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The large number of pains predicts the cessation of exercise habit: one-year retrospective study of Japanese workers

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Abstract

Continuous exercise habits in male workers are important for productivity and health. Number of pains is a potential risk factor for the cessation of exercise habits. However, whether multisite pain can predict the cessation of exercise habits remains unclear. This retrospective study was conducted from 2018 to 2019 (baseline: June and July 2018; follow-up: June and July 2019), and included 75 male workers who exercised regularly in 2018. Exercise habits in 2019 were used as the outcome variable. Number of pains was measured as the reported pain intensity in 14 anatomic regions using a numerical rating scale (NRS) ranging from 0 to 10, and regions with NRS scores ≥ 1 were used as explanatory variables. Simple and multiple logistic regressions were used to determine the effect of number of pains on the cessation of exercise habits. Thirteen workers discontinued their exercise habits in 2019. In the simple and multiple logistic regression models, multi-site pain had a significant effect on the cessation of exercise habits (crude: odds ratio[OR], 1.33; 95% confidence interval[CI], 1.02–1.77; $P=0.035$; adjusted: OR, 1.38; 95%CI, 1.01–1.98; $P=0.047$). Male Japanese workers with number of pains are likely to discontinue their exercise habits.

Keywords

exercise habit, worker, number of pains

Running head

number of pains and exercise habit

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I. Introduction

Exercise habits are essential for the maintenance of physical health and prevention of lifestyle-related diseases. Exercise habits have been associated with a reduced risk of developing cardiovascular diseases, diabetes, and cancer¹⁻³. In the working-age population, exercise habits have proven to provide additional positive effects on work, that is, an improved ability to perform daily tasks and a reduction in absenteeism⁴. These previous studies also suggest that exercise habits must continue to be effective. However, the continuation of exercise habits has been reported to be difficult in working-age men. About 20% of male workers who engaged in exercise habits were found to cease their exercise habits in one year⁵. The positive dose-response between age and inactivity was revealed in male, but not among female⁶. Previous studies have shown that psychological factors, including the enjoyment of exercise and self-efficacy, and physical factors, including physical function and injury, are associated with the cessation of exercise habits⁷⁻¹⁰.

Multi-site pain refers to more than one painful musculoskeletal anatomic site¹¹ and is more harmful to health than single-site pain¹²⁻¹⁴. The previous study has found the presence of multi-site pain to predict low physical function¹⁵, and the low physical function has been associated with low exercise adherence and daily living disabilities in the working-age population^{15,16}. A systematic review and meta-analysis investigated the association between musculoskeletal pain and cessation of exercise habit¹⁷. However, this study revealed an inconsistent association. One of the limitations of this study was considering only the pain prevalence, regardless of the number of pains. The number of pains would be a stronger risk factor of cessation of exercise habit than just pain prevalence. Focusing on the number of pains, rather than the pain prevalence, may clarify the impact of pain on the cessation of exercise habit.

Therefore, this study aimed to investigate the ability of the number of pains to predict the cessation of exercise habits in a male working-age population. The results of this study suggest that the number of pains is an indicator of the need to prioritize pain assessment and intervention and contribute to continuous exercise habits. We hypothesized that persons with multi-site pain are likely to discontinue their exercise habits.

II. Method

Study design

This one-year, retrospective, longitudinal study was performed in a company. Data measurements were conducted from June/July 2018 to June/July 2019. Two hundred and fifty workers participated in all measurements and provided their consent. The inclusion criteria were as follows: 1) age from 18 to 65 years (all full-time workers were aged 18 to 65 in this company), 2) male worker, and 3) engagement in exercise habits in 2018. Two participants were aged < 18 or > 65 years, 45 were female, and 126 did not have an exercise habit in 2018. A total of 78 participants met the inclusion criteria. The exclusion criteria were missing data and pain-related trauma or disease. After excluding three participants with missing data, 75 were included in the final analysis. The data are summarized in the participant flowchart shown in Figure 1.

This study was approved by the Ethics Committee of Kobe University School of Medicine, Faculty of Health Science, and it conformed to the guidelines of the Declaration of Helsinki (488-1).

