

The effects of an intervention program aimed at lifestyle modification on sedentary behavior in male students of a Japanese university

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The purpose of this study was to examine the influences of an intervention program for lifestyle modification on male students at a Japanese university by considering the time spent on sedentary behavior and the use of TV/PC as a measure of sedentary behavior. Further, we examined the decisional balance for exercise, which was a correlational factor of physical inactivity. Seven hundred and eighty-eight male freshmen from an institute of technology in Japan were selected to serve as subjects (intervention group: 411 subjects; control group: 377 subjects). The program for the intervention group included: 1) out-of-class practical assignments that comprised three types of self-monitoring activities for the promotion of healthy behavior, 2) example-based lectures for improving decisional balance, and 3) providing education regarding behavioral strategy for negative thoughts on exercising. The subjects were rated twice, before and after the physical activity programs. The following variables were measured: 1) the time spent on sedentary behavior, 2) the time spent on use of TV/PC, and 3) the decisional balance for exercise. The results of the analyses suggest that the intervention group exhibited enhanced scores targeting the pros of exercise as compared with the control group. On the other hand, the time spent on sedentary behavior decreased and TV/PC use time increased in both the intervention and control groups. Namely, it was not proved that the intervention program for lifestyle modification was valid. In conclusion, the intervention program for lifestyle modification in this study did have inadequate positive effects with respect to the improvement of sedentary behavior in these male students at a Japanese university. In the future, the intervention program for reducing sedentary behavior needs to be improved.

Keywords: time spent on sedentary behavior, time spent on TV/PC use, decisional balance for exercise

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1. Introduction

To improve the habitual physical activity of university students is an important task. Providing health education for university students is truly meaningful because it is expected to influence their lifestyle habit not only during their college days but also after graduation as members of society. In fact, the proportion of people who maintain the appropriate amount of physical activity declines in adults, while it is comparatively high in children and

youth (Haase et al., 2004). Therefore, the lifestyle of late teenagers and early adults, who are in the transitional phase, is important (Caspersen et al., 2000). In addition, according to cross-sectional research of university students from 23 nations conducted by Haase et al. (2004), the amount of physical activity for leisure is much less for Japanese university students compared to students from other countries. It has been indicated in other research as well that the amount of physical activity for university students in Japan is insufficient (Tsutsumi,

2001), and in practice the physical activity level of Japanese university students has captured public attention today.

There are several practical studies which aim at enhancing physical activity (e.g. a study of university students by Sallis et al., 1999). In these studies, the amount of physical activity is used as an evaluation indicator. In contrast, there are few approaches which utilize sedentary behavior as one of the evaluation indicators. To reduce the number of people who lead inactive daily lives is a meaningful challenge as seen in the fact that some countries have made political efforts by establishing a national goal for reducing the inactive population (people who live mainly sedentary lives, or physically inactive lives) (Chogahara, 2003). Moreover, Takami et al. (2003) have elucidated that longer sedentary hours during daytime could be one of the major factors describing those who are categorized as less physically active. However, almost all studies so far addressed 'physical activity (e.g. the time spent on physical activity)', while 'sedentary behavior (e.g. TV watching time)' is seldom used as an indicator. Only a few investigations on sedentary behavior exist in cross-sectional studies as well as in longitudinal and intervention studies.

For instance, Williams et al. (1999) investigated the relationship between psycho-social determinants of physical activity and TV watching time, indicating that those who feel the existence of some barrier which prevents them from practicing physical activity spend more time watching TV. In contrast, few studies have dealt with indicators of sedentary behavior (time spent on sedentary behavior including watching TV) using Japanese university students as subjects, and there was only one study of this kind of Japanese elementary school pupils of 4-6 grades, conducted by Ishii (2003). Although it is significant that Williams et al. (1999) focused on TV watching time as typical sedentary behavior for leisure, it is reasonable to think that the use of personal computers (PC) should be considered as notable sedentary behavior for university students in addition to watching TV, which has been examined so far.

