Advance Publication

INDUSTRIAL HEALTH

Received: June 23, 2023

Accepted: January 5, 2024

J-STAGE Advance Published Date: January 16, 2024

Original article

Association between Different Types of Physical Activity and Occupational Stress in Japanese Workers: A Cross-Sectional Study

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Running Title: TYPES OF PHYSICAL ACTIVITY AND OCCUPATIONAL STRESS

Abstract

This cross-sectional study investigated the association between different types of physical activity (PA) and occupational psychological and physical stress responses among workers in Japan. Stress responses were assessed using the Brief Job Stress Questionnaire. Work-related PA (time spent sitting, sitting bouts, standing, walking, engaging in heavy labor, and moderate-to-vigorous PA [MVPA]) and exercise-based PA (frequencies [times/wk] of flexibility and muscle-strengthening activity, and walking) were measured using a questionnaire. Multiple linear regression was performed to examine the association between each type of PA and stress responses. Participants who engaged in >108 min/d of work-related MVPA exhibited a statistically significant association with higher psychological stress responses when compared to those who engaged in 0–42 min/d of work-related MVPA. For exercise-based PA, participants who engaged in flexibility activity or walking five or more times/wk, or muscle-strengthening activity one to three times/wk, demonstrated significantly lower psychological stress responses compared to those who did not exercise. Participants who engaged in flexibility activity five or more times/wok demonstrated significantly lower physical stress responses compared to those who did not exercise. This study suggests that work-related MVPA is associated with higher psychological stress responses, while exercise-based PA is associated with lower psychological or physical stress responses.

Keywords: workers; stress check program; physical activity; health management; socio-

economic status

Introduction

The International Labor Organization and World Health Organization (WHO) define occupational stress as a harmful physical and emotional response caused by an imbalance between perceived demands, resources, and abilities of individuals to cope with the demands[1, 2]. Excessive stress in the workplace causes poor physical and mental health (e.g., depression and cardiovascular diseases)[3-6] along with an increase in sickness absence[7] and lowering of productivity[8]. A survey on industrial safety and health conducted by the Ministry of Health, Labor, and Welfare Japan in 2021 reported that over half (53.3%) of the workers were experiencing excessive stress[9]. Therefore, it is important to adopt appropriate stress management strategies in order to alleviate physical or psychological stress responses.

The Japanese government launched an occupational health policy called the Stress Check Program in 2015, which was based on the industrial safety and health act[10]. This program assesses psychosocial stress using the Brief Job Stress Questionnaire (BJSQ) at least once a year in workplaces with 50 or more employees. However, stress management and countermeasures are not obligatory for companies with employees fewer than 50. Among all companies in Japan, small and medium-sized enterprises make up 99.7%, comprising approximately 70% of the workforce[11]. Stress management and countermeasures are essential issues in all workplaces, regardless of the number of employees. Therefore, considering the public health impact, it is essential to implement measures for stress management not only in

large corporations but also for employees in small and medium-sized enterprises.

Physical activity (PA) benefits mental and physical health[12, 13]. Although various types of PA exist in lifestyle domains and are known to benefit health[12, 13], the effect of work-related PA is controversial[14]. Moderate-to-vigorous-intensity (i.e., more than three metabolic equivalents) occupational activity at work has been reported to decline over the past 50 years in the United States[15]. A meta-analysis by White et al. reported that high work-related PA was associated with poor mental health[16]. A cross-sectional study in Japan reported that walking to work was not associated with depressive symptoms[17]. Although few studies have reported the effect of work-related PA on occupational stress in Korea[18, 19], the possible relationship between work-related PA and occupational stress among workers remains uninvestigated in Japan.

As for the different types of PA, White et al.'s meta-analysis showed that leisure time PA had a positive effect on the prevention of mental health problems[16]. Although most studies exploring the relationship between leisure time PA and occupational stress in workers have focused on the PA intensity[20-22], the types of exercise-based PA, such as flexibility (stretching) and muscle-strengthening activity, and walking (aerobic), have rarely been investigated. Therefore, examining whether these exercise-based PAs are associated with occupational stress is necessary.

