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Relationship of psychological factors with physical activity stage of change in prime-and middle-aged Japanese

Keiko Mori*

Hisao Suzuki†

Da Hong Wang‡

Jiro Takaki**

Tomoko Takigawa††

Keiki Ogino‡‡

*Department of Public Health, Okayama University Graduate School of Medicine, Dentistry and Pharmaceutical Sciences,

†Faculty of Education, Okayama University,

‡Department of Public Health, Okayama University Graduate School of Medicine, Dentistry and Pharmaceutical Sciences, dahong@md.okayama-u.ac.jp

**Department of Public Health, Okayama University Graduate School of Medicine, Dentistry and Pharmaceutical Sciences,

††Department of Public Health, Okayama University Graduate School of Medicine, Dentistry and Pharmaceutical Sciences,

‡‡Department of Public Health, Okayama University Graduate School of Medicine, Dentistry and Pharmaceutical Sciences,

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Abstract

The present study aimed to investigate the status of physical activity and the differences in psychological factors associated with physical activity from the perspective of transtheoretical model stages between prime- and middle-aged Japanese. The study involved 375 prime-aged volunteers (175 men, 200 women) and 557 middle-aged volunteers (247 men, 310 women) living in Kuse, a town in Okayama Prefecture, Japan. We found that the prime-aged men at the preparation stage had significantly higher self-efficacy scores than at the contemplation stage ($p < 0.01$). Middle-aged men had significantly higher self-efficacy scores at the contemplation stage than at the precontemplation stage ($p < 0.001$). Middle-aged women, meanwhile, had significantly higher self-efficacy scores at the maintenance stage than at the action stage ($p < 0.01$), and at the contemplation stage than at the precontemplation stage ($p < 0.001$). The present findings provide valuable information about the differences in psychological factors affecting physical activity between prime-aged and middle-aged community-dwelling Japanese. This information may be useful to health professionals as they develop effective community-based intervention programs for target populations.

KEYWORDS: transtheoretical model, prime-aged and middle-aged Japanese, physical activity, self-efficacy, interest in physical activity for improving health

Relationship of Psychological Factors with Physical Activity Stage of Change in Prime-and Middle-aged Japanese

Keiko Mori^a, Hisao Suzuki^b, Da-Hong Wang^{a*}, Jiro Takaki^a,
Tomoko Takigawa^a, and Keiki Ogino^a

^aDepartment of Public Health, Okayama University Graduate School of Medicine,
Dentistry and Pharmaceutical Sciences, Okayama 700-8558, Japan, and

^bFaculty of Education, Okayama University, Okayama 700-8530, Japan

The present study aimed to investigate the status of physical activity and the differences in psychological factors associated with physical activity from the perspective of transtheoretical model stages between prime- and middle-aged Japanese. The study involved 375 prime-aged volunteers (175 men, 200 women) and 557 middle-aged volunteers (247 men, 310 women) living in Kuse, a town in Okayama Prefecture, Japan. We found that the prime-aged men at the preparation stage had significantly higher self-efficacy scores than at the contemplation stage ($p < 0.01$). Middle-aged men had significantly higher self-efficacy scores at the contemplation stage than at the precontemplation stage ($p < 0.001$). Middle-aged women, meanwhile, had significantly higher self-efficacy scores at the maintenance stage than at the action stage ($p < 0.01$), and at the contemplation stage than at the precontemplation stage ($p < 0.001$). The present findings provide valuable information about the differences in psychological factors affecting physical activity between prime-aged and middle-aged community-dwelling Japanese. This information may be useful to health professionals as they develop effective community-based intervention programs for target populations.

Key words: transtheoretical model, prime-aged and middle-aged Japanese, physical activity, self-efficacy, interest in physical activity for improving health

The health benefits of regular physical activity and exercise are widely accepted in the United States and are becoming better recognized in Japan [1-3]. However, in actuality, only 28.6% of men and 24.6% of women in Japan engage in regular physical activity [3]. Relative to other developed countries, these percentages are not considered high. Health Japan 21, a national 10-year campaign to set goals to promote the general health of the Japanese

people, recommends increasing the proportion of the Japanese population engaging in regular physical activity to 39% and 35% among men and women, respectively, by 2010. But those recommendations did not indicate how such goals could be reached.

