and Model 2 included overtime work in addition to the factors included in Model 1. Missing values were excluded for each item. Data were

Table 4
Logistic regression analysis* of stress by lifestyle and overtime work among men

Item†	Overall		Nonstress		Stress		Univariate analysis‡	Multivariate analysis§	
	n = 1,251		n = 1,166		n = 85		OR (95% CI)	Model 1‖ OR (95% CI)	Model 2** OR (95% CI)
	n	(%)	n	(%)	n	(%)			
Breakfast (n = 1,249)									
Eat every day	895	(71.7)	839	(72.1)	56	(65.9)	1	–	–
Skip	354	(28.3)	325	(27.9)	29	(34.1)	1.34 (0.94–2.13)		
Eat 2 h prior to bedtime (n = 1,244)									
Very rarely	333	(26.8)	317	(27.3)	16	(19.0)	1	–	–
2–3 times/wk	462	(37.1)	437	(37.7)	25	(29.8)	1.13 (0.60–2.16)		
≥4 times/week	449	(36.1)	406	(35.0)	43	(51.2)	2.10 (1.16–3.80) ††		
Smoking (n = 1,215)									
Never smoked	404	(33.3)	375	(33.1)	29	(35.4)	1	–	–
Ex-smoker	414	(34.1)	388	(34.2)	26	(31.7)	0.87 (0.50–1.50)		
Smoker	397	(32.7)	370	(32.7)	27	(32.9)	0.94 (0.55–1.63)		
Frequency of alcohol (n = 1,244)									
Very rarely	223	(17.9)	200	(17.2)	23	(27.4)	1	–	–
1–3 times/mo	167	(13.4)	151	(13.0)	16	(19.0)	0.92 (0.47–1.80)		
1–2 times/wk	287	(23.1)	272	(23.4)	15	(17.9)	0.48 (0.24–0.94)††		
3–4 times/wk	188	(15.1)	180	(15.5)	8	(9.5)	0.39 (0.17–0.89)††		
Almost every day	379	(30.5)	357	(30.8)	22	(26.2)	0.54 (0.29–0.99)††		
Amount of alcohol (n = 1,139)									
<180 mL/d	358	(31.4)	327	(30.7)	31	(41.3)	1	–	–
180–360 mL/d	435	(38.2)	409	(38.4)	26	(34.7)	0.67 (0.39–1.15)		
360–540 mL/d	229	(20.1)	218	(20.5)	11	(14.7)	0.53 (0.26–1.08)		
≥540 mL/d	117	(10.3)	110	(10.3)	7	(9.3)	0.67 (0.29–1.57)		
Sleeping time (n = 1,246)									
≥6 h	448	(36.0)	433	(37.7)	15	(17.9)	1	–	–
5–6 h	631	(50.6)	583	(50.2)	48	(57.1)	2.38 (1.31–4.30)‡‡		
<5 h	167	(13.4)	146	(12.6)	21	(25.0)	4.15 (2.09–8.27)a		
Physical activity (n = 1,237)									
Yes	317	(25.6)	295	(25.6)	22	(25.9)	1	–	–
No	920	(74.4)	857	(74.4)	63	(74.1)	0.99 (0.60–1.63)		
Overtime work (n = 1,243)									
≤45 h/mo	990	(79.6)	993	(80.6)	57	(67.1)	1		1
≥46 h/mo	253	(20.4)	225	(19.4)	28	(32.9)	2.04 (1.27–3.28)‡‡		2.71 (1.43–5.15)‡‡

* OR > 1, high stress; < 1, low stress.
† Missing values were excluded for each item.
‡ CI, confidence interval; OR, odds ratio.
§ Stepwise selection.
‖ Used eating breakfast, eating 2 hours prior to bedtime, smoking, frequency of alcohol consumption, amount of alcohol consumed, sleep habits and physical activity. Adjusted age, living situation, marital status, employment status, visiting a doctor regularly, taking medication, and body mass index.
** Included overtime work in addition to the factors included in Model 1.
†† $p < 0.05$.
‡‡ $p < 0.01$.
a $p < 0.001$.

analyzed with PASW Statistics for Windows version 20.0 (SPSS Japan Inc., Tokyo, Japan).

