

ORIGINAL ARTICLE

Relationship of obesity to job stress and eating behavior in male Japanese workers

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Objective: To examine a possible relationship between obesity, job stress, and eating behavior in male Japanese workers.

Method: A questionnaire on life style, job stress, and eating behavior was conducted with 208 male workers aged 19–60 years (33.7 ± 12.3 years) in a manufacturing industry in Japan. Height and weight were measured in an annual health examination. The relation between obesity, job stress, and eating behavior were analyzed between 141 nonobese subjects ($\text{BMI} \leq 24.9 \text{ kg/m}^2$) and 67 obese subjects ($\text{BMI} \geq 25.0 \text{ kg/m}^2$).

Results: Obesity was associated with psychological stress responses of tension/anxiety, especially tension. Tension/anxiety was also related to job demands positively and job latitudes negatively. The eating behaviors of subjects with tension/anxiety resembled those of the obese subjects.

Conclusions: The present study suggests that obese male Japanese workers tend to be in a stressful state from high job demands and low job latitudes in the workplace. Such stressful conditions may affect eating behaviors to eat much and contribute to obesity. Stress management might be necessary in the workplace for the prevention of obesity among male Japanese workers.

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Introduction

Obesity is known to be a health problem leading to diabetes mellitus, hypertension, and hyperlipidemia, and to heart disease and stroke.^{1–3} According to the WHO criteria, BMI of 25 kg/m^2 or more and less than 30 kg/m^2 indicates overweight, and BMI of 30 kg/m^2 or more obesity.⁴ On the other hand, it has been realized that the WHO's criteria for obesity should be different for various ethnic groups.⁵ In Japan, the prevalence of the obesity-related diseases was shown to increase with BMI even lower than 30 kg/m^2 ,^{2,6} and hence the Japan Society of the Study of Obesity has adopted BMI of 25 kg/m^2 and more as a criteria for obesity.⁷ According to the National Nutrition Survey 2000 in Japan about 30% of males aged 30–60 years had a BMI of 25 kg/m^2 or more. This is an increase of about 1.5-fold over the past 20 years for all age groups in men. Males of 30–60 years are usually a working population. Hence, obesity is an important health problem among male Japanese workers.

With the rapid globalization and technological innovation in the workplace, job stress is also a health problem, which is reportedly associated with cardiovascular disease.^{8,9} Job stress may contribute to obesity.¹⁰ With male workers, Netterstrøm *et al.*¹¹ showed a significant association between BMI and job strain. In contrast, Kornitzer and Kittel,¹² Steptoe *et al.*¹³ and Jönsson *et al.*¹⁴ did not find significant associations between BMI and psychological job stress in men. Thus, earlier findings about the relationship between obesity and job stress were inconsistent.¹⁰ It is also indicated that job stress may influence eating behavior to lead to obesity.¹⁵ Work-related stress is reported to be associated with an increased intake of fatty foods,^{16–18} which will lead to obesity.¹⁹

In the present study, we conducted a questionnaire survey to clarify the relation between obesity, job stress, and eating behavior in male Japanese workers.

Methods

Study subjects

The subjects were all 214 male employees of a synthetic fiber-manufacturing plant. Self-completed questionnaire forms were distributed to these 214 men at the end of April 2003 and collected in May from those who consented to

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participate. After the questionnaires were collected, they were checked for completeness by an occupational health nurse. Questionnaires were collected from 210 men, for a response rate of 98.1%. Two of the respondents with a history of mental disorders under treatment were excluded; the present analysis was thus conducted with the remaining 208 men aged 19–60 years (mean age \pm s.d.; 33.7 ± 12.3 years).

Body mass index (BMI; kg/m^2) was calculated from the results of the annual health examinations conducted from March to May 2003 in the manufacturing plant. Based on the criteria of the Japan Society for the Study of Obesity, obesity was defined as a BMI $\geq 25 \text{ kg}/\text{m}^2$ in this study, though it is classified as overweight and obesity according to the WHO criteria; the 208 subjects were divided into a nonobese group (141 subjects with BMI $\leq 24.9 \text{ kg}/\text{m}^2$) and an obese group (67 subjects with BMI $\geq 25.0 \text{ kg}/\text{m}^2$).