Health Japan 21 defines regular physical activity as that lasting more than 30 min at least twice a week for at least 1 year [4]. In the United States, 2 guidelines for physical activity have been published: CDC/ACSM criteria were issued jointly by the Centers for Disease Control and Prevention (CDC) and the American College of Sports Medicine (ACSM) in 1995 [5, 6], and ACSM-only criteria were published

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*Corresponding author. Phone:+81-86-293-0247; Fax:+81-86-293-2798
E-mail:dahong@md.okayama-u.ac.jp (DH. Wang)

in 1998 [7]. The former guidelines are designed to increase physical activity and include moderate activity, such as walking briskly for a total of 30 min per day either continuously or intermittently (a minimum of three 10-min bouts during the day) at least 5 times a week [5, 6]. The latter are guidelines for physical endurance activity at high intensity for 20 min 3 to 5 times a week [7].

Recently, psychological factors were found to be important to consider in the development of physical activity intervention programs [8]. One of the most effective models, the transtheoretical model (TTM), has been applied to the adoption of regular physical activity and other health behaviors [9, 10]. This theory was primarily developed to account for or predict the individual internal transformation involved in quitting unhealthy behaviors, such as smoking, and it holds that people progress in these efforts through 5 stages: precontemplation, contemplation, preparation, action, and maintenance [9, 10].

The present study aimed to investigate the present status of physical activity in prime- and middle-aged Japanese according to TTM stages and the CDC/ACSM criteria, and to clarify the differences in psychological factors associated with physical activity at each TTM stage. Based on the results, we discussed effective methods that might increase the proportions of prime- and middle-aged Japanese people who exercise regularly.

Subjects and Methods

Subjects. According to the Health Japan 21 definitions, prime age is 25–44 and middle age is 45–64. During January and February 2004, 375 prime-aged volunteers (175 men, 200 women) and 557 middle-aged volunteers (247 men, 310 women) living in Kuse, a town in Okayama Prefecture, Japan, participated in this study. The study was approved by the ethics committee of Okayama University Graduate School of Medicine, Dentistry and Pharmaceutical Sciences following the “Ethical Guidelines for Epidemiology Study” (Ministry of Health, Labour and Welfare). Written informed consent was obtained from all participants.

Measures. All participants completed a questionnaire about their age, gender, height, weight, marital status, number of cohabitating family mem-

bers, and medical treatment history. The participants were also requested to answer the following questions and to return the questionnaire by regular mail.

1. Subjective health status: “How is your health now? 5 = very good, 4 = good, 3 = normal, 2 = not so good, 1 = bad”.

2. Interest in health: “How interested are you in improving your health? 5 = very much, 4 = somewhat, 3 = moderately, 2 = not much, 1 = not at all”.

3. Interest in physical activity for improving health: “How often do you think about physical activity and exercise to improve your health? 5 = very often, 4 = often, 3 = sometimes, 2 = rarely, 1 = never”.

The participants’ self-efficacy in maintaining regular physical activity was measured based on the physical activity scale originally devised by Sallies *et al.* [11]. The scale consisted of 3 items: (1) set aside time to engage in physical activity; (2) engage in physical activity when feeling sad or under stress and (3) engage in physical activity when family or social demands are great. To rate themselves, the participants used a 5-point Likert scale: 5 = agree strongly, 4 = agree moderately, 3 = not sure, 2 = disagree moderately, and 1 = disagree strongly. The Japanese version of the scale was translated by Nishida *et al.* [12, 13].

The perceived benefits and barriers regarding the physical activity scale were originally constructed by Myers and Roth [14]. For males, the Japanese version of the scale has an 8-factor structure containing 5 benefits (psychological, health, weight control, social, and vital) and 3 barriers (physical, time, and specific obstacles; Cronbach’s $\alpha = 0.92\text{--}0.83$) [13]. For females, the Japanese scale has a 7-factor structure containing the same 3 barriers (Cronbach’s $\alpha = 0.93\text{--}0.83$) but no vital benefit [12].