This study aimed to investigate the different types of PA associated with occupational stress responses among Japanese workers of small and medium-sized enterprises. Our primary

objective was to examine how each type of work-related or exercise-based PA is related to occupational psychological or physical stress responses using the BJSQ. Our findings can help in developing potential interventions to reduce occupational stress among workers in small and medium-sized enterprises.

Subjects and Methods

Study design and participants

This cross-sectional study was conducted using anonymized data provided by a health service company (Canvas Inc., Shimane, Japan). This company collects information on the health of workers from 35 small- and medium-sized enterprises in Shimane Prefecture as part of the Shimane healthcare business subsidy from the Shimane Prefectural Government. Data obtained from April 2021 to August 2022 were used in this study. The inclusion criteria were participation in a questionnaire survey and availability of data. A total of 1,041 workers participated in the survey. After excluding 178 individuals who exhibited logical contradictions in their responses on the PA questionnaire, the data of 863 participants were analyzed (Figure 1). The study protocol was approved by the Research Ethics Committee for Human Subjects of Shimane University Faculty of Human Sciences (#2022-2). All the procedures performed in this study were in accordance with the tenets of the Declaration of Helsinki. Informed consent was obtained from all the participants prior to the commencement of the study.

Occupational stress

The BJSQ was used to assess occupational stress[23]. The detailed methodology of the BJSQ has been provided by the Ministry of Health, Labor and Welfare of Japan[24]. The BJSQ has been widely used for occupational health studies and practice[25]. The BJSQ measures psychological stress response (vigor [three items], irritability [three items], fatigue [three items], anxiety [three items], depression [six items]), and physical stress response [11 items]). Each item of the BJSQ was answered using one of four response options on the Likert scale. In this study, the scores for both psychological and physical stress response items were summed up according to a previous study[23]. A higher total score corresponds to a higher level of stress response. The scores for both psychological and physical stress responses were used as continuous variables.

Types of physical activity

Two types of PA were assessed using a questionnaire. First, time spent sitting, sitting bouts, standing, walking, and engaging in heavy loads as work-related PA was assessed using the Work-related Physical Activity Questionnaire (WPAQ). Moderate-to-vigorous PA (MVPA) was calculated as the sum of time spent walking and engaging in heavy loads. The reliability and validity of WPAQ have been reported to be acceptable by a previous study[26]. Time spent

sitting, sitting bouts, standing, walking, and MVPA were divided into terciles (first tercile=reference group). As approximately two-thirds (n=565; 65.5%) of the participants reported 0 min spent engaging in heavy loads, we divided them into two groups (0 min [= reference group] and more than 1 min).

Second, flexibility and muscle-strengthening activity, and walking were used as exercise-based PA. The frequencies (times/wk) of flexibility and muscle-strengthening activity, and walking were assessed using a modified questionnaire based on previous studies[27, 28]. Previous studies have shown that the test-retest reliability assessment had a moderate and acceptable value for flexibility and muscle-strengthening activity. The test-retest reliability and criterion-related validity of using an accelerometer with a walking-time questionnaire were found to be acceptable. Three exercise-based PAs were categorized into three groups. Group 1 (reference group) was defined as zero times per wk for each activity. Individuals who participated in more than one activity per wk were divided into two groups based on the median.

Other parameters

Data on sex (male, female, or other), age (years), educational attainment (middle school, high school, vocational school, junior college, college, graduate school, or other), household income (less than 2 million yen, more than 2 million to less than 6 million yen, more than 6 million yen, or unsure), employment status (full-time, part-time, contract, dispatch, consignment, and

other), managerial position (yes or no), smoking habits (yes or no), and alcohol consumption habits (every day/sometimes or hardly/do not drink) were obtained using a questionnaire. Educational attainment (high school or less, more than high school, or other), household income (less than 6 million yen, more than 6 million yen, or unsure), and employment status (full-time or other) were categorized. Based on the self-reported body weight and height data, body mass index (BMI) was calculated by dividing the body weight by height squared (kg/m^2).

Statistical analysis

Missing information about independent and dependent variables, which ranged from 0.2% to 18.8% (Table 1), was processed using multiple imputations under the "missing at random" assumption[29]. Each imputation was based on regression models of the analyzed variables. The 20 imputed datasets were analyzed independently and combined for inference, accounting for the variability of imputation[29].