Contents of questionnaire survey

Basic attributes and life style. The survey asked about age, sex, work pattern, job type, overtime working hours, walking time during commute, average sleeping time, health state, regular exercise, smoking habit, alcohol consumption, and so on.

Job stress. The Job Stress Questionnaire,²⁰ which was made in a study commissioned by the Japanese Ministry of Health, Labor and Welfare, was used in the present study. 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.²⁰ The questionnaire consists of three main parts of job stress factors of psychological workload, psychological stress response, and stress mitigation factors.

The questions have a total of 17 items to measure job stress factors of psychological workload (Table 1). These are categorized as quantitative workload (1–3), qualitative workload (4–6), physical workload (7), job latitude (8–10), application of technology (11), interpersonal conflict (12–14), workplace environment (15), and appropriateness of work (16, 17). The section on psychological stress response (Table 2) has a total of 18 items to measure positive responses (activity (1–3)) and negative responses (anger (4–6), fatigue (7–9), tension/anxiety (10–12), and depression (13–18)). The section to assess physical stress response (Table 2) has a total of 11 items. Stress mitigation factors were measured by nine items incorporating support in the family and workplace and two items on satisfaction with workplace and family.

The respective scores for psychological and physical stress responses are then totalled and assessed. Each item was rated on a four-point scale ranging from 'strongly disagree' to 'strongly agree.' Subjects with a psychological stress response score of 51 points or more are considered to have a high mental stress response. Similarly, persons with a total score for physical stress response of 25 points or more are considered to have a high physical stress response.

Table 1 Items of job stress factors in the Job Stress Questionnaire

<i>Job stress factors</i>
1. Have to do very much tasks
2. Cannot complete tasks in the allotted time
3. Have to work very intensely
4. Much concentration is required
5. Difficult work requiring a high level of knowledge and skill
6. Must think about tasks always throughout working hours
7. Work is physically demanding
8. Can work at my own pace
9. Can decide myself how to do the work and the work order
10. Work policy in workplace matches my own opinions
11. Little chance to use my own skill and knowledge in my work
12. There is a conflict of opinions in my department
13. My department does not get along well with other departments
14. My workplace has a good atmosphere
15. My workplace environment (noise, lighting, temperature, ventilation, etc) is not good
16. My work suits me
17. My work is worthwhile

Table 2 Items of psychological and physical stress responses in the Job Stress Questionnaire

<i>Stress response</i>	
<i>Psychological stress response</i>	
1. Am vitalized	
2. Have much energy	
3. Am animated	
4. Feel angry	
5. Feel annoyed inside	
6. Am irritable	
7. Am very tired	
8. Am exhausted	
9. Feel languid	
10. Am tense	
11. Am anxious	
12. Am unsettled	
13. Am depressed	
14. Everything is troublesome	
15. Cannot concentrate on things	
16. Am gloomy	
17. Cannot focus on work	
18. Feel sad	
<i>Physical stress response</i>	
19. Feel dizzy	
20. Joints ache	
21. Head is heavy/get headaches	
22. Neck and shoulders are stiff	
23. Lower back aches	
24. Eyes are tired	
25. Have palpitations or get out of breath	
26. Stomach and intestines in poor condition	
27. Have no appetite	
28. Am constipated or have diarrhea	
29. Cannot sleep well	

Eating behavior. Of the 50 items on the Sakata's Eating Behavior Questionnaire, thirty questions (Table 3) were used that have been shown to differ significantly between obesity patients and healthy people.^{21,22} This questionnaire is used