Concerning current physical activity, we asked the participants to select the items that best described their current physical activity level by referring to the Japanese version of the CDC/ACSM criteria by Martin *et al.* [15] as translated by Nishida *et al.* [12, 13]. According to the CDC/ACSM survey form [16], moderate physical activity includes walking briskly with an increase in pulse and respiratory rate, bicycling (including commuting to work), house cleaning, gardening, and gymnastic exercises; vigorous physical activity includes jogging with greater increases in pulse and respiratory rate, aerobics, and

slightly vigorous gardening and the like in daily life. Their answers were classified into the five TTM stages of behavioral change in physical activity according to the CDC/ACSM criteria (Table 1) [4, 9, 12, 13, 15].

Data analysis. Continuous variables were compared using Student's *t*-test or one-way ANOVA followed by post hoc multiple comparisons (Tukey's honestly significant differences test). Categorical variables were compared using the χ^2 test. A *p*-value

less than 0.05 was regarded as statistically significant. Statistical analyses were performed with SPSS11.0 J for Windows (SPSS Japan, Tokyo, Japan).

Results

Table 2 shows the characteristics of the study population. Most participants answered that their subjective health was normal or better. Both working hours per day and working days per week were sig-

Table 1 Stages of physical activity categorized with each physical activity level

Stage	Physical activity level
Precontemplation stage	1) I do not exercise or walk regularly, and do not intend to start in the near future.
Contemplation stage	2) I do not do exercise or walk regularly, but I have been thinking of starting.
Preparation stage	3) I am trying to start to exercise or walk, or I exercise or walking infrequently.
	4) I am doing moderate physical activity ^a less than 5 times per week or vigorous physical activity ^b less than 3 times per week
Action stage	5) I have been doing moderate physical activity ^a 5 or more times per week (or more than 2.5 h per week) for the last 1-6 months.
	6) I have been doing vigorous physical activity ^b 3 to 5 times per week for 1-6 months.
Maintenance stage	7) I have been doing moderate physical activity ^a 5 or more times per week (or more than 2.5 h per week) for 7 months or more.
	8) I have been doing vigorous physical activity ^b 3 to 5 times per week for 7 or more months.

^a, moderate physical activities cause small increases in breathing or heart rate; ^b, vigorous physical activities cause large increases in breathing or heart rate.

Table 2 Demographics of the subjects

	The prime-aged (aged 24–44)		The middle-aged (aged 45–64)	
	Men	Women	Men	Women
Number of subjects	175	200	247	310
Age (yrs)	32.3 ± 5.7	32.8 ± 5.2	52.9 ± 5.3	52.5 ± 5.2
Height (cm)	170.7 ± 5.6	157.9 ± 4.8***	167.6 ± 5.6 ^{†††}	155.4 ± 5.3***†††
Weight (kg)	66.6 ± 10.7	52.3 ± 7.6***	65.0 ± 9.7	54.2 ± 7.9***††
BMI (kg/m ²)	22.8 ± 3.4	21.0 ± 3.0***	23.1 ± 3.0	22.4 ± 3.0**
25.0–29.9	18.3%	8.8%	24.4%	13.9%
≥30	4.1%	2.2%	2.5%	1.7%
Marital status (Married)	60.9%	75.1%	87.6%	86.1%
Number of cohabitating family members	3.7 ± 1.7	4.0 ± 1.7	3.3 ± 1.8 [†]	3.2 ± 1.7 ^{†††}
Working hours per day	9.1 ± 1.6	7.6 ± 1.7***	8.8 ± 1.8	7.8 ± 1.6***
8.0–8.9 (hrs)	47.2%	50.4%	49.2%	59.6%
≥9 (hrs)	47.8%	18.7%	39.7%	18.3%
Working days per week	5.6 ± 0.7	5.3 ± 0.5**	5.6 ± 0.8	5.4 ± 0.8**
Subjective health score	2.7 ± 1.0	2.9 ± 1.0	2.6 ± 1.0	2.7 ± 1.0

Data are expressed as mean ± standard deviation or percentage. ***p*<0.01, ****p*<0.001 (Student's *t*-test, men vs. women).

[†]*p*<0.05, ^{††}*p*<0.01, ^{†††}*p*<0.001 (Student's *t*-test, prime-age vs. middle-age). BMI, body mass index.

nificantly longer for men than for women.