Recent studies examine relevant factors to physically inactive behavior. Oka et al. (2003) have developed decisional balance scale relating to exercise for behavioral change from a sedentary lifestyle to a physically active lifestyle. Decisional balance means the balance in evaluating various

pros and cons associated with behavioral change. It is believed that those who perform behavior with objectives evaluate pros more than cons (Janis and Mann, 1977). Thus, the examination of decisional balance (evaluation of pros and cons) is required when examining sedentary behavior as the indicator of physical inactivity.

Following from these, the purpose of this study is to examine the influence of an intervention program which intends to change the lifestyle and the sedentary behavior of university students, focusing on the time spent in sedentary behavior and TV/PC use as the evaluating indicator.

2. Methodology

2.1. Participants and Data

Participants were 788 male freshmen (intervention group: 411; 18.35 ± 0.94 years old, control group: 377; 18.36 ± 0.73 years old) who had registered for a common course of "Health-Related Physical Education I (consisting of practice and lecture)" offered in an institute of technology in Japan. This course can be regarded as a compulsory course because more than 95% of students who are enrolled at the institute take it, although it is elective. Participants of this study did not include evening students, and 2 students aged 30 years and older were excluded. The data used in this study were obtained by the "Health-Related Physical Education Lifestyle Survey" conducted along with the course of Health-Related Physical Education I.

2.2. Content of the Course

Among 13 classes during the half-year course, 4 or 5 classes including the first (guidance) and last classes were performed in a classroom without athletic practices A lecture on "the relationship between lifestyle and health in contemporary society" was conducted 2 or 3 times in the classroom. The other 8 or 9 classes were conducted in the gymnastics facility and students selected one sport to play among ping-pong (intervention group: 256, control group: 70), badminton (intervention group: 65, control group: 181) or football (intervention group: 90, control group: 126). The behavioral change skills were introduced only in the lecture targeting the intervention group and daily assignments (Physical

Education homework; see Kiuchi et al., 2003) to be practiced in daily life were imposed only on the intervention group. The daily assignments and the contents of behavioral change skills are shown below.

2.2.1. Daily Assignments (physical education homework)

Three kinds of daily assignments were imposed with the intension of healthy behavior promotion in daily life. The first assignment was to record daily activities by an hour during 3 weeks and to make a list of problems in daily habits. The second assignment was to fill in a checklist (with marks such as a circle, numerals and comments) relating to specific healthy behavior, which is prepared based on the seven habits of Breslow and Enstrom (1980). The checklist includes "mark a circle when you take all three meals, i.e. breakfast, lunch and dinner", "mark a circle when you use stairways in buildings up to 5 stories" or "fill in sleeping hours and mark a circle when it is 6-8 hours". The third assignment is to practice and record the behavioral change program being described later and to amend the program by one week during three weeks.

2.2.2. Behavioral Change Skills and Intervention in Decisional Balance

Prior to the third daily assignments described above, a lecture on behavioral change was held in the classroom. Examples of behavioral change were introduced including "participating in a group study positively to have opportunities to teach exercise to each other and to praise each other's efforts and improvements", "being aware of your efforts and achievements and rewarding yourself for your efforts and results" and "taking note of the experience when you feel pleasure and joy through practicing exercise in order to enhance awareness", expecting to influence the perception of the benefits accompanying exercise. In addition, strategies to cope with negative thoughts of physical exercise were provided based on Blair et al. (2001). Specifically, "even when you feel too irritated to exercise, playing sports makes you happy, letting go of unpleasant feelings", "even when you are busy with so many things to be done, taking a break to stroll around or going out for lunch makes you feel better and restores the energy for the work", and "when the weather is not nice, simple exercise such as stretching or harder household work at home can be good for health" were prepared to be included,

expecting to inspire decisional balance.