The participants' characteristics were described. Categorical data were reported as numbers and percentages, and continuous data were presented as the median and interquartile range (IQR). In this study, each PA parameter was separately entered into a multivariate analysis model to examine the association between work-related or exercise-based PA and occupational stress. Multiple linear regression analyses were performed to estimate the unstandardized regression coefficient (*B*) and 95% confidence intervals (CI) of each occupational stress for

each PA. The analysis was conducted without any adjustments for the crude model. For the adjusted model, the analysis was adjusted for sex, age, BMI, educational attainment, household income, employment status, managerial position, smoking habits, and alcohol consumption. Statistical analyses were performed using SPSS version 29 (IBM Corp., Armonk, NY, USA).

Results

Table 1 presents the characteristics of the study participants before multiple imputations. Of the 863 participants from 35 small- and medium-sized enterprises, 37.9%, 61.0%, and 0.1% were female, male, and other, respectively. The median (IQR) age of the participants was 43 (32, 53) years. In terms of occupational stress responses, the median (IQR) points of psychological and physical stress responses were 36 (29, 43) and 18 (15, 22), respectively. In the context of work-related PA, the median (IQR) of sitting, standing, walking, engaging in heavy labor, and MVPA were 288 (72, 432), 93 (27, 192), 0 (0, 24), and 60 (27, 144) min/d, respectively. The median (IQR) of sitting bouts was 30 (10–60) min/time. The median frequency of flexibility and muscle-strengthening activity, and walking were 0 (0, 5), 0 (0, 0), and 0 (0, 5) times/wk, respectively.

Insert Table 1

Table 2 shows the associations between work-related PA and occupational stress responses. Multiple linear regression analysis showed that higher levels of psychological stress response

were associated with work-related walking for the 3rd tercile category in the crude model (*B*=2.14, 95% CI=0.29, 3.98) compared to the 1st tercile category, and engaging in heavy labor for group 2 in the crude model (*B*=1.67, 95% CI=0.15, 3.20) compared to group 1. The higher levels of psychological stress response were associated with work-related MVPA for the 3rd tercile category in the crude (*B*=2.64, 95% CI=0.83, 4.45) and adjusted models (*B*=2.04, 95% CI=0.18, 3.91) compared to the 1st tercile category. However, sitting, sitting bout, and standing were not associated with psychological stress response. Moreover, there were no significant associations between physical stress response and work-related PA.

Insert Table 2

Table 3 shows the association between exercise-based PA and occupational stress responses. Lower levels of psychological stress response were associated with flexibility activity for group 3 in the crude (*B*=-2.56, 95% CI=-4.32, -0.80) and adjusted models (B=-2.34, 95% CI=-4.07, -0.61) compared to group 1. Lower levels of psychological stress response were associated with muscle-strengthening activity for group 2 in the adjusted model (*B*=-2.93, 95% CI=-5.46, -0.40) compared to group 1. Lower levels of psychological stress response were associated with walking for group 2 in the crude (*B*=-2.55, 95% CI=-4.45, -0.65) and adjusted models (B=-2.31, 95% CI=-4.22, -0.40) and group 3 in the crude (*B*=-2.55, 95% CI=-4.29, -0.80) and adjusted models (B=-2.41, 95% CI=-4.13, -0.70) compared to group 1. Lower levels of physical stress response were associated with flexibility activity for group 3 in the crude (*B*=-

1.25, 95% CI=-2.15, -0.35) and adjusted models (B=-1.14, 95% CI=-2.05, -0.23) compared to group 1. Lower levels of physical stress response were associated with walking for group 3 in the crude model (*B*=-0.94, 95% CI=-1.83, -0.05) compared to group 1. However, there was no significant association between physical stress response and muscle-strengthening activity.