Table 3 shows the numbers and proportions of participants at each TTM stage. The proportions at each TTM stage differ significantly between men and women of prime age, showing a higher proportion of women in the contemplation stage, and a higher proportion of men in the preparation stage. The proportions at each TTM stage did not differ significantly between middle-aged men and women. In addition, among prime-aged subjects who were in the action and maintenance stages, there were no gender differences concerning the practice of moderate or vigorous physical activity. However, among middle-aged respondents, a higher proportion of women than of men engaged in moderate physical activity ($p < 0.05$). The results also showed that 4.0% of prime-aged men,

5.7% of middle-aged men, 7.5% of prime-aged women, and 8.0% of middle-aged women engaged in moderate physical activity, whereas 4.0% of prime-aged men, 5.3% of middle-aged men, 3.0% of prime-aged women, and 2.0% of middle-aged women in the action and maintenance stages engaged in vigorous physical activity. Age and body mass index did not differ significantly among the TTM stages (data not shown).

The prime-aged men at the contemplation stage perceived significantly greater psychological, health, weight control, social, and vital benefits, and had significantly higher levels of interest in both health and physical activity for improvement of health, compared to those at the precontemplation stage. Furthermore, the prime-aged men at the preparation

Table 3 Current physical activity stages of the participants

	The prime-aged (aged 24-44)		The middle-aged (aged 45-64)	
	Men	Women	Men	Women
Precontemplation stage	48 (27.4)	58 (29.0)	68 (27.5)	89 (28.7)
Contemplation stage	44 (25.2)	74 (37.0)*	72 (29.2)	88 (28.4)
Preparation stage	69 (39.4)	47 (23.5)*	80 (32.4)	102 (32.9)
Action stage	4 (2.3)	8 (4.0)	5 (2.0)	12 (3.9)
Maintenance stage	10 (5.7)	13 (6.5)	22 (8.9)	19 (6.1)

Data are expressed as n (%). * $p < 0.05$ (χ^2 test, men vs. women)

Table 4 Factor scores by stage of physical activity in the prime-aged men

Factor	Stage of Physical Activity					F value	Post hoc analysis ^a (Tukey's HSD)
	PC (n = 48)	C (n = 44)	PR (n = 69)	A (n = 4)	M (n = 10)		
Psychological benefits	2.9 ± 0.8	3.6 ± 0.8	3.6 ± 0.9	3.8 ± 1.0	4.0 ± 1.1	7.575***	PC < C***
Health benefits	3.8 ± 0.8	4.3 ± 0.6	4.1 ± 0.6	4.3 ± 0.5	4.3 ± 0.6	4.829***	PC < C***
Weight control benefits	3.3 ± 1.0	4.0 ± 0.9	3.9 ± 1.0	3.0 ± 1.4	4.3 ± 0.7	4.441**	PC < C*
Social benefits	3.3 ± 1.0	4.0 ± 0.9	4.0 ± 1.0	3.8 ± 1.0	4.2 ± 1.0	4.832***	PC < C**
Vital benefits	3.0 ± 0.8	3.7 ± 0.9	3.7 ± 0.9	4.1 ± 0.8	4.0 ± 1.1	5.376***	PC < C*
Physical barriers	2.5 ± 0.9	2.2 ± 0.8	1.8 ± 0.8	2.2 ± 0.8	1.3 ± 0.5	7.910***	
Time barriers	3.5 ± 1.0	3.5 ± 0.9	2.9 ± 1.2	3.8 ± 0.6	2.2 ± 1.2	5.152***	C > PR*
Specific obstacles barriers	2.3 ± 0.9	2.0 ± 0.8	1.7 ± 0.8	2.3 ± 0.9	1.4 ± 0.5	4.979***	
Self-efficacy	2.3 ± 1.0	2.8 ± 0.8	3.4 ± 1.1	3.0 ± 0.5	4.2 ± 1.0	12.359***	C < PR**
Interest in health	2.3 ± 1.0	3.1 ± 0.7	2.9 ± 0.9	3.2 ± 1.5	3.2 ± 0.9	6.946***	PC < C***
Interest in physical activity	1.8 ± 1.0	2.9 ± 0.8	2.7 ± 1.0	3.2 ± 1.0	3.5 ± 1.0	12.359***	PC < C***

PC, Precontemplation stage; C, Contemplation stage; PR, Preparation stage; A, Action stage; M, Maintenance stage; ^a, Comparison of factor scores showing significant differences between the adjacent stages. Data are expressed as mean ± standard deviation.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ (One-way ANOVA).

stage perceived a significantly lower time barrier than those at the contemplation stage and had significantly higher levels of self-efficacy than those at the contemplation stage (Table 4).

