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行動医学を応用した身体活動推進プログラムの効果に関する無作為割付対照試験

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【要旨】 身体活動の健康に対する効果はすでに多くの研究により知られているが、身体活動量を増加させ長期間維持させるような効果的なプログラムは確立されておらず、生活習慣病対策の上で重要な課題となっている。そこで、行動医学を応用した身体活動推進プログラムを開発しその効果を検討することを本研究の目的とした。対象は運動習慣のない中高年女性86名とし、8ヶ月間 (2ヶ月間の集中介入+6ヶ月間の経過観察) の無作為割付対照試験を実施した。評価指標は24時間活動記録法に基づいた身体活動によるエネルギー消費量、運動に関する行動科学指標、体力、体格・体構成、血中脂質とした。エネルギー消費量は、総エネルギー消費量 (総消費量) に加え、活動強度別に中等度の活動による消費量 (中等度消費量)、高強度の活動による消費量に分けて検討した。評価は介入前、2ヵ月後 (集中介入直後)、8ヶ月後 (経過観察終了後) の3回実施し、その全てに参加した84名 (47~68歳、平均年齢57.2歳) (経過観察率97.7%) を解析の対象とした。その結果、総消費量、中等度消費量の2ヵ月後および8ヵ月後の変化量は対照群と比較して介入群において有意に大きかった。また、運動頻度、運動習慣のステージ、運動習慣の自己効力、一部の体力指標、体脂肪率において介入の効果が認められた。以上より、新たに作成した行動医学的手法を用いた身体活動推進プログラムは、8ヶ月間に渡り身体活動量を増加させ、体力、体脂肪率を改善することに有効であることが明らかとなった。

〈Key words〉身体活動、介入、無作為割付対照試験、行動医学

Relation of the stages of change for exercise behaviors, self-efficacy, decisional-balance, and diet-related psycho-behavioral factors in young Japanese women

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Background. **A large proportion of young Japanese women is inactive. Exercise has important health benefits, however, abnormal weight/eating concerns and excessive dieting practices among physically active young women also have been reported in many cross-sectional studies. The purpose of this study was to examine the relationships between stages of change for exercise behaviors and exercise/dieting related psycho-behavioral factors using the Transtheoretical Model of behavior change as a theoretical framework.**

Methods. **A cross-sectional study included 450 young Japanese women aged 18 to 21 (18.4±0.67 years). Subjects in precontemplation (n=111, 24.7%), contemplation (n=120, 26.7%), preparation (n=177, 39.3%), action (n=17, 3.8%), and maintenance (n=25, 5.6%) were compared on physique, body composition, current exercise practices, exercise self-efficacy, decisional balance (benefits and costs exercise), as well as dieting behaviors and weight/eating concerns.**

Results. **Stages of change for exercise behaviors were significantly related to exercise self-efficacy and perceived benefits as well as to dieting behaviors and weight/eating concerns. Subjects in the higher stages had higher self-efficacy, perceived benefits of exercise, and healthy dieting behaviors; however, some of them also had unhealthier dietary practices, higher phobia of obesity and obsession with eating than those in lower stages.**

Conclusions. **These findings provide support for applying the transtheoretical model of exercise behavioral change to Japanese young women. Additionally, it is also important to pay attention to stage specific psycho-behavioral factors related to their dieting.**

KEY WORDS: Health behavior - Exercise - Self-efficacy - Diet - Eating disorders, psychology - Women - Decision making.

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Physical activity promotion is not only physiologically beneficial in terms of the prevention of various lifestyle related diseases such as coronary heart disease, diabetes mellitus and obesity, but it also has many psychological benefits such as reducing stress and improving self-esteem.[1] However, a large proportion of young Japanese women are physically inactive. According to a 1998 Japanese National Nutritional Survey, only 15.2% of young women from 20 to 29 years old perform physical activity regularly.[2] This rate is lower than those of older age-groups in women (*i.e.*, 60-year-old age-group: 31.2%, 70-year-old age-group: 27.3%) and all age-groups in men (25.5%); yet, there are few research studies regarding physical activity among young women in Japan.

The Transtheoretical Model of Prochaska *et al.*[3] has increasingly been used as the theoretical basis for the development of life style behavior intervention strategies. This model regards behavior change as a process that involves progression through a series of stages: 1) precontemplation: a stage at which there is no intention to change behavior in the foreseeable future, 2) contemplation: a stage in which people are aware that a problem exists, and are seriously thinking about overcoming it but have not yet made a commitment to take action, 3) preparation: a stage that combines inten-

tion and behavioral criteria, 4) action: a stage in which individuals modify their behavior, and finally 5) maintenance: a stage in which people work to prevent relapse and consolidate the gains attained during action.[4] Different psycho-behavioral patterns are typical to each of the five stages. These differences help to explore how and why persons move through these stages. Furthermore, it was suggested that stage-specific interventions are more successful than nonspecific intervention.[5]

Two important components within the Transtheoretical Model are self-efficacy and decisional balance. Self-efficacy is a specific belief in one's ability to perform to a certain level a particular behavior.[6] Exercise self-efficacy has been found to be increasing in a linear fashion with advancing the stages of change for exercise.[7-9] In these studies, precontemplators reported the lowest self-efficacy, and those in maintenance reported the highest exercise related self-efficacy. Decisional balance is the central concept within the Decision-Making Theory.[10] This theory posits that people make decisions based on their evaluation of the cost and benefit associated with the decision. Perceptions of benefits of and costs to performing exercise have been shown to vary systematically across the stages of change. Precontemplators reported more costs than benefits of exercising, whereas action stage persons reported more benefits than costs to exercising.[8, 11] These findings validated the stages concept as applied to exercise behavior. However, only a few studies examined the applicability of the stages of change model to exercise behavior in young Japanese women.