3. Results

3.1. Characteristics of participants

A total of 3,017 workers (41.5% men and 58.5% women) completed questionnaires (response rate, 67.6%). Table 1 presents the demographic characteristics, job characteristics, and health status of the participants.

3.2. Combination of stress responses

Of the men and women, 39 (31%) and 71 (4.0%) respondents were classified as having fatigue, respectively, 31 (2.5%) and 45 (2.5%) were classified as having anxiety, and 69 (5.5%) and 126 (7.1%) were classified as having depression, respectively The results of combining scores for fatigue, anxiety, and depression are presented in Table 2. There were 254 (8.4%) participants in the stress group, and 2,763 (91.6%) in the nonstress group. The stress group included more women than did the nonstress group ($\chi^2 = 7.314$, $p < 0.01$). A total of 102 (40.2%) participants scored positive for depression only, which was the greatest number in any category of stress, whereas no respondents scored positive for fatigue plus anxiety. The mean total (standard deviation) fatigue, anxiety, and depression scores were 6.4 (2.3), 5.4 (2.2), and 5.7 (2.3), respectively. The Cronbach's α was 0.92.

3.3. Characteristics of stress and nonstress groups

The results of the χ^2 test comparing stress and various characteristics are shown in Table 3. There were significant differences in age, marital status, employment status, visiting a doctor regularly, and taking medication among the overall group. Among men, there were significant differences in age and employment status: in the stress group; 41.8% were in their 40s and 2.4% were nonregular employees. Among women, there were significant difference in taking medication and visiting a doctor: in the stress group; 31.1% took medicine and 47.7% visited a doctor. These rates were higher than in the nonstress group.

3.4. Univariate logistic regression analysis

Relationships between stress responses and lifestyle by sex were examined using univariate logistic regression analysis

Table 5
Logistic regression analysis* of stress by lifestyle and overtime work among women

Item†	Overall		Nonstress		Stress		Univariate analysis‡	Multivariate analysis§	
	n = 1,766		n = 1,597		n = 169		OR (95% CI)	Model 1‖ OR (95% CI)	Model 2¶ OR (95% CI)
	n	(%)	n	(%)	n	(%)			
Breakfast (n = 1,759)									
Eat every day	1,240	(70.5)	1,125	(70.7)	115	(68.9)	1	–	–
Skip	519	(29.5)	467	(29.3)	52	(31.1)	1.09 (0.77–1.54)		
Eat 2 h prior to bedtime (n = 1,759)									
Very rarely	782	(44.5)	719	(45.2)	63	(37.7)	1	–	–
2–3 times/wk	581	(33.0)	526	(33.0)	55	(32.9)	1.19 (0.82–1.74)		
≥4 times/wk	396	(22.5)	347	(21.8)	49	(29.3)	1.61 (1.09–2.39)††		
Smoking (n = 1,714)									
Never smoked	1,227	(71.6)	1,117	(71.9)	110	(68.3)	1	–	–
Ex-smoker	226	(13.2)	206	(13.3)	20	(12.4)	0.99 (0.60–1.62)		
Smoker	261	(15.2)	230	(14.8)	31	(19.3)	1.37 (0.90–2.09)		
Frequency of alcohol (n = 1,758)									
Very rarely	673	(38.3)	610	(38.4)	63	(37.3)	1	–	–
1–3 times/mo	340	(19.3)	302	(19.0)	38	(22.5)	1.22 (0.80–1.87)		
1–2 times/wk	359	(20.4)	328	(20.6)	31	(18.3)	0.92 (0.58–1.44)		
3–4 times/wk	153	(8.7)	144	(9.1)	9	(5.3)	0.61 (0.29–1.25)		
Almost every day	233	(13.3)	205	(12.9)	28	(16.6)	1.32 (0.83–2.12)		
Amount alcohol (n = 1,400)									
<180 mL/d	724	(51.7)	657	(51.9)	67	(50.0)	1	–	–
180–360 mL/d	417	(29.8)	376	(29.7)	41	(30.6)	1.07 (0.70–1.61)		
360–540 mL/d	195	(13.9)	176	(13.9)	19	(14.2)	1.06 (0.62–1.81)		
≥540 mL/d	64	(4.6)	57	(4.5)	7	(5.2)	1.20 (0.53–2.75)		
Sleeping time (n = 1,762)									
≥6 h	633	(35.9)	584	(36.6)	49	(29.2)	1	1	1
5–6 h	859	(48.8)	784	(49.2)	75	(44.6)	1.14 (0.78–1.66)	1.65 (0.98–2.78)	1.72 (1.01–2.92)††
<5 h	270	(15.3)	226	(14.2)	44	(26.2)	2.32 (1.50–3.59)[a]	2.86 (1.53–5.36)[a]	2.97 (1.58–5.60)‡‡
Physical activity (n = 1,750)									
Yes	399	(22.8)	368	(23.2)	31	(18.7)	1	–	–
No	1,351	(77.2)	1,216	(74.4)	135	(81.3)	0.13 (0.88–1.98)		
Overtime work (n = 1,741)									
≤45 h/mo	1,722	(98.9)	1,562	(99.1)	160	(97.0)	1		–
≥46 h/mo	19	(1.1)	14	(0.9)	5	(9.5)	3.49 (1.24–9.81)††		