Middle-aged men at the contemplation stage reported a perception of significantly greater psychological, weight control, social, and vital benefits than middle-aged men at the precontemplation stage, and also reported significantly higher levels of self-efficacy

and interest in physical activity for improving health. Furthermore, the middle-aged men at the preparation stage perceived a significantly lower time barrier than those at the contemplation stage (Table 5).

Table 6 demonstrates that prime-aged women at the contemplation stage perceived significantly greater psychological and health benefits and had significantly higher levels of self-efficacy, interest in health, and interest in physical activity for improving health than

Table 5 Factor scores by stage of physical activity in the middle-aged men

Factor	Stage of Physical Activity					F value	Post hoc analysis ^a (Tukey's HSD)
	PC	C	PR	A	M		
	(n = 68)	(n = 72)	(n = 80)	(n = 5)	(n = 22)		
Psychological benefits	2.6 ± 0.8	3.0 ± 0.7	3.0 ± 0.7	3.2 ± 0.6	3.3 ± 0.6	5.811***	PC < C**
Health benefits	3.9 ± 0.9	4.1 ± 0.7	4.2 ± 0.7	4.0 ± 0.5	4.1 ± 0.7	1.306	
Weight control benefits	3.4 ± 1.2	3.8 ± 0.9	3.6 ± 1.0	3.7 ± 0.8	3.9 ± 0.8	2.323	PC < C*
Social benefits	3.6 ± 1.2	4.2 ± 0.8	4.2 ± 0.9	4.0 ± 0.7	4.3 ± 0.9	4.788***	PC < C**
Vital benefits	3.2 ± 1.0	3.7 ± 1.0	3.7 ± 1.0	4.1 ± 0.9	3.9 ± 0.8	3.888**	PC < C*
Physical barriers	2.2 ± 0.8	2.1 ± 0.7	1.9 ± 0.7	1.8 ± 0.6	1.9 ± 0.7	1.626	
Time barriers	3.3 ± 1.0	3.2 ± 1.1	2.7 ± 1.1	2.7 ± 1.3	2.6 ± 1.0	4.051**	C > PR*
Specific obstacles barriers	1.9 ± 0.8	1.9 ± 0.8	1.7 ± 0.8	1.5 ± 0.6	1.7 ± 0.7	1.216	
Self-efficacy	2.3 ± 1.0	3.2 ± 1.0	3.5 ± 1.0	4.1 ± 0.5	4.3 ± 0.7	26.819***	PC < C***
Interest in health	2.7 ± 0.9	3.0 ± 0.8	3.0 ± 0.9	3.8 ± 0.5	3.5 ± 0.6	5.283***	
Interest in physical activity	1.8 ± 1.1	2.8 ± 0.9	2.9 ± 0.9	3.0 ± 1.2	3.6 ± 0.6	19.636***	PC < C***

PC, Precontemplation stage; C, Contemplation stage; PR, Preparation stage; A, Action stage; M, Maintenance stage; ^a, Comparison of factor scores showing significant differences between the adjacent stages. Data are expressed as mean ± standard deviation.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ (One-way ANOVA).