Additionally, in promoting exercise for young women, it is very important to consider the negative relationship between exercise and dieting related psychobehavioral health. It has been suggested that regular exercise habits might also be associated with a series of weight control behaviors, and preoccupations that can cause health-damaging effects.[12] Particularly for young women, weight loss is the main incentive for initiating regular exercise.[13, 14] Several studies were aimed at the association between regular exercise and weight/eating related problems in young women, and consistently demonstrated a strong positive correlation.[15] Exercise participation was a significant predictor of eating disorder symptoms. Furthermore, a previous study of female college students in Japan[16] found that exercise was associated with eating disorder- and weight loss-related concerns/behavior even though they did not exercise frequently.

For young women, engaging in regular exercise prevents osteoporosis and promotes a sense of social well-being; however, it is unclear how exercise stages are associated with weight/eating related psycho-behavioral factors. To further explore exercise behavior among young Japanese women, this study examined self-efficacy, decisional balance, dieting behavior, and weight/eating concerns in each stage of exercise behavior.

Two research questions were addressed in this study: 1) how did exercise self-efficacy and balance of decisional considerations vary among the five stages? and 2) how did dieting behavior and weight/eating concerns vary between the five stages?

Materials and methods

Subjects and procedure

A total of 450 female students from two universities in Tokyo participated in the current study. The mean age of the subjects was 18.4 years (SD=0.67, range 18 to 21). All of the students were in the same ethnic group and were of Asian race. Of these, 36 (8.0%) were in the Department of Education, 158 (35.1%) in the Department of English Language and Literature, 85 (18.9%) in Dietetics, 87 (19.3%) in Nurse Training, and 84 (18.7%) in Life Science. During the students' regular education classes, subjects were administrated a questionnaire that included the measures described below and conducted physiological measures.

Questionnaire

Stages of change for exercise behaviors.—Using the 5-point ordered categorical scale based on a measure developed by Cardinal,[17] which was translated into Japanese by the authors, the stages of exercise behavior were assessed as follows: precontemplation (PC): "*I presently do not exercise and do not plan to start exercising in the next six months*"; contemplation (C): "*I presently do not exercise but I have been thinking about starting to exercise within the next six months*"; preparation (PR): "*I presently get some exercise, but not regularly*"; action (AC): "*I presently exercise on a regular basis, but I began only within the past six months*"; maintenance (MT): "*I presently get*

some exercise and have been exercising regularly for longer than six months". Spearman's rank correlation coefficient of reliability over a three-day period was 1.00 (n=12), and concurrent validity for this measure already has been established by its significant association with the Seven Day Recall Physical Activity Questionnaire and peak$\dot{V}O_2$.[17] A two week period test-retest reliability of the Japanese version of the stage of change for exercise behavior measure was examined in a subset of 57 participants of this study. Spearman's rank correlation coefficient was 0.81.

Current exercise practices.—Subjects were asked to indicate whether they engaged in any exercise or sports on a regular basis. For each activity endorsed, they were asked to indicate the number of days per week or month and duration per session typically spent participating in that activity.

Exercise self-efficacy.—A five-item self-efficacy measure was developed for this study, taking previously published documents into account.[8, 18] These items were: *"make time to exercise even when I am tired," "make time to exercise even when I am in a bad mood," "make time to exercise even when something is bothering me," "make time to exercise even when I am depressed"* and *"make time to exercise even when I am busy."* A-five point Likert scale was used to rate each item, from 1 being *"I could not do it"* to 5 being *"Sure I could do it"*. The scores of these five items were totaled; scores could range from 5 to 25. Internal consistency of this scale was 0.82 for the total subjects completing this scale (n=450). Test-retest reliability over a two-week period of this scale in a subset of 56 participants was 0.83.

Decisional balance measures.—Six benefit of exercise items and six cost to exercise items were developed for this study, taking measures reported by Marcus, *et al.*[8, 11] into account. Examples of benefit items were *"I would feel healthier if I exercised regularly"* and *"I would feel less stressed if I exercised regularly,"* and examples of negative items were *"Regular exercise would take too much of my time", "I would have less time for my family and friends if I exercised regularly"*. A five-point Likert scale was used to rate each item with 1 being *"not important"* to 5 being *"extremely important"*. In preliminary analysis, a principal-component analysis using oblimin rotation (delta=0) was conducted to confirm its factor component. The solution with eigenvalues greater than 2.0 for the Decisional Balance contained two factors accounting for 38.9% of the variance (Table I). Internal consistency of these measures in the subjects completing the scale (n=447) were 0.77 for benefit items and 0.76 for cost items. Test-retest reliabilities (Pearson correlation coefficients) of the subscale score over a 2-week period in a subset of 53 participants were 0.83 and 0.78, respectively.