Insert Table 3

Discussion

This cross-sectional study examined the association between work-related or exercise-based PA and occupational stress responses among workers in Japanese small and medium-sized enterprises. The summary of the findings from this study is as follows: Firstly, work-related MVPA (>108 min/d, which corresponds to the 3rd quartile) was significantly associated with higher levels of psychological stress responses, while engaging in exercise-based PA, such as flexibility activity or walking for more than five days a week, as well as muscle-strengthening activity one to three times a week, was significantly associated with lower psychological stress responses. The practice of flexibility activity was also linked to lower levels of physical stress responses. In this way, work-related PA suggested a correlation with higher stress responses, while exercise-based PAs were associated with lower stress responses. Particularly, flexibility activity was suggested to have the potential to be beneficial for both psychological and physical stress responses.

Our study revealed that work-related MVPA in the 3rdnd tercile (>108 min/d) was positively associated with psychological stress responses compared to the 1st tercile (0–42 min/d). This finding was in concordance with a previous meta-analysis[16]. King et al.'s meta-analysis reported that high work-related PA was associated with poor mental health[16]. Although the increased duration of severe work-related PA was associated with high psychological distress in Korean male workers, no such association was found in females[18]. Moreover, the intensity of work-related PA and duration of moderate-to-severe work-related PA were not associated with psychological distress in both sexes[18]. Another Korean study found that high moderate-intensity occupational PA was associated with high perceived stress in males and females[19]. However, although there was no association between vigorous-intensity work-related PA and perceived stress, the relationship between vigorous PA and perceived stress showed a negative trend in females[19]. White et al. reported that female traders who engaged in low or high amounts of work-related walking had significantly lower psychological distress symptoms than those who engaged in no work-related walking[30]. Thus, although occupational PA may increase stress, the association between work-related PA and mental health may vary across occupations.

Our results show that each exercise-based PA is significantly associated with lower stress responses. The American College of Sports Medicine (ACSM) recommends flexibility exercises at least twice a week[31]. Since flexibility activity more than five times a week was

associated with significantly lower levels of psychological and physical stress responses, the necessity of a higher frequency than the recommended one can be considered. Furthermore, at least two muscle-strengthening activities per week are recommended in the WHO guidelines[12, 13]. Previous meta-analyses reported that resistance exercise training significantly improved anxiety and depression in healthy participants and those with physical or mental illness[32,33]. Our study found an association between muscle-strengthening activity 1 to 3 times/wk and psychological stress response. Kamada and colleagues reported the J-shaped relationship between the amount of strength training in older women and all-cause mortality[34]. In other words, the lowest hazard ratio (0.87) was observed at 82 min/wk (The hazard ratio exceeded 1 for 146 minutes or more per week). Although the frequency of muscle-strengthening activity on psychological stress responses in this study appears to be within the range of the WHO guidelines, there was no significant association observed between performing strength training four or more times a week and psychological stress responses. Considering the low frequency of muscle-strengthening activity in the participants of this study, further studies are necessary. The WHO 2020 guidelines on PA and sedentary behavior[12, 13] recommend that adults perform at least 150–300 min/wk of moderate-intensity or at least 75–150 min/wk of vigorous-intensity aerobic PA. ACSM recommends performing aerobic exercise from 3 to 5 times a week or achieving the recommended level of PA (moderate-intensity exercise for ≥150 min /wk)[31]. In our study, although we do not have information about the total exercise duration (min/wk), a

frequency of at least once a week demonstrates a beneficial association with psychological stress responses.

Potential mechanisms exist in the relationship between work-related PA, exercise-based PA, and occupational stress. Holtermann et al. reported the health paradox of work-related PA[34]. People with high levels of leisure-time PA have a lower risk of long-term sickness absence, whereas workers with high levels of work-related PA showed an increased risk of long-term sickness absence. Work-related PA is associated with overload with insufficient recovery time, elevates 24-hour heart rate and blood pressure, increases markers of inflammation (e.g., C reactive protein), as well as other factors, and may increase the risk of compromising health[35]. On the other hand, individuals who exercise regularly may be more resistant to acute stress's emotional effects than those who do not[36]. Regular activation of stress systems by exercise may produce beneficial adaptations that allow these systems to respond more effectively to acute stress[37]. von Haaren et al.'s interventional study showed that regular aerobic exercise reduces affective reactivity to real-life stressors, possibly by buffering the negative effects of stress on the autonomic nervous system[38]. During real-life stressors, the aerobic exercise training group showed significantly reduced physiological stress reactivity of the autonomic nervous system (heart rate variability) compared to the control group[39]. Furthermore, Becker et al. investigated stress responses induced by resistance training[40]. Salivary cortisol decreased during upper body strength training sessions. After the training session, an improvement in