After explaining these, participating students in turn were asked to arrange their behavioral change programs. Not only "behavioral objectives to reform" but also "environmental improvement (antecedent stimulus)" and "reinforcer after achievement (consequent stimulus)" were asked to be established in the program. For instance, if a behavioral objective is "to perform jogging for 20 min twice a week", then "to place running shoes at a conspicuous corner of the entrance" is set as the antecedent stimulus and "to drink a favorite sports drink after running" is set as the consequent stimulus. It was assumed that the antecedent stimulus would reduce the cons involved in performing exercise and the consequent stimulus would increase recognition of the pros.

2.3. Measured Indicator

Each measurement indicator was determined twice, before registering for the course (at the course guidance in April) and after completing the course (the last class of July). The survey was conducted concurrently under the direction of teachers. The survey intent was described on the survey form and it was noted that answers have no effect on learning results, that the confidentiality of personal information is protected, and that participation is not mandatory. After the explanation, consent for participation was confirmed by participants writing their names on the survey forms.

2.3.1. Demographic Data

Subjects were required to answer their age, previous sports experience (years) and present participation in sports activities (including athletic sports clubs in university and group activities relating to sports in and outside university).

2.3.2. Time Spent on Sedentary Behavior

Items in the short version of the International Physical Activity Questionnaire (IPAQ) in Japanese (Murase et al., 2002) were used. The IPAQ is a questionnaire created by a working group of the World Health Organization (WHO) to evaluate physical activity using globally unified criteria (Murase et al., 2002). The question sentence used in this study was, "You are asked a question below. It is about the time you spend sitting or lying on the floor

(at work and home and in your study time and leisure time). Include all such time as: time spent sitting at a desk, talking with your friends, reading a book, doing something while sitting on the floor, watching TV while lying on the floor, and so on. Sleeping time, however, should not be included. Now, the question is: How many hours a day in total do you usually spend on such sedentary behavior on the weekday and at the weekend?" Two sections, for weekdays and weekends were provided for this question. The time spent on sedentary activity in one day was calculated by multiplying weekday hours by 5, adding doubled weekend day hours and then dividing by 7.

2.3.3. Time Spent on TV/PC Use

In order to determine the time spent on TV/PC use for leisure, the item "How many hours a day do you watch TV/video, play TV games or use a PC other than in study and work-related situations?" was included based on Williams et al. (1999). Two sections for weekdays and weekends were also prepared for this question and the time spent on TV/PC use in one day was calculated by multiplying weekday hours by 5, adding doubled weekend day hours and then dividing by 7. While the time spent on sedentary activity in 2.3.2. includes sedentary activity for other than leisure (working time, etc.), the time spent on TV/PC use was only for leisure in this study. Therefore, the time spent on TV/PC use is considered to be the sedentary activity indicator which should be reduced by priority.

2.3.4. Decisional Balance for Exercise

The decisional balance scale for exercise (Oka et al., 2003) was used to measure the degree of awareness relating to pros and cons gained from performing physical exercise regularly. The scale is composed of two kinds of factors, pros and cons, accompanying exercise (the score ranges from 10 to 50 points in both factors). The decisional balance is the balance in evaluating various pros and cons arising from behavioral change, and is one of the controllable factors which affect stages of change for behavior, theorized in the transtheoretical model of behavioral change (Prochaska and DiClemente, 1983). The pros factors arising from performing exercise include items such as "regular physical exercise makes people slim, healthier and stronger" and "regular physical exercise alleviates stress", while the cons factors include "regular physical

exercise becomes a hindrance to work (family)" and "regular physical exercise requires too much physical strength." Each item was evaluated on a 5-point scale, from "I do not agree with it at all (one point)" to "I certainly agree with it (five points)."

2.4. Statistical Analysis

First of all, the age and the years of previous sports experience before starting the course was compared by using the *t* test for independent samples, and the present participation in sports activities was compared by using the χ^2 test. Subsequently, an intergroup comparison was conducted on the scores before starting the course relating to each measurement indicator using the *t* test for independent samples, and then followed an analysis of variance on repetitive 2 (group: intervention or control) \times 2 (time: prior or post course). When there was a missing value in each measurement item, the score of relevant factor for the participants was excluded from the analysis. SPSS 11.0J was used for the statistical software.