Table 3 Items of eating behaviors in the Sakata's Eating Behavior Questionnaire

Eating behavior
1. Tend to gain weight more easily than others
2. Gain weight just by drinking water
3. Have eaten a lot since childhood
4. Eat fast
5. Chew food very little
6. Can not chew well
7. Eat at all different times
8. Do not have time to eat leisurely
9. Do not feel satisfied unless I eat until full
10. If it is food I like, I can eat more after meals
11. Eat together if others are eating
12. Like noodles
13. Prefer strong tastes
14. Like oily foods
15. Often eat fast food
16. Eat daytime snacks
17. Snack after dinner
18. Always have a bowl of fruit or sweets out
19. If fruit or sweets are out, I always eat some
20. Often eat snack foods
21. If given food, I eat it all because I don't want to waste it
22. Always gain weight on consecutive holidays or the New Year and <i>O-bon</i> holidays
23. Eat to get rid of irritability
24. Often cautioned by others about eating too much
25. Feel regret after eating too much
26. When buying food, am not content unless I buy more than necessary
27. When making food, am not content unless I make a lot
28. If food is left over, I eat it so as not to waste it
29. When eating out or getting home delivery, I always order a lot
30. Often drink canned soft drinks, canned coffee, sports drinks, or nutritional drinks

in some hospitals for obesity treatment in Japan.²³ These 30 questions are classified into the seven areas regarding cognition of constitution (1–3), eating style (4–6), eating rhythm abnormalities (7, 8, 16, 17, 30), feeling of satiety (9, 10, 24, 25, 28), substitute eating and drinking (11, 18, 19, 21–23), meal contents (12–15, 20), and motivation for eating (26, 27, 29).

Statistical analysis

The relationship between obesity, job stress, and eating behavior in the obese and nonobese groups was investigated as follows. The χ^2 test and Mann–Whitney *U*-test were used for basic attributes, life style, job stress, and eating behavior. The relation between obesity and each category of job stress factors, stress responses and eating behaviors was investigated with a logistic regression analysis after adjusting for age. The relation between psychological stress response and each category of job stress factors and eating behaviors was also investigated using the Spearman's correlation coefficient. All statistical analyses were completed with the statistical package SPSS 11.5J.

Table 4 Characteristics of obese and nonobese subjects

Characteristic	Nonobese, n = 141	Obese, n = 67	P-value
BMI (kg/m ²)	21.7 ± 1.9	27.9 ± 3.6	
Age (years)	32.6 ± 12.2	36.0 ± 12.2	0.009**
Blue collar worker	87 (61.7)	42 (62.7)	0.546
Overtime work	103 (73.0)	48 (71.6)	0.832
Overtime (h/week)	3.7 ± 4.9	3.7 ± 5.3	0.627
Do not exercise	89 (63.1)	39 (58.2)	0.786
Smoke	93 (66.0)	37 (55.2)	0.327
Drink alcohol ≥ 5 days/week	28 (19.8)	20 (29.9)	0.113
Sleeping hours	6.5 ± 1.0	6.5 ± 1.0	0.914

***P* < 0.01.

Table 5 Age-adjusted OR and 95% CI between obesity and job stress factors

Job stress factors	Age-adjusted OR	95% CI	P-value
Quantitative workload	1.07	0.90–1.28	0.452
Qualitative workload	1.14	0.96–1.36	0.146
Physical workload	0.81	0.61–1.09	0.164
Job latitude	1.09	0.92–1.28	0.314
Application of technology	1.01	0.70–1.47	0.956
Interpersonal conflict	1.01	0.85–1.20	0.888
Workplace environment	0.98	0.73–1.31	0.891
Appropriateness of work	1.08	0.88–1.34	0.456
Incorporating support	1.01	0.94–1.08	0.823

Results

Basic attributes and life style

Mean age was significantly higher in the obese group (36.0 ± 12.2 years) than in the nonobese group (32.6 ± 12.2 years), while working pattern, type of job, hours of overtime work, exercise, or smoking or drinking habits were not different between the two groups (Table 4).

Job stress

Job stress factors. Since there was a significant difference in age between the obese and nonobese subjects, logistic regression analyses for relations between obesity and job stress factors were conducted while considering age. The results showed no significant relation between obesity and job stress factors (Table 5).

Psychological and physical stress response. Subjects with a total of 51 points or more for mental stress response accounted for 9.2% of the nonobese group and 10.4% of the obese group. Subjects with 25 points or more for physical stress response accounted for 10.6% of the nonobese group and 19.4% of the obese group. There were no significant differences between the two groups.