positive affect was observed. In addition, Corey et al. found that psychosocial stress improved with the use of restorative yoga (control group) versus a low-impact stretching intervention for individuals with metabolic syndrome (stretching group)[41]. For example, significant decreases after a 1-year follow-up were observed in salivary cortisol levels, chronic stress severity, and stress perceptions in the stretching group compared with the control group[41]. Chronic stress-induced cortisol dysfunction may contribute to the development of chronic pain[42]. While it is well-known that flexibility activity is beneficial for the prevention and reduction of musculoskeletal pain, a previous review also reported the utility of flexibility activity for work-related musculoskeletal pain[43]. Flexibility activity might have a positive impact on psychological and physical stress responses.

This study had a few limitations. First, we used a cross-sectional design, which precludes the possibility of a causal inference between PA and occupational stress. A previous study reported that occupational stress affected leisure-time PA in Japanese workers[44]. Therefore, care should be taken when interpreting the results of this study. Second, the participants in this study were not randomly sampled, which could have resulted in selection bias. The small sample size resulted in low statistical power, and our results may have underestimated the associations. Third, exercise-based PA assessed using questionnaires did not assess specific exercise content (e.g., type of strength or flexibility exercise) because it only enquired about the frequency. Therefore, the possibility of underestimating the task cannot be ruled out because it was

dependent on the participant's understanding of the movement form. For example, flexibility activity includes static and dynamic stretching; however, we were unable to consider these differences. Finally, we could not control for the effects of unmeasured factors, such as work environment (e.g., job type and industry), content (e.g., workload and work pace), and context (e.g., bullying, harassment, and violence)[45], on the relationship between PA and occupational stress. Therefore, it is imperative to exercise caution when interpreting and disseminating the findings of this study.

In conclusion, this cross-sectional study found that workers engaged in work-related MVPA had higher psychological stress responses. Furthermore, higher frequencies of exercise-based flexibility activity were associated with lower levels of psychological and physical stress responses. In addition, muscle-strengthening activity and walking were associated with lower levels of psychological stress responses. Further interventional studies are needed to verify whether various types of PA have preventive effects on occupational stress.

Acknowledgments

The authors thank the members who participated in this study, as well as the Shimane CoHRE study members for their assistance.

Funding

This work was supported by the Shimane healthcare business subsidy from the Shimane Prefectural Government.

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Figures:

Figure 1. Flowchart showing the flow of participants

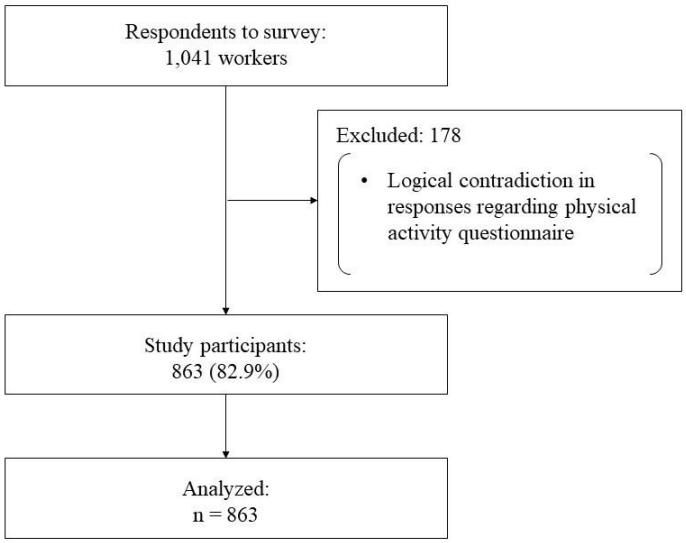

Table 1. Characteristics of participants (n = 863)