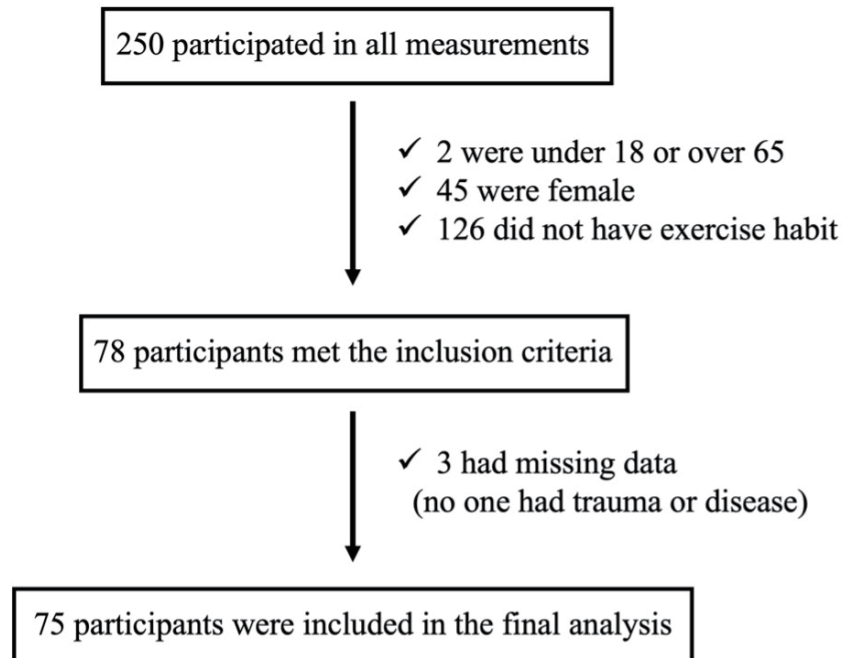


Fig1: Flow chart showing the process of participant inclusion

Measurements

1) Exercise habit

We collected data regarding exercise habits from annual health check-ups in 2018 and 2019. The question was “Do you exercise at least twice a week, for at least 30 min each time, for at least one year?” A “yes” response was classified as “having an exercise habit”¹⁸. Participants whose 2018 response was “yes” were included in this study, and their 2019 response was used as the outcome variable. The response “yes” in 2019 was defined “continuation of exercise habit” and “no” in 2019 was defined “cessation of exercise habit”.

2) Number of pains

We measured number of pains using a paper-based questionnaire in 2018. Number of pains was measured as the reported current intensity of pain in the following 14 anatomical regions: neck, shoulder (right/left), elbow (right/left), wrist (right/left), back, hip (right/left), knee (right/left), and ankle (right/left). All regions are shown in Figure 2. A numerical rating scale (NRS) ranging from 0 to 10 was used to measure musculoskeletal pain intensity in each body region^{19,20}. On this scale, 0 means “no pain,” and 10 means “worst imaginable pain”; in this study, 0 indicated “no pain,” while 1–10 indicated “pain”^{21,22}. The

measurements by NAS were conducted in each 14 regions. Finally, the number of regions was used as an explanatory variable.

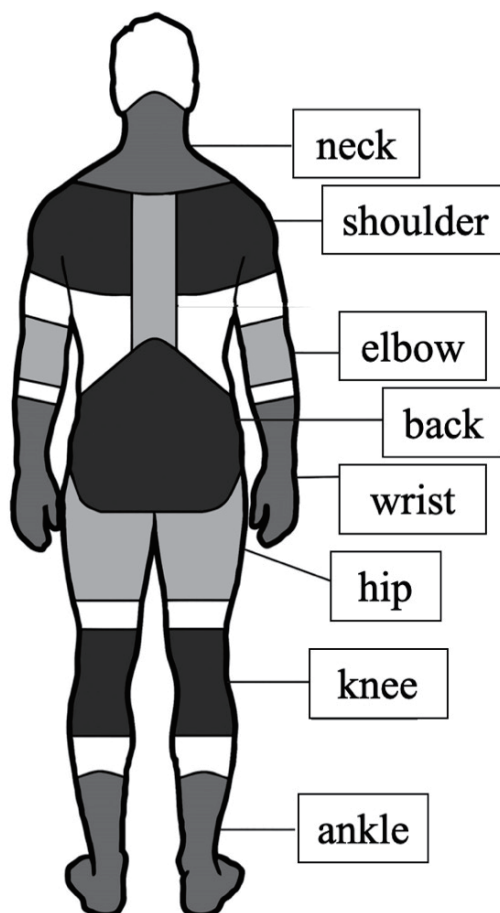


Fig2: Illustration of the human body used to assess pain regions

3) Other data

We extracted data regarding age, sex, body mass index (BMI), and smoking habits from the 2018 annual health check-up. To collect data on smoking habits, participants were asked about their current habits. Thereafter, the participants who currently had smoking habits were defined as “smokers,” while those who did not were defined as “non-smokers.”

