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Job Stressors and Diabetes Development and Related Stress Factors are correlated with Atherosclerosis

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Abstract

Several previous studies investigated the effects of occupational stress on the onset of diabetes mellitus (DM). However, studies of occupational stress and DM using the Brief Job Stress Questionnaire (BJSQ), a standard stress check method in Japan, are limited. This study aimed to determine the relationship between occupational stress factors and the onset of DM using the BJSQ.

We examined 6,620 male workers in a company aged 40 years and above in 2013. At that time, the BJSQ was administered. Overall, 2,604 subjects with impaired glucose tolerance that was free of mental disorders and DM were followed-up for 5 years and re-examined in 2017. The retrospective data analysis was conducted in 2019. We documented 241 new cases of DM in 2017 (diabetes group). Compared with the non-diabetes group, subjects in the diabetes group had significantly decreased "skill utilization". The binomial logistic regression analysis (generalized linear model) revealed that "skill utilization" was associated with the risk of DM development in 2017 (odds ratio, 1.632; 95% confidence interval, 1.061–2.510). Our results showed that low utilization of skill might increase the risk of diabetes development in Japanese male workers.

Keywords: Occupational stress; Brief Job Stress Questionnaire (BJSQ); Diabetogenic factor; Type 2 Diabetes Mellitus

Introduction

A recent survey report prepared by the Ministry of Health, Labour, and Welfare (MHLW) on the current health status in Japan stated that "lifestyle-related diseases account for about 60% of all mortalities and about 30% of all medical costs."1 There has been an increase in the number of patients with lifestyle-related diseases, such as diabetes mellitus (DM). The 2007 National Health and Nutrition Survey published sobering data showing that 8.9 million people were strongly suspected of having DM and potentially 13.2 million people had DM. More than 10 years have passed since that survey, but the 2017 National Health and Nutrition Survey results showed no significant changes in the data [1].

In this context, Health Japan 21 (second term) has set "achieving extension of healthy life expectancy and reduction of health disparities" as its ultimate goal, which also includes "thorough prevention of the onset and progression of lifestyle-related diseases" in the basic health promotion policies. As part of those efforts, the Japanese government launched specific health checkups and specific health guidance in 2008 to prevent lifestyle-related diseases, especially in people aged 40 years and older. These measures target a large portion of working-age population and are therefore crucial in the field of occupational health [2].

Equally important are mental health measures. According to surveys conducted by the MHLW, the percentage of workers with intense work-related stress was 50.6% in 1982, reached 62.8% in 1997, and has since remained around 60%.3 Under these social circumstances, the Occupational Safety & Health Program formulated by the MHLW has specified mental health measures as a priority for the past 10 years.

In Japan, occupational health physicians are involved in the health management of workers, wherein they provide comprehensive medical care, including measures against lifestyle-related diseases and mental health impairments. However, in some cases, workers do not make an effort to improve their lifestyle habits due to stress, despite receiving health guidance on DM. Furthermore, there have been several cases involving workers in high-stress environments who later developed early signs of DM. Therefore, it is reasonable to assume that occupational stress may play a role in the onset of DM [3,4].

Several previous studies investigated the effects of occupational stress on the onset of DM. In Japan, the Brief Job Stress Questionnaire (BJSQ),8 a product of a Grant-in-Aid for workers using the BJSQ.

Continuous variables were expressed as mean (standard deviation). For comparison between the two groups, the $\chi 2$ (chi-squared) test, Wilcoxon signed-rank test or Mann-Whitney U test was used. Using binomial logistic regression analysis (generalized linear model), we calculated the odds ratios and 95% confidence intervals (CIs) to determine the risk factors of the BJSQ for the onset of DM in 2017. The model was produced by forward selection after using the Spearman's rank correlation coefficient to remove factors with multicollinearity from the factors with p values < 0.25 in univariate analysis of health checkup results and job stressors in 2013. The significance level was set at $p < 0.05$. Missing data were excluded from the analysis. IBM SPSS Statistics for Windows (Version 22.0. Armonk, NY: IBM Corp.) was used for statistical analysis.