Variables		Median (IQR) or n (%)
Sex, n (%)	Female	327 (37.9)
	Male	526 (61.0)
	Other	1 (0.1)
	Missing data	9 (1.0)
Age; years, median (IQR)		43 (32, 53)
	Missing data, n (%)	26 (3.0)
BMI; kg/m^2, median (IQR)		22.1 (20.2, 24.5)
	Missing data, n (%)	68 (7.9)
Educational attainment, n (%)	High school or less	382 (44.3)
	More than high school	454 (52.6)
	Other	7 (0.8)
	Missing data	20 (2.3)
Household income, n (%)	Less than 6 million yen	569 (65.9)
	More than 6 million yen	173 (20.0)
	Unsure	91 (10.5)
	Missing data	30 (3.5)
Employment status, n (%)	Full-time	658 (76.2)
	Other	188 (21.8)
	Missing data	17 (2.0)
Managerial position, n (%)	Yes	288 (33.4)
	No	538 (62.3)
	Missing data	37 (4.3)
Smoking status, n (%)	Yes	167 (19.4)
	No	693 (80.3)
	Missing data	3 (0.3)
Alcohol consumption, n (%)	Every day or sometimes	465 (53.9)
	Hardly or do not drink	396 (45.9)
	Missing data	2 (0.2)
Stress responses		
Psychological stress response, points, median (IQR)		36 (29, 43)
	Missing data, n (%)	162 (18.8)
Physical stress response, points, median (IQR)		18 (15, 22)
	Missing data, n (%)	15 (1.7)
Work-related physical activity		
Sitting; minutes/day, median (IQR)		288 (72, 432)
Sitting bout; minutes/time, median (IQR)		30 (10, 60)
	Missing data, n (%)	32 (3.7)
Standing; minutes/day, median (IQR)		93 (27, 192)
Walking; minutes/day, median (IQR)		48 (24, 120)
Engaging in heavy labor		0 (0, 24)
MVPA; minutes/day, median (IQR)		60 (27, 144)
Types of physical activity		
Flexibility activity; times/week, median (IQR)		0 (0, 5)
	Missing data, n (%)	3 (0.3)
Muscle-strengthening activity; times/week, median (IQR)		0 (0, 0)
Walking; times/week, median (IQR)		0 (0, 5)
	Missing data, n (%)	2 (0.2)

IQR; interquartile range, BMI; body mass index, MVPA; moderate to vigorous physical activity

Table 2. Association between work-related physical activity and occupational stress response among workers

		Psychological stress response						Physical stress response					
		Crude model			Adjusted model			Crude model			Adjusted model		
		B	(95% CI)	P-value	*B*	(95% CI)	P-value	*B*	(95% CI)	P-value	*B*	(95% CI)	P-value
Sitting vs 1st tercile (0-144 minutes/day)	2nd tercile (>144 and <=384 minutes/day)	-1.45	(-3.21, 0.30)	0.11	-1.06	(-2.87, 0.75)	0.25	0.46	(-0.46, 1.37)	0.33	0.63	(-0.33, 1.60)	0.20
	3rd tercile (>384 minutes/day)	-0.10	(-1.99, 1.79)	0.92	-0.26	(-2.31, 1.78)	0.80	0.83	(-0.12, 1.78)	0.09	1.00	(-0.06, 2.06)	0.06
Sitting bout vs 1st tercile (0-20.00 minutes/time)	2nd tercile (>20 and <=40 minutes/time)	-1.12	(-3.09, 0.85)	0.27	-0.87	(-2.86, 1.12)	0.39	0.08	(-0.88, 1.04)	0.87	0.17	(-0.82, 1.16)	0.73
	3rd tercile (>40 minutes/time)	-1.49	(-3.27, 0.29)	0.10	-1.77	(-3.60, 0.05)	0.06	0.17	(-0.73, 1.08)	0.71	0.16	(-0.79, 1.11)	0.74
Standing vs 1st tercile (0-48 minutes/day)	2nd tercile (>48 and <=148.5 minutes/day)	1.50	(-0.35, 3.35)	0.11	1.30	(-0.52, 3.13)	0.16	0.60	(-0.35, 1.55)	0.21	0.54	(-0.42, 1.50)	0.27
	3rd tercile (>148.5 minutes/day)	1.38	(-0.37, 3.13)	0.12	1.16	(-0.62, 2.94)	0.20	-0.59	(-1.49, 0.30)	0.19	-0.65	(-1.57, 0.28)	0.17
Walking vs 1st tercile (0-30 minutes/day)	2nd tercile (>30 and <=96 minutes/day)	-0.31	(-2.06, 1.45)	0.73	-0.17	(-1.94, 1.59)	0.85	0.15	(-0.75, 1.05)	0.74	0.16	(-0.75, 1.07)	0.73
	3rd tercile (>96 minutes/day)	2.14	(0.29, 3.98)	0.02	1.79	(-0.07, 3.64)	0.06	0.30	(-0.67, 1.27)	0.55	0.25	(-0.75, 1.25)	0.62
Engaging in heavy labor vs Group 1 (0 minutes/day)	Group 2 (>=1 minutes/day)	1.67	(0.15, 3.20)	0.03	1.10	(-0.45, 2.65)	0.16	0.62	(-0.18, 1.42)	0.13	0.60	(-0.24, 1.43)	0.16
MVPA vs 1st tercile (0-42 minutes/day)	2nd tercile (>42 and <=108 minutes/day)	-0.03	(-1.85, 1.80)	0.98	-0.04	(-1.88, 1.81)	0.97	-0.05	(-0.97, 0.88)	0.92	-0.07	(-1.01, 0.86)	0.88
	3rd tercile (>108 minutes/day)	2.64	(0.83, 4.45)	<0.01	2.04	(0.18, 3.91)	0.03	0.44	(-0.49, 1.38)	0.35	0.38	(-0.60, 1.37)	0.44