From the 2018 paper-based questionnaire, we assessed year of education and the frequency of hospital or clinic visits which were related to musculoskeletal pain. The number of years of education was used as the educational variable. Participants who had visited the hospital or clinic at least once in the preceding 12 months indicated “pain-related visit,” and those who had never visited the hospital or clinic indicated “no visit”.

Statistical analyses

Categorical variables (e.g., smoking habit, and pain prevalence) are presented as numbers and percentages. Normally distributed continuous variables are presented as the mean and standard deviation. Non-normally distributed continuous variables are presented as medians and interquartile ranges (Table 1).

Simple and multiple logistic regressions were used to determine the effect of multi-site pain on the cessation of exercise habits. One of the inclusion criteria was having exercise habit in 2018. The outcome

Table 1: The characteristics of the participants (n = 75)

Age, year	32 [26 - 45.5] [‡]
Body mass index, kg/m ²	22.7 (3.5) [†]
Year of education	14 [12 - 18] [‡]
Smoke, n (%)	13 (17)
Pain-related visit, n (%)	15 (20)
Cessation of exercise habit, n (%)	13 (17)
Number of musculoskeletal-pain sites	2 [0 - 4] [‡]
Pain prevalence, n (%)	
Neck	32 (43)
Right shoulder	29 (39)
Left shoulder	28 (37)
Right elbow	6 (8.0)
Left elbow	4 (5.3)
Right wrist	9 (12)
Left wrist	9 (12)
Back	37 (49)
Right hip	7 (9.3)
Left hip	7 (9.3)
Right knee	8 (11)
Left knee	9 (12)
Right ankle	4 (5.3)
Left ankle	3 (4.0)

†: Mean (Standard deviation); ‡: Median [Interquartile range]

variable was the prevalence of exercise habits in 2019, who did not have exercise habit were “1” and having exercise habit were “0”. The explanatory variable was the number of musculoskeletal pain episodes. The following variables were selected as confounding factors: age, sex, BMI, year of education, smoking habits, and frequency of pain-related hospital and clinic visits. The forced entry approach was used to adjust the confounding factor. The confounding factors were based on those used in previous studies ^{12,23,24}. As the

sensitivity analysis, the same analysis with using the number of pains as categorical variable (0: non-pain or having 1 pain site, 1: the pain sites were 2 or more;) were conducted. Coefficients and 95% confidence intervals (95% CI) were calculated, and statistical significance was set at $P < .05$. R-4.1.2 was used for all statistical analyses ²⁵.

III. Results

The characteristics of the participants ($n = 75$) are shown in Table 1. The median patient age was 32 years (interquartile range [1st and 3rd quartiles], 26–45.5). Thirteen (17%) participants discontinued their exercise habits in 2019. The median number of musculoskeletal-pain sites was 2 (range, 0–4). Among all the regions, neck pain was the most prevalent ($n = 37$; 49%), followed by back pain ($n = 33$; 44%).

Table 2 shows the effect of the number of pains on the cessation of exercise habits. In the simple logistic regression model, the large number of pains had a significant effect on the cessation of exercise habits (OR, 1.33; 95% CI, 1.02–1.77; $P = 0.035$). Even after adjusting for covariates, the significant effect of the number of pains on the cessation of exercise habits persisted (OR, 1.38; 95% CI, 1.01–1.98; $P = 0.047$).

Table 3 shows the results of sensitivity analysis. In the adjusted model, the association was not significant. However, there are same trends to the main analysis.