TABLE I.–*Results of principal-component loading for decisional balance measure (no.=447).*

Items	Loading	
	Benefits	Costs
I would feel less stressed if I exercised regularly	0.50	-0.12
Regular exercise would help feel better in my life	0.67	-0.23
Regular exercise would be useful for my weight control	0.62	-0.11
I would be healthier if I exercised regularly	0.69	-0.09
Other people would respect me more if I exercised regularly	0.36	0.18
I would feel better about myself if I exercised regularly	0.87	-0.17
Regular exercise would take too much for my time	-0.08	0.73
I would have less time for my family and friends if I exercised regularly	-0.01	0.61
I would have less time for relax if I exercised regularly	-0.17	0.60
I think I would be too tired to do my daily work after exercising	-0.06	0.58
At the end of the day, I am too exhausted to exercise	-0.05	0.54
I would probably be sore and uncomfortable if I exercised regularly	-0.20	0.46
Eigenvalue	2.5	2.2
Percent of variance	20.5	18.4
Cummulative percent	20.5	38.9

Diet behavior scale.—The diet behavior scale[19] was employed to assess the subjects' dieting behavior. This scale is a validated self-reported questionnaire, which is comprised of 22 items on two subscales (Structured Diet subscale and Extraordinary Diet subscale) rated on a six-point Likert scale ranging from 1 being *"not at all"* to 5 being *"always"* with the general instruction: *"During the past three months, how much have you been dieting to lose weight with the following methods?"* The Structured Diet subscale: SD (14 items) includes healthy dieting behaviors (*e.g.*, eating slowly, decreasing fat intake). The Extraordinary Diet subscale: ED (eight items) includes unhealthy dieting behaviors (*e.g.*, skipping meals, eating low-calorie food only, using laxatives). Cronbach's α coefficients were 0.81 and 0.93, respectively (n=443).

Eating Attitude Test (EAT-20).—To assess weight/dieting-related cognitive and behavioral characteristics, the Japanese version of the Eating Attitude Test: EAT-20 20 (Originally developed by Garner *et al.*[21]) was used. This measure was composed of 20 items on three subscales (obsession with eating, dieting, and obese phobia) using a six-point Likert scale ranging from 1 being *"never"* to 6 being *"always"* Examples of obsession with eating subscale (eight items) include *"feel extremely guilty after eating"* and *"become anxious prior to eating"*, and examples of dieting subscale (eight items) include *"avoid foods with sugar in them"* and *"display self control around food"*. Finally examples of obese phobia subscale (four items) include *"am terrified about being overweight"* and *"feel uncomfortable after eating sweets"*.

Physique and body composition

Height measurement, and waist and hip circumferences were measured to the nearest millimeter and body weight to the nearest 0.1 kg, while fat distribution was assessed in two different ways: skinfold thicknesses (SFT) and circumference (waist/hip ratio, WHR [cm/cm]). The body mass index (BMI) was calculated as weight in kilograms divided by height in meters squared. Triceps and subscapular SFT were determined in triplicate using the skinfold caliper. Percentage of body fat, body fat mass (BFM) and lean body mass (LBM) were calculated from the sum of the skinfold data using a formula by Brozek *et al.*[22] Waist and hip circumstances were measured on subjects standing in an upright position following an unforced exhalation. Circumstance measurements were taken for the waist at a level midway between the inferior margin of rib cage and the superior border of the iliac crest, and for the hips at the area of greatest circumstance in the buttock area.

Statistical analyses

All of the data were analyzed using the SPSS 10.0 statistical package (SPSS Institute Inc., 1999). Multivariate analysis of variance (MANOVA) and one-way analysis of variance (ANOVA) were used to examine the association between the stages of change for exercise behaviors and other dependent variables. In order to provide a standard metric, some of the psycho-behavioral measures were converted to T-scores (M=50, SD=10). Tukey *posthoc* tests were used to determine which stages of change were able to differentiate. A p-value of 0.05 (two-tailed) was interpreted as statistically significant for all of the analyses. Sample size varied in the different analyses due to missing data.

Results

Demographics

The mean BMI was 20.6 kg/m^2 (SD=2.4; range 15.1 to 36.6). Sixteen per cent of the subjects were thin (BMI <18.5 kg/m^2), 81.0% were normal (18.5 kg/m^2 ≤BMI <25 kg/m^2), and 2.7% were obese (BMI ≥25.0 kg/m^2) according to the criterion defined by the Japan Society for the Study of Obesity (1999). The mean number of physical activity sessions per week was 0.65 (SD=1.4). Of this group, 74.9% had exercised regularly during junior high school periods whereas 52.3% had exercised regularly during high school periods.

Distribution of the stages of change for exercise behaviors

Based on the definition of the Stages of Change for Exercise Behaviors Questionnaire, subjects were classified into five stages: precontemplation: PC (n=111, 24.7%); contemplation: C (n=120, 26.7%); preparation: PR (n=177, 39.3%); action: AC (n=17, 3.8%); and maintenance: MT (n=25, 5.6%). Almost half of the inactive subjects were thinking about doing more exercise.