B; unstandardized regression coefficients, CI; confidence interval, MVPA; moderate-to-vigorous physical activity

Each physical activity indicator was examined separately using multiple linear regression. For the adjusted model, the analysis was adjusted for sex, age, body mass index, educational attainment, household income, employment status, managerial position, smoking habits, and alcohol-drinking habits.

Table 3. Association between exercise-based physical activity and occupational stress response among workers

		Psychological stress response						Physical stress response					
		Crude model			Adjusted model			Crude model			Adjusted model		
		B	(95% CI)	P-value	*B*	(95% CI)	P-value	*B*	(95% CI)	P-value	*B*	(95% CI)	P-value
Flexibility activity vs Group 1 (0 times/week)	Group 2 (1-4 times/week)	-1.45	(-3.41, 0.51)	0.15	-1.45	(-3.40, 0.49)	0.14	-0.47	(-1.48, 0.53)	0.35	-0.43	(-1.44, 0.59)	0.41
	Group 3 (More than 5 times/week)	-2.56	(-4.32, -0.80)	<0.01	-2.34	(-4.07, -0.61)	0.01	-1.25	(-2.15, -0.35)	0.01	-1.14	(-2.05, -0.23)	0.01
Muscle-strengthening activity vs Group 1 (0 times/week)	Group 2 (1-3 times/week)	-2.22	(-4.73, 0.29)	0.08	-2.93	(-5.46, -0.40)	0.02	-0.95	(-2.23, 0.34)	0.15	-1.01	(-2.32, 0.30)	0.13
	Group 3 (More than 4 time/week)	0.22	(-2.31, 2.75)	0.86	-0.15	(-2.66, 2.35)	0.90	-0.83	(-2.07, 0.41)	0.19	-0.91	(-2.17, 0.35)	0.16
Walking vs Group 1 (0 times/week)	Group 2 (1-4 times/week)	-2.55	(-4.45, -0.65)	0.01	-2.31	(-4.22, -0.40)	0.02	-0.95	(-1.93, 0.03)	0.06	-0.79	(-1.78, 0.20)	0.12
	Group 3 (More than 5 times/week)	-2.55	(-4.29, -0.80)	<0.01	-2.41	(-4.13, -0.70)	0.01	-0.94	(-1.83, -0.05)	0.04	-0.83	(-1.73, 0.06)	0.07

B; unstandardized regression coefficients, CI; confidence interval

Each physical activity indicator was examined separately using multiple linear regression. For the adjusted model, the analysis was adjusted for sex, age, body mass index, educational attainment, household income, employment status, managerial position, smoking habits, and alcohol-drinking habits.