* OR > 1, high stress; < 1, low stress.
† Missing values were excluded for each item.
‡ CI, confidence interval; OR, odds ratio.
§ Stepwise selection.
‖ Used eating breakfast, eating 2 hours prior to bedtime, smoking, frequency of alcohol consumption, amount of alcohol consumed, sleep habits, and physical activity. Adjusted age, living situation, marital status, employment status, visiting a doctor regularly, taking medication, and body mass index.
¶ Included overtime work in addition to the factors included t Model 1.
†† $p < 0.05$.
‡‡ $p < 0.01$.
[a] $p < 0.001$.

(Tables 4 and 5). Regarding lifestyle variables, those who drank less frequently, ate 2 hours prior to bedtime on four or more occasions per week, slept for shorter periods of time, and worked for 46 hours or more/month had an increased risk of stress responses among men (Tables 4).

Women who reported eating 2 hours prior to bedtime on at least four occasions per week, slept less than 5 hours per night, and worked 46 hours or more/month had an increased risk of stress responses (Table 5).

3.5. *Multivariate logistic regression analysis*

Relationships among stress responses and lifestyle and overtime work according to sex were also examined using multivariate logistic regression analysis (Tables 4 and 5). Model 1 revealed no significant associations between lifestyle and stress among men after adjusting for certain lifestyle-related demographic characteristics (Table 4). Model 2, which examined overtime work in addition to the variables included in Model 1, found that men who worked 46 hours or more/month had an increased risk of stress responses (Table 4). Model 1 showed that women who slept 5 hours or less had an increased risk of stress responses, and the results of Model 2 were similar to those for Model 1 (Table 5).

4. Discussion

This study examined relationships between stress responses and lifestyle, including sleeping and eating behaviors in Japanese workers, while also considering the impact of overtime work. These analyses of cross-sectional data suggested that stress responses were related to lifestyle among women but not among men. In multivariate analyses, stress responses were related to short sleeping times among women, whereas they were related to working long hours rather than lifestyle among men. In addition, a relationship between stress response and eating prior to bedtime was identified by univariate analysis among both men and women.