Stages of change for exercise behaviors and physique/body composition

Means and *posthoc* contrasts for each body and circumstance variable across each stage of exercise are reported in Table II. The MANOVA of body weight related measures was significant, Hotelling's T^2=0.21, p<0.001. ANOVA revealed significant differences between groups on BMI, F (4, 443)=3.67, p=0.006. BMI was significantly higher for subjects in MT compared to PC and C. Lean body mass was also showed significant differences between stages, F (4, 441)=16.12, p<0.001. This measure was higher for subjects in PR and MT compared to PC, and MT compared to C, PR and AC. However, there were no significant differenc-

TABLE II.—*Means and Standard Deviations of the body composition measures across the stages of change for exercise behaviors.*

Variables	Stages of change for exercise behaviors										Tukey's HSD ($p<0.05$)
	PC[a]		C[b]		PR[c]		AC[d]		MT[e]		
	M	SD	M	SD	M	SD	M	SD	M	SD	
BMI (kg/m^2)	20.1	(1.8)	20.5	(2.5)	20.8	(2.6)	20.4	(2.5)	22.0	(1.8)	PC, C<MT
SFT (mm)	42.3	(8.1)	43.7	(8.9)	42.8	(9.7)	43.9	(11.2)	42.6	(10.1)	–
Body fat (%)	28.1	(4.7)	28.9	(5.1)	28.4	(5.5)	28.9	(6.5)	28.3	(5.7)	–
FBM (kg)	14.1	(3.5)	15.0	(4.4)	15.1	(4.7)	15.4	(4.3)	16.6	(4.3)	–
LBM (kg)	35.8	(3.1)	36.1	(3.5)	37.0	(3.3)	36.8	(41.8)	41.8	(6.0)	PC<PR, MT; C, PR, AC<MT
WHR	0.72	(0.03)	0.73	(0.04)	0.72	(0.04)	0.73	(0.05)	0.73	(0.03)	–

[a]n=111. [b]n=120. [c]n=177. [d]n=17. [e]n=25. Stage of change for exercise behaviors: PC=precontemplation; C=contemplation; PR=preparation; AC=action; MT=maintenance. All comparisons were made using analyses of variance. *Posthoc* comparisons were made using the Tukey procedure. Tukey comparisons that were significant are indicated by the "<" symbol. If differences were not significant, a comma was used. Dash=no significant differences. SFT=skinfold thicknesses. SFT(mm) calculated as triceps SFT (mm) + subscapular SFT (mm). FBM=fat body mass. LBM=lean body mass. WHR=waist/hip ratio[cm/cm].

TABLE III.—*Mean "t"-scores and Standard Deviations of the psycho-behavioral measures across the stages of change for exercise behaviors.*

Variables	Stages of change for exercise behaviors										Tukey's HSD ($p<0.05$)
	PC[a]		C[b]		PR[c]		AC[d]		MT[e]		
	M	SD	M	SD	M	SD	M	SD	M	SD	
Exercise self-efficacy	44.6	(8.8)	49.7	(8.7)	51.9	(9.5)	54.3	(10.2)	59.2	(12.0)	PC<C, PR, AC, MT; C, PR<MT
Decisional balance:											
—Benefits of exercise	46.0	(9.5)	52.5	(9.5)	50.6	(9.9)	50.5	(9.0)	51.4	(11.1)	PC<C, PR
—Costs to exercise	50.9	(9.4)	50.3	(10.5)	49.6	(9.9)	46.9	(10.0)	49.2	(11.2)	–
Diet Behavior Scale:											
—Structured diet	48.0	(9.8)	48.3	(9.6)	51.5	(10.0)	53.7	(9.7)	54.6	(9.6)	PC<PR, MT; C<MT
—Extraordinary diet	46.1	(9.4)	49.1	(9.5)	52.2	(9.7)	52.0	(11.3)	55.3	(10.0)	PC<PR, MT; C<MT
Eating Attitude Test:											
—Obsession with eating	47.8	(8.6)	49.7	(10.5)	50.8	(9.6)	51.9	(12.8)	54.1	(12.1)	PC<MT
—Dieting	46.2	(8.5)	49.0	(9.9)	52.1	(10.0)	53.8	(10.2)	54.8	(10.3)	PC<PR, AC, MT; C<MT
—Obese phobia	46.5	(8.8)	51.2	(10.0)	50.6	(10.2)	50.9	(9.2)	54.8	(10,6)	PC<C, PR, MT
—EAT total	46.4	(8.6)	49.8	(10.3)	51.4	(9.7)	52.7	(11.4)	55.3	(10.8)	PC<PR, MT

[a]n=111. [b]n=120. [c]n=177. [d]n=17. [e]n=25. Stage of change for exercise behaviors: PC=precontemplation; C=contemplation; PR=preparation; AC=action; MT=maintenance. All comparisons were made using analyses of variance. *Posthoc* comparisons were made using the Tukey procedure. Tukey comparisons that were significant are indicated by the "<" symbol. If differences were not significant, a comma was used. Dash=no significant differences.

es on skinfold thickness, percent body fat, and waist-hip ratio between the different stages of exercise.