Table 2: The effect of the number of musculoskeletal-pain sites on the cessation of exercise habit

	crude			adjusted		
	OR	95%CI	<i>P</i>	OR	95%CI	<i>P</i>
The number of pains	1.33	1.02 to 1.77	0.035	1.38	1.01 to 1.98	0.047
Age	1.04	1.00 to 1.10	0.051	1.03	0.98 to 1.09	0.16
BMI	1.08	0.91 to 1.27	0.31	1.07	0.89 to 1.29	0.42
Year of education	0.94	0.74 to 1.19	0.66	0.95	0.72 to 1.25	0.74
Smoking habit	1.56	0.30 to 6.25	0.55	1.63	0.29 to 7.72	0.54
Hospital or clinic visits	1.25	0.25 to 4.87	0.76	0.63	0.10 to 3.03	0.59

OR: Odds ratio; 95% CI: 95% confidence interval; BMI: body mass index
 In the adjusted model, confounding factors (age, sex, BMI, year of education, smoking habit, and frequency of pain-related hospital or clinic visits) were adjusted.

Table 3: The effect of the number of musculoskeletal-pain (categorical) on the cessation of exercise habit

	crude			adjusted		
	OR	95%CI	<i>P</i>	OR	95%CI	<i>P</i>
The number of pains: 0 or 1	1.00	ref	-	1.00	ref	-
The number of pains: 2~	4.04	1.11 to 19.3	0.047	3.63	0.90 to 18.7	0.085
Age	1.04	1.00 to 1.10	0.051	1.03	0.98 to 1.09	0.14
BMI	1.08	0.91 to 1.27	0.31	1.09	0.90 to 1.30	0.33
Year of education	0.94	0.74 to 1.19	0.66	0.92	0.69 to 1.22	0.59
Smoking habit	1.56	0.30 to 6.25	0.55	1.35	0.23 to 6.59	0.71
Hospital or clinic visits	1.25	0.25 to 4.87	0.76	0.58	0.09 to 2.76	0.52

OR: Odds ratio; 95% CI: 95% confidence interval; BMI: body mass index
In the adjusted model, confounding factors (age, BMI, year of education, smoking habit, and frequency of pain-related hospital or clinic visits) were adjusted.

IV. Discussion

This study investigated the effect of the number of pains on the cessation of exercise habits in male Japanese workers. In the 75 male workers who had exercise habits, the large number of pains at baseline affected the cessation of exercise habits during follow-up. To the best of our knowledge, this is the first study to investigate the effect of the number of musculoskeletal-pain sites on the cessation of exercise habits.

In previous studies, workers with the large number of pains were likely to experience a decline in their physical function, including walking, climbing stairs, and carrying luggage ²⁶. In the present study, workers with the large number of pains tended to discontinue their exercise habits, which were included in their physical function. These results corroborate those of previous studies. Previous studies have also shown multi-site pain to be significantly associated with physical demand regardless of pain intensity ^{13,14}, thus suggesting that decreasing the pain site is important in preventing the cessation of exercise habits rather than prevalence of pain which was investigated in the previous studies. United States guidelines reveal that high pain intensity potentially requires several treatments and considerable time compared with low pain intensity ²⁷. Thus, focusing on low-intensity pain and improving pain may prevent the cessation of exercise habits.

Additionally, we found the number of pains to affect exercise habit in people of working age. Previous studies have shown that a healthy lifestyle (adequate amount of physical activity or avoidance of a sedentary lifestyle) during leisure time had more positive effects on productivity and health than that during working time ^{28,29}. The leisure-time physical activity in middle-aged workers potentially protects against heart-related mortality at older age ³⁰. Thus, improving multi-site pain may promote a healthy lifestyle during leisure time and improve work ability and health.

This study has four limitations. First, the sample size was small, with only 75 participants, and it was not sufficient to adjust for covariates. Future studies with larger sample sizes are warranted. Second,

exercise habits were self-assessed. Previous studies have shown that subjective assessments of exercise time differ from objective assessments^{31,32}. However, this study measured the prevalence of exercise habits and not time. Therefore, bias was minimized. Third, psychological factors, socioeconomic factors, and geographical data were not evaluated. Nonetheless, year of education, which can be categorized under socioeconomic factors³³, and years of education were adjusted in this study. However, this adjustment was insufficient because the year of education could not completely explain the socioeconomic status. In future studies, these factors should be adjusted as covariates.

V. Conclusion

In conclusion, male Japanese workers with the large number of pains are more likely to discontinue their exercise habits. Improving low-intensity exercise potentially prevents the cessation of exercise habits.

Declaration of Conflicting Interests

The authors declare no conflicts of interest associated with this manuscript.

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