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Original Article

Exercise Self-Efficacy as a Mediator between Goal-Setting and Physical Activity: Developing the Workplace as a Setting for Promoting Physical Activity

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ABSTRACT

Background: Physical activity (PA) is ranked as a leading health indicator and the workplace is a key setting to promote PA. The purpose of this study was to examine how goal-setting and exercise self-efficacy (SE) during a health promotion program influenced PA level among Japanese workers.
Methods: Using a cross-sectional study design, we surveyed 281 employees. The short version of the International Physical Activity Questionnaire was used to assess PA level. Exercise SE was assessed using a partially modified version of Oka's exercise SE scale. Personal goals were assessed as the total numbers of "yes" responses to five items regarding "details of personal goals to perform PA". A mediational model was used to examine whether exercise SE mediates between the number of personal goals and PA level.
Results: The mean age of the participants was 46.3 years, 76.2% were men, and the most common occupational category was software engineer (30.6%). The average PA level per week exceeded the recommended level in 127 participants (45.2%). One hundred and eighty-four participants (65.5%) set some form of concrete personal goal to perform PA. The relationship between the number of personal goals and PA level was mediated by exercise SE.
Conclusion: Our study showed that exercise SE mediates goal-setting and increases PA. The results suggest that the components of PA promotion programs should be tailored to enhance participants' confidence in performing PA.

1. Introduction

Regular physical activity (PA) is associated with a reduced risk of noncommunicable diseases (NCDs) such as type 2 diabetes and cardiovascular disease [1,2]. In the second term of National Health Promotion in the 21st century (Healthy Japan 21), PA is ranked as a leading health indicator. Healthy Japan 21 announced the goals of increasing both the mean number of steps per day of adults and the percentage of individuals who perform regular PA [3]. Under Healthy Japan 21, regular PA is defined as exercising for ≥ 30 minutes at least twice per week continuously for at least 1 year. According to the 2014 National Health and Nutrition Survey, the mean number of steps per day of Japanese men and women was 7,043 and 6,015 [4], respectively; below the daily target level of 10,000 steps [5]. Moreover, only 31.2% of men and 25.1% of women performed regular PA [4].

Most employed adults spend about half of each working day at the workplace; therefore, the workplace is a key setting to promote PA [3,6]. Recent systematic reviews on effective approaches for increasing PA among workers recommend a tailor-made behavior modification program catered to each individual [7]. Many tailor-made behavior modification programs incorporate practical components and strategies based on behavioral science, including goal-setting, self-monitoring, and self-efficacy (SE) [8]. The components of health programs for increasing PA have diversified and now combine practical components and strategies, resulting in a wide

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variation in the types of participants, duration, and provision of direct (face-to-face) and indirect (non-face-to-face) support [9–11].

Interest in health promotion programs at the workplace has increased, but there is controversy regarding their effectiveness. Dishman et al [12,13] reported that a 3-month intervention at the workplace significantly increased the percentage of participants with a sufficient PA level. Proper et al [14] reported that a 9-month intervention at the workplace significantly increased exercise energy expenditure but did not change the proportion of participants with a sufficient PA level. Haruyama et al [15] implemented 3 months of indirect intervention in Japanese workers, and reported no change in the proportion of those with a sufficient PA level. In a study in Canadians, Pan et al [16] reported that exercise SE was the most influential factor for increasing PA.

To develop the workplace as a setting to more effectively promote PA, the relationship between the various practical components and strategies for promoting and increasing PA must be clarified. In the present study, we focused on the relationships of "goal-setting" and "exercise SE". Goal-setting is thought to function to reinforce continued efforts towards a goal. A goal is most successfully achieved when a person commits to that goal and has confidence to reach that goal [17]. SE is the degree of confidence one has in being able to reach a goal. Exercise SE has been suggested to influence the practice of PA [16].

The aim of this study was to investigate, using a mediational model, how goals voluntarily set by participants of an event to promote PA and their exercise SE influence their PA level.

2. Materials and methods

2.1. Participants

Participants were employees at an information and communications company in Japan. This company held a voluntary health promotion event for employees from May 15, 2012 to August 31, 2012. Just after completion of the health promotion event, the participants were asked to respond to an online survey, which was also voluntary, and 281 completed surveys were returned.

2.2. Questionnaire

The sociodemographic background data of the participants were sex, age, marital status, number of years of education, and occupational category. The online survey asked about their PA level, exercise SE, and setting of personal goals.