Stages of change for exercise behaviors and psycho-behavioral measures

Mean exercise frequency per week was 0.63±1.0 times in PR, 3.8±1.8 times in AC and 4.5±1.3 times in MT. ANOVA revealed a significant difference on exercise frequency among PR, AC and MT stages, F (2, 218)=168.86, $p<0.001$. Tukey's *posthoc* test indicated that subjects in AC and MT exercised more frequently than those in PR. Although those in MT reported the highest frequency of participation, the frequency was not significantly different from those in the AC group. A significant difference in duration of each exercise session was also observed, F (2, 218)=34.9, $p<0.001$. Mean duration of each exercise session was 36.6±54.0 min in PR, 97.0±107.6 min in AC and 151.9±107.6 min in MT. Tukey's *posthoc* analysis revealed that duration of each exercise session was significantly longer among subjects in MT and AC compared to PR, and MT compared to AC. MT reported the longest time exercising.

Mean T-scores and *posthoc* contrasts for each psycho-behavioral variable across each stage are reported in Table III. Difference in exercise self-efficacy by the stages was significant, F (4, 449)=18.10, $p<0.001$.

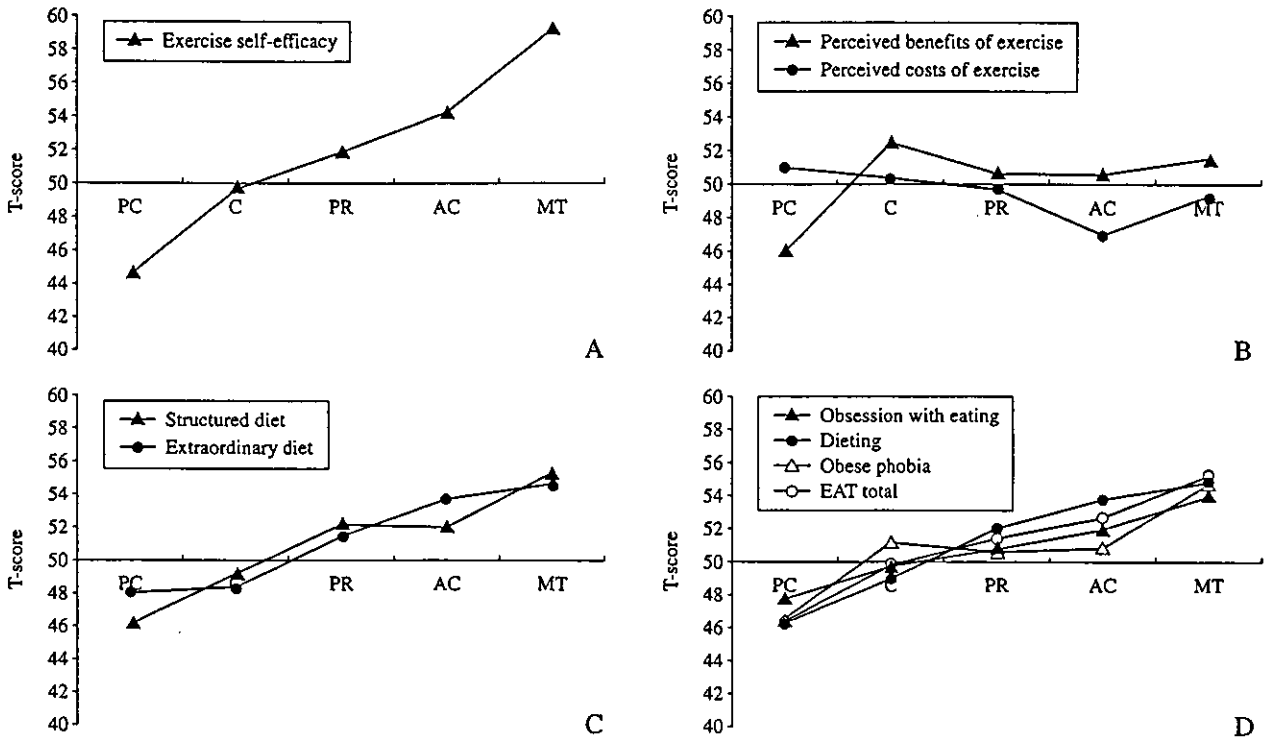

Fig. 1.—Mean T-scores of A) the exercise self-efficacy; B) the decisional balance measure; C) the Diet Behavior Scale; and D) Eating Attitude Test by the stage of change for exercise behaviors.

Based on Tukey's *posthoc* analysis, exercise self-efficacy scores were significantly higher for subjects in PR, C, PR, AC, and MT compared to PC, and MT compared to C and PR. Figure 1A illustrates the mean T-score differences on the exercise self-efficacy for each of the five stages.

MANOVA of the decisional balance measures was significant, Hotelling's T^2=0.070, p<0.001. Difference on the perceived benefits of exercise was also significant, F (4, 446)=7.05, p<0.001. Based on a Tukey's *posthoc* analysis, the perceived benefits of exercise scores were significantly higher for subjects in C and PR compared to PC. However, there was no significant difference on perceived costs for exercise among the five stages. Figure 1B illustrates the mean T-score differences on the two subscales of decisional balance for each of the five stages.