Clinical Background

The mean age of the 2,604 subjects was 55.7 (7.8) years; body mass index (BMI), 24.5 (3.5) kg/m2; systolic blood pressure (SBP), 135 (17) mmHg; diastolic blood pressure (DBP), 82 (12) mmHg;

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high-density lipoprotein (HDL) cholesterol level, 56. 9(14.4) mg/dL; triglyceride (TG) level, 165.9 (128.9) mg/dL; low-density lipoprotein (LDL) cholesterol level, 124.2 (29.6) mg/dL; HbA1c level, 5.8 (0.2)%; percentage of smokers, 35.8%; number of cigarettes smoked/day, 18 (7); alcohol consumption rate, 63.6%; estimated amount of alcohol consumed at one time, 1.7 (0.9) go (1 go = 180 mL of sake = 20 g of alcohol); percentage of individuals who exercised daily, 37.0%; percentage of subjects engaged in a hobby, 71.1%; estimated sleep time, 6.2 (0.9) hours; and estimated monthly overtime work, 12.4 (11.1) hours; percentage of night workers, 59.0%. By occupation, the subjects consisted of: field managers, 21.2%; office managers, 16.2%; station staff, 13.9%; rolling stock staff, 12.8%; office staff, 11.6%; drivers, 7.8%; track and structure staff, 5.5%; conductors, 4.0%; electrical engineering staff, 3.3%; secondees, 2.1%; research engineers, 0.6%; medical staff, 0.6%; and executives, 0.4% [5-7].

In addition, to identify the risk factors of the BJSQ for DM development, several 2013 factors that could contribute to the development of DM in 2017 were investigated using binomial logistic regression analysis (generalized linear model). As the results of such analysis the "skill utilization" showed an association to the risk of DM development in 2017 (odds ratio, 1.632; 95% confidence interval, 1.061–2.510) [8-11].

Furthermore, we calculated the "skill utilization" cutoff in 2013 using the receiver operating characteristic curve by the presence/absence of DM in 2017. Subjects with a standardized score ≤ 3 (1967 men) were classified as the low skill utilization group, while those with a standardized score ≥ 4 (404 men) were classified as the high skill utilization group. The rate of development of DM in 2017 decreased significantly in the high skill utilization group versus the low skill utilization group (9.9% vs. 6.4%, respectively; p = 0.031) [12-17].

Conclusions

Our study longitudinally examined the correlation between job stressors using the BJSQ and the development of DM in the employees of one company. Measures that promote mental health in the workplace are likely to generate a favorable cycle for DM control. It is essential to continue promoting comprehensive and advanced health management, not just to comply with the laws and regulations but also for fulfillment of the primary role of occupational health physicians (Tables 1 and 2).

Table 1: Stress check results in 2013.

Diabetes mellitus (DM) in 2017	2017 DM (+) n = 241	2017 DM (–) n = 2363	Significance Probability
Job stressors			
Workload (quantity)	3.4(1.0)	3.4(1.0)	0.559
Workload (quality)	3.1(0.9)	3.1(0.9)	0.481
Physical burden	3.0(0.9)	3.0(0.9)	0.672
Interpersonal stress	3.1(0.9)	3.2(0.9)	0.056
Workplace stress	2.8(0.9)	2.8(0.9)	0.251
Degree of control	2.8(1.0)	2.9(1.0)	0.395
Skill utilization	2.8(0.7)	2.9(0.7)	**0.017**
Job fitness	2.7(1.0)	2.8(1.0)	0.094
Sense of reward	2.9(1.0)	2.9(1.0)	0.853
Stress response			
Vigor	3.0(1.0)	3.0(1.0)	0.935
Irritation	3.3(1.0)	3.4(1.0)	0.177
Fatigue	3.1(1.0)	3.2(1.0)	0.428
Anxiety	3.3(1.1)	3.4(1.0)	0.514
Depression	3.5(1.1)	3.6(1.1)	0.587
Physical complaints	3.3(0.9)	3.4(0.9)	0.686
Modifiers			
Support, supervisor	2.9(1.1)	2.9(1.1)	0.994
Support, colleagues	2.8(1.0)	2.8(0.9)	0.927
Support, family and	3.3(1.3)	3.4(1.3)	0.261

Table 2: Number of participants with effective BJSQ data in 2013.

diabetes mellitus	2017 DM (+) n = 241	2017 DM (–) n = 2363
Job stressors		
Workload (quantity)	220(91.3%)	2150(91.0%)
Workload (quality)	220(91.3%)	2144(90.7%)
Physical burden	220(91.3%)	2150(91.0%)
Interpersonal stress	220(91.3%)	2146(90.8%)
Workplace stress	220(91.3%)	2149(90.9%)
Degree of control	220(91.3%)	2149(90.9%)
Skill utilization	220(91.3%)	2151(91.0%)
Job fitness	220(91.3%)	2151(91.0%)
Sense of reward	220(91.3%)	2151(91.0%)
Stress response		
Vigor	220(91.3%)	2153(91.1%)
Irritation	220(91.3%)	2152(91.1%)
Fatigue	219(90.9%)	2152(91.1%)
Anxiety	220(91.3%)	2152(91.1%)
Depression	220(91.3%)	2151(91.0%)
Physical complaints	218(90.5%)	2144(90.7%)
Modifiers		
Support, supervisor	219(90.9%)	2146(90.8%)
Support, colleagues	219(90.9%)	2150(91.0%)

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