2.3. Physical activity level

The short version of the International Physical Activity Questionnaire (IPAQ) was used to assess PA level [18,19]. The questions were structured so as to confirm the average number of days and duration of PA per week, in terms of metabolic equivalents (METs) based on intensity. PA intensity was classified into the following four categories: "vigorous" (8 METs), "moderate" (4 METs, excluding walking), "walking", and "sitting". Walking was further classified into the following three categories: "a fast rate with hard breathing" (5 METs), "moderate rate with some breathlessness" (3.3 METs), and "slow" (2.5 METs).

To calculate PA level per week, intensity in METs was multiplied by the average frequency and duration (hours) of PA per week, and then these results (METs·h/w) were totaled. The Japanese Ministry of Health Labour and Welfare (MHLW) recommends $\geq$ 3 METs as an effective intensity to prevent NCDs [20]. Therefore, "slow walking" (2.5 METs), which is $<$ 3 METs in intensity, was excluded from calculations in this study. IPAQ is a survey that assesses PA level at the population level, and its reliability and validity have been demonstrated at 14 centers in 12 countries worldwide using a standardized method. In Japan, Murase et al [18] confirmed the reliability and validity of the IPAQ.

2.4. Exercise SE scale

Exercise SE was assessed using a partially modified version of Oka's exercise SE scale [21], which was created based on the scale by Marcus et al [22]. There were a total of five question items, such as "I am confident that I can participate in regular exercise even when I feel I don't have the time", to assess the degree of confidence in being able to engage in PA. A 5-point Likert scale was used with responses ranging from "I do not think so at all" (1 point) to "I very much think so" (5 points). The scores were totaled for the five exercise SE scale items as the exercise SE score, which ranged from 5 points to 25 points. A higher score signified higher SE. The Oka exercise SE scale was created in Japanese, and its reliability and validity have been demonstrated [21].

2.5. Setting personal goals to perform PA

To assess "details of personal goals to perform PA", we reviewed whether elements of the following five items were included in the personal goals: "frequency of PA", "forms of exercise performed each time", "duration and intensity of exercise each time", "time limit for achieving goals", and "outcome expectancies when goals are achieved" (e.g., "If I exercise regularly, I will lose X pounds in X months"). The two responses were either "yes" or "no". The total number of "yes" responses to the five items is referred to hereafter as the "number of personal goals".

2.6. Data analysis

The strength of the correlation between each of two variables among PA level, number of personal goals, and exercise SE was examined by calculating the Pearson's product–moment correlation coefficient. Mediation analysis [23] is a method of analysis in which a third variable is added to determine the path of two variables or to examine whether there is a false association between two variables (Fig. 1). To examine whether exercise SE mediates between the number of personal goals and PA level, Baron and Kenny's [24] 3-step single mediator framework was used.

In the first step, the correlation between number of personal goals and exercise SE score of the participants was examined by single regression analysis. In the second step, the correlation between number of personal goals and PA level was examined by single regression analysis. In the third step, whether the exercise SE score mediates the relationship between number of personal goals and PA level was examined by multiple regression analysis. Fig. 1 shows a mediator model in which the number of personal goals

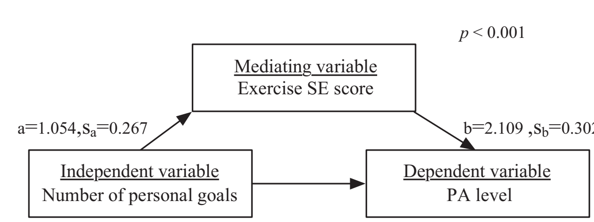

Fig. 1. Mediational model. PA, physical activity; SE, self-efficacy; a, raw regression coefficient for the association between number of personal goals and exercise SE score; s_a, standard error of a; b, raw coefficient for the association between exercise SE score and PA level; s_b, standard error of b; p, p-value of Sobel test.

Table 1
Sociodemographic background data of the participants

Age (y)	46.3 ± 7.5
Sex	
Male	214 (76.2)
Female	67 (23.8)
Marital status	
Married	218 (77.6)
Single	63 (22.4)
Years of education (y)	
≤12	33 (11.7)
13–15	52 (18.5)
16	166 (59.1)
>16	24 (8.5)
Unknown	6 (2.1)
Occupational category	
Software engineer	86 (30.6)
Clerical	76 (27)
Sales	25 (8.9)
Planning	25 (8.9)
Technical	18 (6.4)
Other	51 (18.1)

Data are presented as mean ± SD or frequency (%).