3. Results

3.1. Comparison of Participants Prior to the Course

The intergroup comparison of the score on each measured indicator prior to the course did not show any significant difference in age, years of previous sports experience (intervention group: 5.57 ± 3.45 years, control group: 5.84 ± 3.63 years), present participation in sports activities (intervention group: participation—88 / no-participation—300; control group: participation—72/ no-participation—276), the time spent on sedentary activity, the time spent on TV/PC use, the score of decisional balance for exercise (subtracting cons points from pros points), the pro score and the con score.

3.2. Change in Sedentary Behavior

3.2.1. Time Spent on Sedentary Behavior

Figure 1 shows the change in time spent on sedentary behavior in each group. The result of the analysis of variance elucidated that the time spent on sedentary behavior was reduced in both groups, which shows the main effect for time. In contrast, the

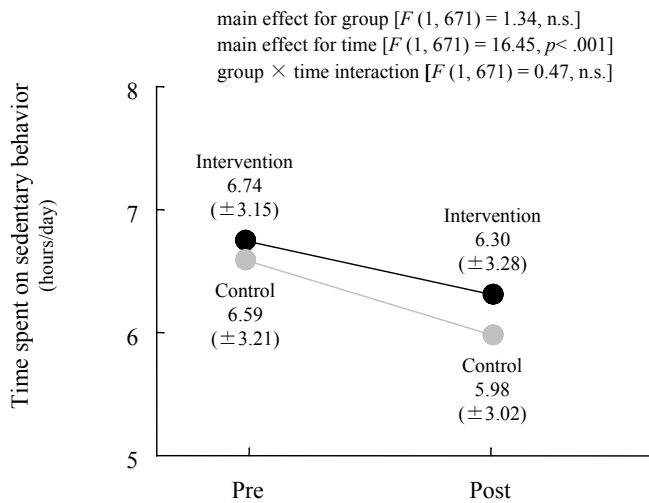


Figure 1 Changes in time of sedentary behavior in the intervention and control group (mean times ± standard deviations)

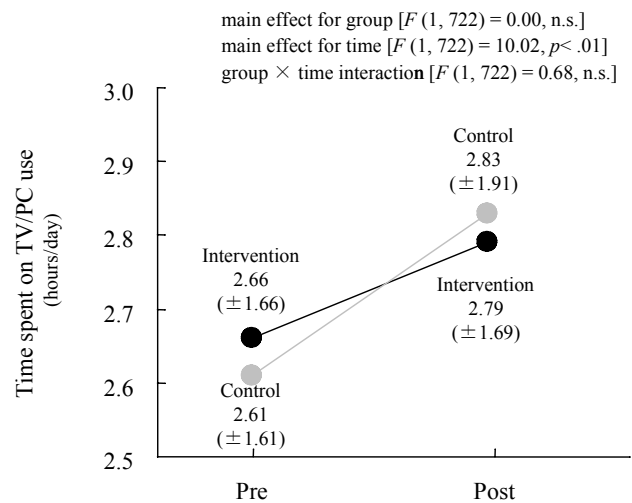


Figure 3 Changes in score of decisional balance for exercise in the intervention and control group (mean scores ± standard deviations)

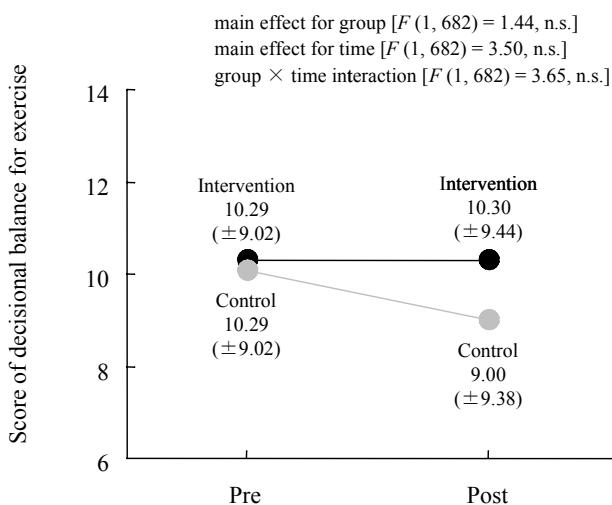


Figure 2 Changes in time of TV/PC use in the intervention and control group (mean times ± standard deviations)

main effect for group and the interaction of group × time were not observed.