MANOVA of the Dieting Behavior subscale scores was significant, Hotelling's T^2=0.096, p<0.001. ANOVA for the Structured Diet subscale scores was significant, F (4, 441)=8.85, p<0.001. Individuals in PR and MT reported significantly higher scores than those in PC. Furthermore, individuals in MT had significantly higher scores than those in C. Similarly, ANOVA for Extraordinary Diet subscale scores showed significant differences, F (4, 441)=4.90, p=0.001. Individuals in PR and MT reported significantly higher scores than PC. Additionally, individuals in MT had significantly higher scores than those in C. Figure 1C illustrates the mean T-score differences on the two subscales of Diet Behavior Scale for each of the five stages. The means of two subscale scores showed linear trends.

MANOVA of the Eating Attitude Test subscale scores was significant, Hotelling's T^2=0.110, p<0.001. Significant differences were observed for the obsession with eating subscale scores on EAT, F (4, 443)=2.96, p=0.020. Individuals in MT showed a significantly higher score than PC. Similarly, ANOVA for dieting subscale scores on EAT was significant, F (4, 443)=8.73, p=0.001. Dieting scores were significantly higher for subjects in PR, AC and MT compared to

PC, and MT compared to C. Furthermore, there was a significant difference in obese phobia subscale scores on EAT, $F(4, 443)=5.63$, $p<0.001$. Individuals in C, PR and MT showed significantly higher obese phobia scores than PC. Finally, EAT total scores were significantly different between the five stages, $F(4, 443)=6.98$, $p<0.001$. These scores were significantly higher for subjects in PR and MT compared to PC. Figure 1D illustrates the mean T-score differences on three subscales and the total score of Eating Attitude Test for each of the five stages. The means of three subscales and the total score showed a linear trend with advancing stages.

Discussion

The sample in this study appeared to be less 'active' than in previous studies using the stages of change for exercise behavior.[7-9, 11, 17, 23] A greater proportion of the subjects in the present study were in the precontemplation stage (24.7%) compared with the studies by Gorely *et al.* (*i.e.*, older adults sample: 14.5%),[7] Marcus *et al.* (worksite sample: 8.0% and 7.2%, respectively),[8] Wyse *et al.* (*i.e.*, young females: 6.3%),[9] Marcus *et al.* (worksite sample: 7.4%),[11] Cardinal *et al.* (female adults: 4.5%),[17] and Booth *et al.* (*i.e.*, 20 year old age-group: 6.1%).[23] On the other hand, a lower proportion of the sample population in this study were in the maintenance stage (5.6%) compared with the studies by Gorely *et al.* (*i.e.*, older adults sample: 37.3%),[7] Marcus *et al.* (worksite sample: 19.2% and 24.7%, respectively),[8] Wyse *et al.* (*i.e.*, young females: 18.2%),[9] Marcus *et al.* (worksite sample: 19.4%),[11] Cardinal *et al.* (female adults: 23.0%),[17] and Booth *et al.* (*i.e.*, 20-year-old age-group: 39.4%).[23] These differences might be attributed to a singularity of the subjects in the present study not including men and older age adults. However, the distribution of the stages in our study appears to reflect the evidence of the exercise epidemiology literature in Japan,[2] in that a large proportion of young women is inactive.

In our study, there was no significant difference in skinfold thickness, percent body fat, body fat mass and waist-hip ratio between the five stages; however, subjects in maintenance showed significantly higher BMI than those in precontemplation and contemplation. The maintenance stage also showed the greatest increase in lean body mass among the five stages. Physical activity and body weight generally have been correlated; lack of physical activity is associated with obesity. However, our results conflict with previous studies. There is one report that there were no significant differences in BMI among stages,[9] and the authors explained this in part by the relatively homogeneous nature of the sample population. The results in our study may be partly explained by the following possibilities: 1) there is evidence that exercise adherence leads to changes in the composition of the exerciser's self-selected diet, such as increased carbohydrate rather than fat as a means of increasing intake to balance expenditure.[24] Persons in the maintenance stage might overcompensate, eat too much, and become overweight while maintaining their activity; 2) in Japan, young women are generally getting slimmer and many of them have a small muscle mass.[2] Therefore, exercise adherence in the maintenance stage might be associated with increases in body mass and the prevention of increased body fat mass.

Subjects in the maintenance stage reported a significantly more frequent and a longer amount of time exercising than those in both precontemplation and contemplation stages, providing support for the findings of Cardinal,[17] Lee,[25] and Wyse *et al.*[9] Additionally, the exercise self-efficacy result showed a steady and significant increase from the precontemplation stage to maintenance stage, although clear significant differentiation between all of the stages was not revealed. This result is also consistent with previous findings in the exercise stages of change publications.[7-9] In prospective studies, it is suggested that self-efficacy is a very important predictor of dropouts from or maintenance in exercise.[26-28] Since the most effective way of creating a strong sense of self-efficacy is through mastery experience, it is not clear from this cross-sectional study whether self-efficacy links to predictive behavior or is merely a reflection of increased experience with exercise. Self-efficacy can also be developed by three other methods: vicarious experiences by social models, social persuasion, and physiological/emotional states.[6, 29] Vicarious experience is used a great deal in exercise programs. One value of group participation is that people see others successfully exercising. The health educator frequently uses verbal persuasion to motivate a person to try new behaviors with the hope that experimenting with new positive behaviors will result in personal experience that directly increases self-efficacy. In behavior modification, decreasing physiological arousal increases self-effi-

cacy. Therefore, our results show the possibility that increasing exercise self-efficacy by these means promotes advancing the stages of participants' exercise behaviors.