Table 2
Details and distribution of personal goals, and distribution of exercise self-efficacy scores

	Frequency (%)
Details of personal goals*	
Outcome expectancies when goals are achieved	103 (55.1)
Duration and intensity of exercise each time	67 (35.8)
Frequency of PA	62 (33.2)
Time limit for achieving goals	36 (19.3)
Forms of exercise performed each time	20 (10.7)
Number of personal goals	
0	97 (34.5)
1	115 (40.9)
2	46 (16.4)
3	14 (5)
4	6 (2.1)
5	3 (1.1)
Exercise SE score	
Mean	16.3
Standard deviation	4.8
Median	17
Minimum	5
Maximum	25

* Personal goals were defined as concrete goals to perform PA set during a health promotion event. Those who set at least one personal goal ($n = 184$) were included in the analysis. More than one personal goal could be selected.
PA, physical activity.

is the independent variable, exercise SE score is the mediating variable, and PA level is the dependent variable.

The Sobel test was also used to examine the mediation effect of the exercise SE score on the relationship between number of personal goals and PA level. The statistical analysis software used for all analyses was SPSS version 20.0 (SPSS Inc., Chicago, IL, USA).

2.7. Ethical considerations

Information about the study, including the nature of this study and the fact that participation was voluntary, was explained to participants online, and consent was obtained online. This study was reviewed and approved by the Ethics Committee at the Kyushu Institute of Technology, Fukuoka, Japan.

3. Results

Table 1 shows the sociodemographic background of the participants. The mean age was 46.3 (standard deviation = 7.5) years, 76.2% were men, and 77.6% were married. More than half had ≥ 16 years of education. The most common occupational category was software engineer (30.6%).

Fig. 2 shows the distribution for PA level in the participants. The median value was 18.7 METs·h/w, the first quartile value was 1.4 METs·h/w, and the third quartile value was 36 METs·h/w. The average PA level per week exceeded the 23 METs·h/w recommended by the Japanese MHLW in 127 participants (45.2%).

Table 2 shows the distribution of details of personal goals (5 items), number of personal goals, and exercise SE score. At the beginning of the health promotion event, 184 participants (65.5%) responded that they had "set some form of personal goal to perform PA". With regard to distribution of the five items of personal goals examined in this study, the most common was "outcome expectancies when goals are achieved", which corresponds to a personal attainment goal, in 103 participants (55.1%). The second most common was "duration and intensity of exercise each time", which is a practical goal, in 67 participants (35.8%), while the third most common was "frequency of PA", another

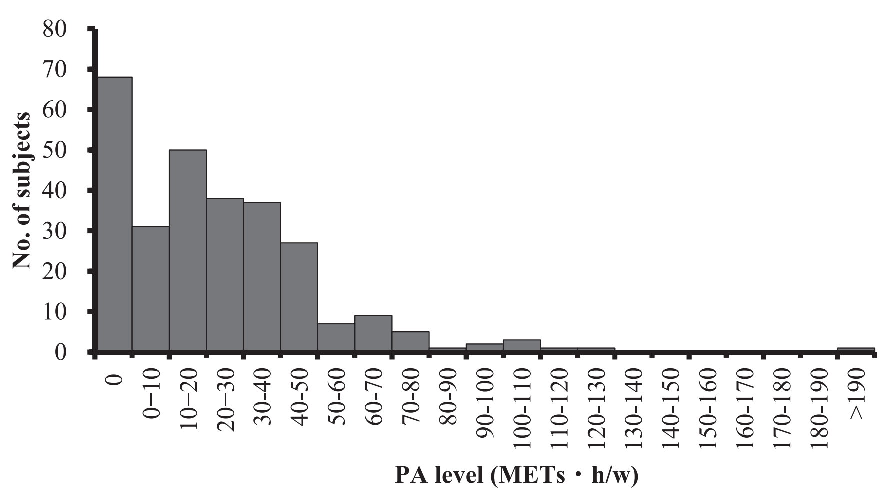

Fig. 2. Distribution of physical activity level. The International Physical Activity Questionnaire was used to measure PA level. PA level was calculated by the conditions described in the Materials and methods section and is shown as METs·h/w. Because the Japanese Ministry of Health, Labour and Welfare recommends ≥ 3 METs as an effective intensity to prevent noncommunicable diseases, "slow walking" (2.5 METs) was excluded for the calculations. MET, metabolic equivalent; PA, physical activity.

Table 3
Correlations between PA level, exercise SE score, and number of personal goals

Variable	Exercise SE score	No. of personal goals
PA level	0.408*	0.159*
Exercise SE score	–	0.23*

* $p < 0.01$.
PA, physical activity; SE, self-efficacy.