3.2.2. Time Spent on TV/PC Use

As **Figure 2** indicates, the main effect for group and the group × time interaction were not observed but the main effect for time was observed.

3.3. Change in Decisional Balance for Exercise

3.3.1. Decisional Balance for Exercise

Figure 3 shows the change in the score of decisional balance for exercise. It became clear that the main effect for group and for time and the group × time interaction were not observed.

3.3.2. Pros for Exercise

Although the group × time interaction was observed in the score for pros accompanying exercise, the main effect for group and for time were not seen (**Figure 4**). That is, as the period of course advanced, the intervention group became sensitive to the pros for exercise more than the control group.

3.3.3. Cons for Exercise

As **Figure 5** indicates, the main effect for time was observed in the score for cons accompanying exercise and it became clear that the cons score increased significantly as the course period advanced. In contrast, the main effect for group and the group × time interaction were not observed.

4. Discussion

The purpose of this study was to examine the influence of an intervention program which intends to transform the sedentary behavior of university students (time spent on sedentary behavior and time

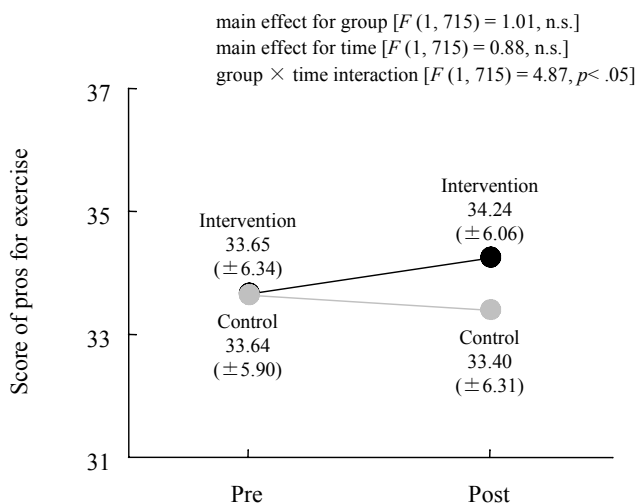


Figure 4 Changes in score of pros for exercise in the intervention and control group (mean scores ± standard deviations)

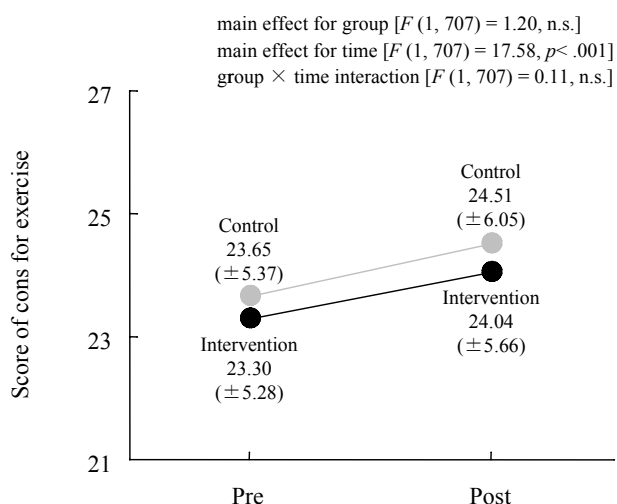


Figure 5 Changes in score of cons for exercise in the intervention and control group (mean scores ± standard deviations)

spent on TV/PC use) and on relevant factors of sedentary behavior (decisional balance for exercise). Some considerations follow on the result of each measured indicator.