Decisional balance results indicate that perceived benefits of exercise were significantly different between the five stages. Persons in different stages of exercise place differential importance on the positive aspects of exercise. On the other hand, we could not find a significant difference on perceived costs between people in the five stages. The perceived costs to exercise appeared not to be consistent with the previously reported worksite publications.[8, 11] The lack of a significant difference in perceived costs, however, suggests that all the subjects in all stages perceived their costs to exercise similarly. Another previous study[30] investigated the multi-dimensional structure of perceived benefits of exercise and the barriers to exercise (costs) within a multi-stage theoretical framework for exercise adoption. In this study, significant differences were found on the time-effort and social subscales, whereas there were no significant differences on physical and specific barrier subscales between stages. Further studies are needed to clarify the relationships between the stages of change for exercise behavior and decisional balance using a multi-dimensional scale.

As predicted, not only healthy dieting, but also unhealthy dieting behaviors significantly increased with advancing stages. Similarly, obsession with eating, dieting, obese phobia and EAT total scores measured by the Eating Attitude Test also significantly increased with advancing stages. These results suggest that advancing the stage of change for exercise behaviors is related to healthy dieting behavior, but is also related to increased abnormal eating attitudes and unhealthy dieting behavior. These results are also consistent with our previous study,[16] with the lower frequency exercise group reporting more unhealthy dieting, as well as greater concern with eating than the non-exercise group. Garner *et al.*[31] suggested that many women who exercise intensely might be more motivated by controlling weight than by elevating physical fitness. Eating disorders in athletes and exercise dependence in eating disorder patients have been studied in many cross-sectional studies; however, there were few studies that focused on the association between exercise behavior and diet-related psychobehavioral factors among young women. Therefore, little was known about the difference in concern with weight and appearance and dieting practices between each exercise stage. Clearly, the series of results in our work also show the possibilities that weight management plays an important role in the advancing stages of exercise among young Japanese women.

In this study, the generalizability of our findings is limited due to only students engaged in full-time education being examined. It therefore is not clear whether the results of our study can be applied to other same age-group populations or not. The cross-sectional designs also have a number of limitations. However, several implications from this investigation were derived. Firstly, a different cognitive and behavioral approach focused on exercise self-efficacy and perceived benefits of exercise may be successful in facilitating change depending on an individual's current exercise stage. For example, if individuals are in the precontemplation stage, the field practitioner should develop their personal value for exercise and increase the confidence to perform exercise by various means. This is because advancement in the stage of change for exercise behavior may be influenced by perceived benefits to exercise and exercise self-efficacy. Secondly, although the causal relationship between the advancing stage and diet-related psycho-behavioral factors is unclear, attention to diet-related cognitive and behavioral factors in exercise promotion based on the stages of change among young women is necessary. For example, professionals may modify unhealthy diet practices and abnormal weight/eating concerns in the preparation, action, and maintenance stages.

Conclusions

The stages of change for exercise behaviors is associated with exercise self-efficacy and perceived benefit to exercise, as well as dieting behaviors and weight/eating concerns among young Japanese women. The assessment of diet-related factors in cross-sectional studies, and dieting modification approaches in stage specific exercise intervention may be useful for this age-group. We believe that the existence of diet-related factors at each stage is not limited to young Japanese women, and future research endeavors must now be employed to examine these factors and the utility of stage-based intervention in educational settings and differentiation in decisional balance assessed by multidimensional scales between stages.

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Question
行動科学に基づく運動療法とは？

行動科学を取り入れた運動療法を実践したいと考えています．具体的な手法を教えてください．

Answer

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運動が必要なことは分かるのですが，実際に運動を始めて継続していくということは非常に難しいものです．最近では「行動科学」に関心が集まっていますが，行動科学を取り入れた指導というのは一体どのようなものでしょうか．表に運動療法の指導に活用したい行動科学技法の例をまとめました．運動に関する情報（運動の効果，いつ，どこで，どのように運動を行うのかなど）を提供すること，可能ならば運動実技を取り入れることはもちろん重要ですが，さらに，行動科学技法の指導を加えることが運動習慣の定着に役立つものと期待されています．これらの技法は患者さんの行動変容への準備性（運動習慣のステージ）に応じて，適宜組み合わせて指導していくとさらに効果的と考えられます．

これらの中でも「目標設定」と「セルフモニタリング」は特によく用いられる方法です．この2つの方法を上手に用いながら，表に示した行動科学技法を用いていくとよいでしょう．「目標設定」のポイントは，① 運動する本人が自分で決めること，②「したいこと」でかつ「できそうなこと」であること，③ 目標は具体的であること，などです．「できそうであること」は心理学用語で「自己効力が高い」と表現されますが，できそうもない目標を立てると，行動変容に失敗してやる気や自信をなくすという悪循環に陥りがちです．立てた目標が患者さんの病態改善に不十分な運動量であることもありますが，まずは達成可能な目標を立てるように指導します．かならずしも十分な効果は期待できないかもしれないが，行動を変えていくには少しずつステップアップしていくこと（シェイピング）が重要であることを伝えましょう．目標が具体的であるということは，いつ，どこで，何を行うのかがイメージできること，目標が達成されたかどうかを客観的に評価できるということです．「できるだけ歩くようにします」では行動変容のための目標としては不十分です．「毎日の買い物は自転車ではなく歩いていく」「1日30分，近所のコースを歩いて，1日平均10,000歩を目指す」などのような具体的な目標に心掛けます．