The results of each category about psychological and physical stress response were shown in Table 6. A significant association was found in a psychological stress response category of 'Tension/Anxiety' (odds ratio (OR) 1.22; 95%

Table 6 Age-adjusted OR and 95 % CI between obesity, psychological and physical stress responses

Job stress response	Age-adjusted OR	95% CI	P-value
<i>Psychological stress response</i>			
Activity	1.02	0.88–1.17	0.815
Anger	1.15	1.00–1.32	0.052
Fatigue	1.06	0.93–1.22	0.388
Tension/Anxiety	1.22	1.05–1.42	0.008
Depression	1.02	0.93–1.12	0.635
Physical stress response	1.02	0.96–1.08	0.573

Table 7 Spearman’s correlation coefficients between psychological stress response (Tension/Anxiety) and job stress factors

Job stress factors	Tension/Anxiety
Quantitative workload	0.279**
Qualitative workload	0.236**
Physical workload	–0.011
Job latitude	–0.300**
Application of technology	0.202**
Interpersonal conflict	0.277**
Workplace environment	0.192**
Appropriateness of work	–0.221**
Incorporating support	–0.164*

* $P < 0.05$, ** $P < 0.01$.

confidence interval (CI) 1.05–1.42, $P = 0.008$). Associations between obesity and the respective item for category of ‘Tension/Anxiety’ were shown in ‘be tense’ (OR 1.88; 95% CI 1.31–2.70, $P = 0.001$), ‘be anxious’ (OR 1.25; 95% CI 0.88–1.76, $P = 0.213$) and ‘be unsettled’ (OR 1.40; 95% CI 0.96–2.07, $P = 0.085$). Physical stress response did not show a significant association with obesity (Table 6).

Correlation between job stress factors and psychological stress response. Since a significant relation was found between obesity and the psychological stress response category of ‘Tension/Anxiety,’ an association between the stress response of ‘Tension/Anxiety’ and job stress factors was examined using the Spearman’s correlation coefficient. ‘Tension/Anxiety’ was positively correlated with job stress factors related to job demand of quantitative and qualitative workload, and interpersonal conflict ($P < 0.01$, Table 7). ‘Tension/Anxiety’ was also negatively associated with job latitude ($P < 0.01$).

Eating behavior

Relation between obesity and eating behavior. An age-adjusted logistic regression analysis was conducted to investigate a relation between obesity and eating behaviors. As shown in Table 8, significant OR over 1.2 were encountered in the category of ‘Cognition of constitution’ (OR 1.95; 95% CI 1.61–2.36, $P < 0.001$), ‘Feeling of satiety’ (OR 1.28; 95% CI 1.15–1.42, $P < 0.001$), ‘Substitute eating and drinking’ (OR 1.23; 95% CI 1.11–1.37, $P < 0.001$). Significant OR over 2

Table 8 Age-adjusted OR and 95% CI between obesity and eating behaviors

Eating behavior	Age-adjusted OR	95% CI	P-value
Cognition of constitution	1.95	1.61–2.36	<0.001
Motivation for eating	1.19	1.04–1.36	0.011
Substitute eating and drinking	1.23	1.11–1.37	<0.001
Feeling of satiety	1.28	1.15–1.42	<0.001
Eating style	1.15	1.00–1.31	0.045
Meal contents	1.12	1.01–1.26	0.040
Eating rhythm abnormalities	1.05	0.94–1.17	0.385

Table 9 Spearman’s correlation coefficients between psychological stress response (Tension/Anxiety) and eating behaviors

Eating behaviors	Tension/Anxiety
Cognition of constitution	0.206**
Motivation for eating	0.205**
Substitute eating and drinking	0.192**
Feeling of satiety	0.212**
Eating style	0.259**
Meal contents	0.120
Eating rhythm abnormalities	0.109