Table 6 Factor scores by stage of physical activity in the prime-aged women

Factor	Stage of Physical Activity					F value	Post hoc analysis ^a (Tukey's HSD)
	PC	C	PR	A	M		
	(n = 58)	(n = 74)	(n = 47)	(n = 8)	(n = 13)		
Psychological benefits	3.3 ± 0.7	3.7 ± 0.8	3.5 ± 0.7	3.1 ± 1.0	3.9 ± 0.9	3.665**	PC < C*
Health benefits	4.0 ± 0.6	4.4 ± 0.6	4.2 ± 0.7	3.6 ± 1.2	4.4 ± 0.6	4.825***	PC < C**
Weight control benefits	3.8 ± 0.7	4.2 ± 0.7	3.9 ± 0.8	3.8 ± 1.4	4.3 ± 0.6	2.755*	
Social benefits	3.9 ± 0.7	4.1 ± 0.7	4.1 ± 0.7	3.7 ± 0.9	4.2 ± 0.8	1.505	
Physical barriers	2.5 ± 0.8	2.2 ± 0.8	2.1 ± 0.7	1.9 ± 0.7	2.2 ± 1.0	2.425*	
Time barriers	3.4 ± 0.9	3.1 ± 0.8	3.1 ± 0.7	2.3 ± 1.1	2.7 ± 1.2	3.485**	
Specific obstacles barriers	1.9 ± 0.8	1.6 ± 0.7	1.7 ± 0.6	1.4 ± 0.5	1.6 ± 0.7	2.325	
Self-efficacy	2.4 ± 0.9	2.9 ± 1.1	3.1 ± 1.0	3.0 ± 0.9	4.1 ± 1.4	8.592***	PC < C*
Interest in health	2.6 ± 0.8	3.1 ± 0.8	3.1 ± 0.7	2.7 ± 1.0	3.0 ± 0.9	3.322*	PC < C*
Interest in physical activity	2.3 ± 1.0	2.8 ± 0.7	3.0 ± 0.8	2.5 ± 0.9	2.9 ± 1.0	5.278***	PC < C**

PC, Precontemplation stage; C, Contemplation stage; PR, Preparation stage; A, Action stage; M, Maintenance stage; ^a, Comparison of factor scores showing significant differences between the adjacent stages. Data are expressed as mean ± standard deviation.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ (One-way ANOVA).

those at the precontemplation stage.

Middle-aged women at the maintenance stage had a significantly higher level of self-efficacy than those at the action stage; and those at the contemplation stage had higher levels of self-efficacy and interest in physical activity for improving health than those at the precontemplation stage, while those at the preparation stage had a higher level of interest in physical activity for improving health than those at the contemplation stage (Table 7).

Discussion

Our findings indicated that, from the perspective of the TTM stages, self-efficacy and interest in physical activity for improving health are important factors for prime- and middle-aged Japanese people in their decision about whether or not to engage in regular physical activity.

One of the goals of Health Japan 21 is to raise public awareness of physical activity for improving health, and to increase physical activity in daily life. As far as we know, no data show that interest in physical activity for improving health is associated with increased levels of physical activity as TTM stages progress. It may be useful to increase interest in physical activity for improving health, as well as self-efficacy, among prime- and middle-aged Japanese people, by providing information that emphasizes the

benefits of physical activity and showing practical physical activities that can be performed simply in daily life. We also found that the self-efficacy scores for prime- and middle-aged women were significantly lower in the precontemplation stage than in the contemplation stage. The self-efficacy scores for prime-aged men were significantly lower in the contemplation stage than in the preparation stage. In agreement with studies in Europe, North America, and Australia [17-21], the present results reveal a consistent positive relationship between exercise self-efficacy and stage of change. In Japan, a few recent studies investigated this relationship in occupational fields and also found a positive relationship between exercise self-efficacy and stage of change [12, 13, 19]. Since the present study used a community-based sample, the subjects seemed to represent a more general population and to be more representative of Japanese men and women than a survey of an occupational field.

Sallis *et al.* reported that people in the precontemplation stage do not recognize the benefits of physical activity [18]. In this study, prime-aged men in the contemplation stage had significantly higher perceived psychological, health, weight control, social, and vital benefits than those in the precontemplation stage; and the scores for middle-aged men in all benefit types except health, were significantly lower in the precontemplation stage than that in the contemplation stage. Interest in physical activity for improving health was