「セルフモニタリング」は自分自身の行動を記録することです．患者さんの意欲に応じて負担になりすぎないような方法を提案しま

KEY WORD
運動習慣のステージ
シェイピング

表　運動指導に活用したい行動科学技法

	内容	具体例	活用したいステージ
目標設定	実施する運動療法の内容などを具体的な目標として定める	いつ，どこで，何をするのか話し合い，目標とする 来週からウォーキングを始めます．週3日，近所のコースを30分歩きます． 週5日以上犬の散歩を担当します	C, PR, A, M
セルフモニタリング	自分自身の行動を記録する	運動した日には手帳に○をつける 記録票を冷蔵庫に貼り，毎日実施した内容と時間を記録する	PR, A, M
利益不利益分析	自分にとっての運動療法の利益や不利益について検討する	利益や不利益のリストなどを提示して話し合う 利益が大きく，不利益の少ない運動計画を立てる	PC, C, PR
シェイピング	簡単な行動から始めて，少しずつ目標とする行動に変えていく方法	週2日，15分のウォーキングから始め，次第に目標を高くしていく	PR
モデリング	運動療法を実施している人を観察して学習すること	運動習慣のある糖尿病患者の話を聞く 運動習慣のある人と付き合うようにする 運動習慣者のビデオを見る	PC, C, PR, A, M
刺激統制法	運動療法を実施しようと思う刺激を増やすこと	普段から動きやすい服装にする 体重記録を目に付く場所に掲示する	PC, C, PR, A, M
オペラント強化法	運動した後に良い結果(賞賛，ご褒美，気持ちよさなど)が得られるように工夫すること	目標体重を達成したら洋服を買うように決めておく 運動したらほめてもらう，あるいは自分自身をほめる ウォーキングコースにお気に入りの場所，店，図書館などを入れる	PR, A, M
行動置換法	運動不足になるような好ましくない行動を身体を動かすことに置き換えること	通勤は交通機関を利用せず歩く テレビの番組が始まったらストレッチをする	C, PR, A
社会的支援	運動療法を理解してくれたり，励ましてくれたり，一緒に実施してくれたりしてくれる人を探す方法	家族と運動や自分の目標について話をするようにする 一緒に運動する仲間を増やす	PC, C, PR, A, M
コミットメント	運動することを宣誓すること	宣誓書を作成する	C, PR
ポジティブ・セルフトーク	前向き，建設的に考えるようにすること	否定的に考えてしまうパターンをたずね，前向きに考える練習をする	C, PR, A, M
逆戻り防止法	運動を止めてしまいそうになる機会を予測して，対策を立てること	季節の変化，けが，忙しい時期，引越しなどを予測して対策を考えておく	A, M

PC：無関心期，C：関心期，PR：準備期，A：実行期，M：維持期

す．運動を実施した日にカレンダーや手帳に○をつけるようにすることは最も簡便な方法です．いつ，どこに何を記録するのか，記録表や手帳をどこに掲示・保管するのかなども決めておきましょう．

文　献
1) 厚生労働省健康局：身体活動・運動習慣の獲得・継続のための指導．保健指導マニュアル作成検討会報告（身体活動・運動）．13-36, 2002
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記録したものはできる限り指導者がチェックして，「がんばりましたね」とほめたり，「先週は平均○○歩でしたね」と確認したり，スタンプを押す，コメントを書くなどすることが大切です．さらに，目標の達成度に応じて適宜目標の修正を行っていきます．

各技法を運動指導へどのように活用するのか，どのステージにどの技法を活用すれば効果的なのかといった問題はまだまだ研究途上の課題ですが，表にステージと技法の活用例をまとめましたので参考にしてください．

KEY WORD 解説

運動習慣のステージ：　行動変容への準備性に応じた次の5段階．無関心期（運動を行っていないし，始める意思もない），関心期（運動を行っていないが，始める意思がある），準備期（何らかの運動を実施しているが，十分な運動量ではない），実行期（十分な運動を実施しているが，継続期間が短く定着していない），維持期（十分な運動習慣が定着している）．関心期の目安は「6カ月以内に開始する意図があるかどうか」，維持期の目安は「6カ月以上継続しているかどうか」とされることが多い．

シェイピング：　簡単な行動から始めて，少しずつ目標としている行動に変えていく方法をシェイピングと呼ぶ．

ADVICE

上手な目標設定を行うということは実はとても難しいことです．運動種目や目標の例をリストとして提示する，この2週間限定の目標を立ててみる（宿題のようなもの），運動靴などの購入やスポーツクラブの調査を目標にしてみるなど，いろいろと工夫して目標設定の支援をしましょう．また，結果について話し合い，目標を修正していくことはとても大切です．