The sedentary behavior indicator is examined first. The time spent on sedentary behavior declined and the time spent on TV/PC use increased in both groups. It is estimated that the increase in the time spent on TV/PC use, which is typical sedentary behavior for leisure, was caused by entering university, and at the same time the decline in the

time spent on sedentary behavior was caused by the fact that their new college life has started. This study could not acknowledge any intervention effect on sedentary behavior, as the interaction of the two indicators was not observed in the result of the analysis of variance. In particular, the reasons for the increase in the time spent on TV/PC use, which should be decreased by priority, could be inferred as: 1) students began to acquire familiarity with PC after enrollment in the information processing class at the university, and 2) leisure time itself increased more than in April when students had immediately finished taking the university entrance examination. Thus, the possibility of a decrease in the time spent on TV/PC use cannot be rejected if the intervention is conducted at an appropriate time other than immediately after university entrance. In addition, the time for study increased as the examination season began in July when the measurement after the course was conducted, which seems to have had some influence on the increase in the time spent on sedentary behavior in both groups.

Secondly, decisional balance for exercise will be considered. A previous study which was conducted with middle aged subjects (average age: 48.3±4.6 years) (Oka et al., 2003) reported that the pros score on physical exercise was 33.4 points, the cons score was 24.3 points, and the decisional balance score (pros points subtracted by cons points) was 9.1 points in the result. It is clear that the present study achieved nearly consistent data with the previous study. Concerning the decisional balance score for exercise, the main effect for group, the main effect for and the group × time interaction were not observed. Consequently, the intervention conducted in this study was confirmed to have no influence on the comprehensive decisional balance. The evaluation of cons accompanying exercise increased both in the intervention and control groups. This means that both groups increasingly felt the cons for exercise as they became accustomed to the college lifestyle. In contrast, the group × time interaction was observed in the pros score for exercise, which showed a positive change in the pros score for the intervention group compared to the control group. The result confirms the effect of the intervention program and it is supposed that intervention to promote the awareness of the pros for exercise particularly enhanced the evaluation of the pros for exercise. However, since the amount of change in

the score of the intervention group remains under one point, this slight change requires a careful interpretation.

No effect of the intervention program was observed in the time spent on sedentary behavior and in the time spent on TV/PC use in this study. The fact that the time spent on TV/PC use, which was hypothesized to decrease in particular, increased in the same way as the control group indicates that the intervention was insufficient in this study. As the reason why the effect of the intervention program was not observed, it can be assumed that the smaller decline in the sense of cons for exercise caused the smaller decline in sedentary behavior. This is an issue to be examined further in future.

This study contains three limits. Firstly, subjects were allocated into two groups according to the selection of sports. Therefore, the allocation was not random. Secondly, there is a possibility that the teaching ability of the teacher had some effect on the result. Thirdly, the direct approach was not fully executed to decrease sedentary behavior. It is reasonable to think that a program with the aim of reducing sedentary behavior requires not only an approach to increase physical activity as performed in conventional interventions but also an approach to reduce sedentary behavior. Specifically, as stated by Oka (2000), discussion on pros and cons related to physical activity and examination on pros and cons for other persons aside from oneself are considered effective. Moreover, the application of a "decisional balance sheet (Prestwich et al., 2003)", in which a subject is asked to write the pros and cons for exercise, would be useful. It is particularly preferable to include content which can reduce the increased cons accompanying exercise as the course advanced in this study. In addition, Oka et al. (2003) indicate that the decisional balance differs according to the stages of change for exercise. It is speculated that it is effective to encourage those who are in the precontemplation stage and do not have interest in performing exercise to increase their evaluation of pros, and to encourage those who are in the contemplation stage to decrease their sense of cons. Thus, intervention on the decisional balance, conforming to each stage of change and targeting those in the precontemplation stage and those in the contemplation stage separately, is expected in future.

In conclusion, although this study examined the influence of an intervention program intended

to transform lifestyle habits relating to sedentary activity of university students by using the measurement indicator of sedentary behavior which has not been studied in Japan, satisfactory results were not achieved. Improvement of the intervention program, consideration of intervention timing and reexamination of measurement indicator of sedentary behavior are expected to be performed in future studies.

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