Table 7 Factor scores by stage of physical activity in the middle-aged women

Factor	Stage of Physical Activity					F value	Post hoc analysis ^a (Tukey's HSD)
	PC (n = 89)	C (n = 88)	PR (n = 102)	A (n = 12)	M (n = 19)		
Psychological benefits	3.3 ± 0.8	3.6 ± 0.7	3.8 ± 0.7	3.4 ± 0.8	4.0 ± 0.7	5.955***	
Health benefits	4.0 ± 0.8	4.3 ± 0.7	4.3 ± 0.6	4.1 ± 0.5	4.7 ± 0.4	4.769***	
Weight control benefits	3.7 ± 0.9	3.9 ± 0.8	3.9 ± 0.8	3.8 ± 0.8	4.1 ± 0.7	1.413	
Social benefits	3.9 ± 0.9	4.2 ± 0.7	4.3 ± 0.7	4.0 ± 0.9	4.6 ± 0.4	5.198***	
Physical barriers	2.3 ± 0.8	2.2 ± 0.8	2.0 ± 0.8	1.8 ± 0.7	1.9 ± 0.8	3.708**	
Time barriers	3.0 ± 1.0	3.0 ± 1.0	2.8 ± 1.1	2.4 ± 1.1	1.9 ± 0.9	5.913***	
Specific obstacles barriers	1.8 ± 0.7	1.8 ± 0.9	1.6 ± 0.7	1.5 ± 0.6	1.6 ± 0.9	1.089	
Self-efficacy	2.6 ± 1.1	3.1 ± 0.9	3.4 ± 0.9	3.2 ± 0.8	4.2 ± 0.8	15.990***	PC < C***, A < M*
Interest in health	3.1 ± 0.8	3.3 ± 0.8	3.5 ± 0.7	3.2 ± 0.8	3.6 ± 0.8	4.021**	
Interest in physical activity	2.5 ± 0.9	2.9 ± 0.8	3.4 ± 0.8	3.4 ± 0.7	3.6 ± 0.8	17.029***	PC < C*, C < PR*

PC, Precontemplation stage; C, Contemplation stage; PR, Preparation stage; A, Action stage; M, Maintenance stage; ^a, Comparison of factor scores showing significant differences between the adjacent stages. Data are expressed as mean ± standard deviation.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ (One-way ANOVA).

also significantly lower in the precontemplation stage than in the contemplation stage for both prime- and middle-aged men. It seems that although men in the precontemplation stage perceived the benefits of physical activity, those benefits were not a powerful motivator for them to adopt regular physical activity. Therefore, it may be necessary to increase interest in physical activity for improving health, and to increase self-efficacy, for men in the precontemplation stage by providing information on the benefits of physical activity and showing the practical ways that physical activity can be simply performed in daily life.

Prime- and middle-aged men considered time as a barrier to physical activity. Time barriers were significantly higher among men in the contemplation stage than in the preparation stage. The present findings implied the importance of removing or alleviating these time barriers as much as possible for people in the contemplation stage in order to plan interventions aimed at moving on to higher stages of physical activity.

In the U.S., a greater percentage of people do vigorous physical activity than moderate physical activity [22]. In the present study, on the other hand, the 2 rates were almost the same for men and among women the proportion doing moderate activity was higher than that doing vigorous activity. This might be explained by data showing that Japanese women engage in less physical activity [23] compared to men and prefer moderate physical activity to vigorous physical activity [20, 24]. Therefore, recommending moderate rather than vigorous physical activity to women might be more effective in increasing the proportion of women who engage in regular physical activity.

Our data suggest the importance of informing target persons that moderate physical activities that can be part of one's daily routine, such as walking, commuting or shopping by bicycle, gardening, and stretching exercises at home, have few barriers and are beneficial to their health.

The findings in this study are subject to some limitations. First, the number of participants was small. Second, no public sports facilities exist in the target area, although many kinds of activity are available throughout the town, such as walking courses with signs and local exercise lessons conducted regularly at community centers. Third, because this study was

cross sectional, causal relationships were not determined and physical activity itself might also be one of confounders to psychological determination. Fourth, some reporting bias may have been introduced because the survey was carried out via a self-reported measure of physical activity.

Further study is needed to examine whether the findings in this town can be applied to all adult Japanese. Nevertheless, the findings of the present study provide valuable information about the differences in psychological factors of physical activity between community-dwelling prime- and middle-aged Japanese. Such information may help health professionals develop effective intervention programs for target populations.

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