Table 4
Mediational model for PA level, exercise SE score, and number of personal goals

	Item	Regression coefficient	Standard error	p
Step 1				
Mediating variable	Exercise SE score			
Independent variable	Number of personal goals	1.054	0.267	< 0.001
Step 2				
Dependent variable	PA level			
Independent variable	Number of personal goals	3.923	1.46	0.008
Step 3				
Dependent variable	PA level			
Independent variable	Number of personal goals	1.701	1.386	0.221
Mediating variable	Exercise SE score	2.109	0.302	< 0.001

PA, physical activity; SE, self-efficacy.

practical goal, in 62 participants (33.2%). The mean exercise SE score was 16.3 (standard deviation = 4.8) points. The median exercise SE score was 17, the minimum was 5, and the maximum was 25.

Table 3 shows the results of correlation analysis between each of two variables among PA level, exercise SE score, and number of personal goals. The moderate, positive correlation was observed between the exercise SE score and PA level, with a correlation coefficient of 0.408 ($p < 0.01$). The weak positive correlation was observed between the exercise SE score and number of personal goals, with a correlation coefficient of 0.23 ($p < 0.01$). The very weak, positive correlation was observed between PA level and number of personal goals, although the correlation was still significant with a correlation coefficient of 0.159 ($p < 0.01$).

Table 4 shows the results of a mediation model that examined whether the exercise SE score mediated a relationship between number of personal goals and PA level. Regression analysis in the first step showed that number of personal goals was significantly related to the exercise SE score as a mediating variable (regression coefficient = 1.054; $p < 0.001$). Regression analysis in the second step showed that number of personal goals was significantly related to PA level as the dependent variable (regression coefficient = 3.923; $p = 0.008$). Multiple regression analysis in the third step showed no significant relationship between number of personal goals and PA level (regression coefficient = 1.701; $p = 0.221$), but showed that the exercise SE score was significantly related to PA level (regression coefficient = 2.109; $p < 0.001$). The Sobel test also showed that the exercise SE score was a strong mediator in the relationship between number of personal goals and PA level (Fig. 1).

4. Discussion

Our study found that exercise SE not only directly influences increases in PA, but also plays a mediator role. There has been little research in Japan to date on mediators that promote PA. The present study is one of few to analyze mediators to promote PA in the workplace. Our findings suggest that exercise SE is a key factor in promoting PA in the workplace.

Goal-setting and SE are in a cyclical relationship of mutual stimulation when people achieve goals [25]. For example, when people attain goals in an upward cycle, SE increases, and this increased SE leads people toward even higher goals. The reverse phenomenon occurs in a downward cycle. In a program to promote PA, participants being able to voluntarily set more detailed goals can lead to a cycle in which exercise SE is increased. Atkinson [26] found that people exert their highest levels of effort for moderately difficult tasks, but if a task is either very difficult or very easy, their efforts toward the task decrease. Setting detailed goals may help bridge the gap between a desired result and adjusting lifestyle and behavior, and this may increase the likelihood of participants continuing to perform PA since they will be motivated when they select moderately difficult tasks.

Our study shows that exercise SE mediates goal-setting and increases PA, and at the same time, goal-setting indirectly influences increases in PA. Conn et al [9] classified interventions for achieving the outcome of increased PA into two types. One type is behavioral intervention, which includes techniques such as goal-setting, self-monitoring, cues, and rewards. The other type is cognitive intervention, which includes techniques such as decision-making, health education, and providing information. They concluded that in order to increase PA, emphasis should be placed on behavioral interventions more so than on cognitive interventions. Goal-setting is a typical technique in behavioral intervention. Therefore, goal-setting may lead to an increase in PA level.

Performing regular PA involves many behavioral factors [27]. Thus, it is difficult for health providers to effectively design and plan programs to improve PA levels in adults without identifying the different conditions that influence the initiation and continuation of regular PA, such as overtime hours, commuting time, and responsibilities at home. In the future, it will be necessary to further investigate components for discerning the different factors and conditions that are related to increasing PA and to enhance the effectiveness of various approaches for improving exercise SE as a mediator that increases PA.

This study had several limitations. First, because the study design was cross-sectional, the detected relationships cannot be interpreted as cause-and-effect. Second, because the participants in this study were employees from a single company in Japan, caution should be taken in generalizing the results. Third, no standard scales were used for goal-setting.

In conclusion, this is one of few studies in the workplace showing that exercise SE is a mediator that increases PA. It will be necessary to further develop studies regarding components for discerning conditions in which exercise SE is increased. We considered that one of the components that led to a cycle in which exercise SE was increased was setting concrete goals. The results of this study suggest that the components of PA promotion programs should be tailored to enhance participants' confidence in performing PA.

Conflicts of interest

All authors declare no conflicts of interest.

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