** $P < 0.01$.

were encountered in the items of ‘I tend to gain weight more easily than others’ (OR 6.32; 95% CI 3.88–10.30, $P < 0.001$) and ‘I gain weight just by drinking water’ (OR 2.90; 95% CI 1.99–4.22, $P < 0.001$) in the category of ‘Cognition of constitution,’ and ‘I feel regret after eating too much’ (OR 2.82; 95% CI 1.93–4.13, $P < 0.001$) and ‘I am often cautioned by others about overeating’ (OR 2.45; 95% CI 1.64–3.65, $P < 0.001$) in the category of ‘Feeling of satiety,’ and ‘I eat to get rid of irritability’ (OR 3.10; 95% CI 1.93–4.98, $P < 0.001$) in the category of ‘Substitute eating and drinking.’

Correlation between eating behavior and psychological stress response. A possible relation between the psychological stress response of ‘Tension/Anxiety’ and eating behaviors was also investigated using the Spearman’s correlation coefficient. The results are given in Table 9. A positive correlation ($r > 0.2$) with ‘Tension/Anxiety’ was found in the category such as ‘Eating style,’ ‘Feeling of satiety,’ ‘Cognition of constitution,’ ‘Motivation for eating.’ All these categories corresponded with eating behaviors for which a significant correlation was encountered in the obese group.

Discussion

The present study showed that obese male Japanese workers tended to be in a stressful state associated with high job demands and low job latitudes in the workplace. Obesity was not directly associated with psychological workload factors such as high job demands and/or low job latitudes, which was generally in accordance with previous studies showing

little evidence for an association between BMI and psychological workload.¹⁰ However, the present study indicated that obesity was closely associated with the psychological stress response of 'Tension/Anxiety.' This survey also showed that 'Tension/Anxiety' was associated with the psychological workload factors reflecting high job demands and low job latitudes. Such work-related tension/anxiety may contribute to obesity among male Japanese workers.

Job-related stress is thought to be associated with diseases such as heart disease and hypertension.^{8,9} In the 'job demands-control model' proposed by Karasek,²⁴ high stress responses and health problems are likely to occur when the workers have high demands and low latitudes over the work.^{25,26} In the present study no association was found between obesity and psychological workload factors. The reviewed articles by Overgaard *et al.*¹⁰ also mentioned that no evidence between BMI and psychological workload was generally found for men. However, this study showed a significant association between obesity and the psychological stress response of 'Tension/Anxiety.' In addition, the tension/anxiety was related with high job demands and low job latitudes. Thus, the present findings seems to be in accordance with Karasek model, suggesting that high job demands and low job latitudes are likely to bring on tension among male workers, which may contribute to obesity. Interpersonal conflict might be related to incorporating support.

In Western countries factory workers reportedly tended to have greater BMI than management workers, whereas in Japan management workers, office workers, engineers, and sedentary job workers tended to have greater BMI.^{27,28} Shift work has also been shown to be associated with BMI.²⁷ In addition, obesity was found to be greater in unemployed males and males living alone.¹⁷ In the present study, no significant differences were found in relation to job kind or position, or shift work.

It is suggested that stress may influence eating, resulting in either eating or not eating, and that women are more prone to stress-induced eating than men.¹⁵ Men may react to stress by increasing alcohol use.²⁹ The present study showed that eating behaviors of workers having 'Tension/Anxiety' under job stress resembled those of obese persons. The category related to obesity such as 'Eating style,' 'Feeling of satiety,' 'Cognition of constitution,' 'Motivation for eating' suggest that workers feeling stressed are prone to eat much. It is, hence, supposed that work-related tension may affect eating behaviors to eat much and result in obesity. Some studies have also reported that number of meals, skipping breakfast, and eating out are associated with obesity.^{30,31} However, no relation was found with skipping breakfast or eating out in this study.

The present study showed that obese male Japanese workers tended to be in a stressful state, which could be associated with high job demands and low job latitudes. Such stressful conditions may affect eating behaviors to eat much and subsequently contribute to obesity among male workers. To avoid overeating from stress, stress management

might be required in the workplace. The present study was a cross-sectional study of a small number of male workers in one workplace of a manufacturing industry in Japan. These results could be specific to that study condition. Future studies are needed to get conclusive results.

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