Eating prior to bedtime was related to stress responses in both men and women according to univariate analyses. The relationship between stress responses and eating prior to bedtime did not emerge in the multivariate analysis because sleeping and working overtime were more directly related to stress responses than was eating prior to bedtime. However, the results indicated that eating prior to bedtime was indirectly related to stress responses. Although previous studies have shown that eating at night is related to short sleep times and high distress [15,17,19], these studies targeted participants with psychological problems, such as eating disorders. Our study suggests the possibility that eating prior

to bedtime is indirectly associated with stress responses in a nonclinical sample.

By contrast, multivariate analysis revealed that among women, stress responses were related to short sleeping times. This relationship remained after adjusting for working overtime. Previous studies have shown that time spent sleeping was related to job stress [2] and disease, including depression [12]. One study reported that people who slept for 6 hours or less had more perceived stress and depression [9], but that study did not conduct a detailed analysis of those who slept for less than 6 hours. The present study indicated that 25% of workers slept less than 5 hours and those workers were in the stress group; thus, shorter sleeping patterns were associated with a greater risk for stress. We found no relationship between sleeping time and working overtime among women in the multivariate analysis. It is possible that short sleeping times may be due to psychological disorders, such as depression. Although our study did not examine whether participants suffered from psychological disorders, the participants were generally healthy, as most of them worked every day without major problems. Therefore, we believe that such disorders did not have a major impact on the study results.

According to the multivariate analysis, stress responses were related to working overtime but not to lifestyle in men. Although that analysis did not identify any relationships between stress and lifestyle factors, the univariate analysis showed that stress responses were related to the amount of sleep, frequency of alcohol consumption, and eating 2 hours prior to bedtime among men. This is probably because the relationship between stress responses and working long hours was so strong that the relationship between lifestyle and stress responses disappeared in the multivariate analysis. Grosch et al [38] reported a positive association between working long hours and job stress; similarly, increased overtime has been significantly associated with increased stress responses in various studies [39–41]. In particular, men have reported working longer hours than women in America and Japan [42,43]. In addition, it is thought that the lifestyle factors that were significantly related to stress responses in the univariate analysis were indirectly related to stress responses, and that working overtime work is the most important contributor to the impact of lifestyle on stress among men. Regarding overtime work, a previous study showed that working more than 60 hours/month was related to mental and physical health issues [22,24]. In addition, the MHLW reported that working more than 45 hours of overtime per month reduces sleeping time (less than 5 hours; this time was related to the occurrence of cardiovascular disease) and the accumulation of, and failure to recover from, fatigue in workers. In addition, the MHLW reported that working more than 45 hours of overtime per month was strongly associated with the occurrence of cardiovascular and cerebrovascular disease [34]. Therefore, the MHLW established 45 hours as the maximum number of overtime hours per month to protect the health of workers, rather than 60 hours per month. This study used the MHLW standard.

This study had several limitations. First, the study had a cross-sectional design; thus, cause-and-effect relationships between stress responses and lifestyle could not be determined. However, our study suggests that stress responses are related to working overtime, sleeping less and eating prior to bedtime in healthy people. Second, the only job-related stressor examined was overtime work, although other job-related stressors such as control, compatibility, and social support may also have had an impact. Thus, other job-related stressors should be examined in the future. Third, our results may not be generalizable because only one company was surveyed. However, because this study did use a large sample, the results are of particular value and are generally easy to interpret. Finally, we did not examine education or income, although we did examine employment status.

This study provides evidence that stress responses are related to lifestyle among women but not among men. Among women, stress responses were related to short sleeping times; among men, they were related to working overtime rather than to lifestyle. In addition, stress responses were commonly related to eating at night in the univariate analysis, although this relationship was not seen in the multivariate analysis in either sex. A previous study suggested that eating at night was related to high BMI [15,16]. It is thought that eating at night is unhealthy and can cause obesity. Therefore, it will be necessary to control short sleeping times and overtime work to manage stress and prevent obesity.

Conflicts of interest

The authors declare that there are no conflicts of interest.

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