Effect of a Walking Program with the E-mail Function of Cellular Phone

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This study examined whether a walking program encouraged using the e-mail function of participants’ cellular phones promotes behavior changes. Study participants were persons who wanted to join a walking program for their health. The experimental group had 1,111 members (male: n=554, female: n=557, 30-49 yrs) and the control group had 1,190 members (male: n=598, female: n=592, 30-49 yrs). The participants in the experimental group were encouraged to execute a walk behavior with e-mails using their cellular phones twice a week for one month. The contents of the e-mails depended on the level of walking as determined before the study for each participant. The main points studied were the time (in minutes) of walking per week and the extent of changes in the walking behavior. The analysis of results after receiving encouraging e-mail messages for one month showed more time spent walking for the experimental group in comparison with the time of the control group [Mean inter-group difference in change: 70.1 min/week, (p<0.05)]. The extent of changes in walking behavior (expressed as a percentage) was higher in the experimental group (38.5%) than in the control group (22.3%) (χ²=61.19, p<0.05). These results indicates that the walking program, encouraged by e-mail messages received on a cellular phone, promotes walking behavior in people.

Keywords: physical activity, walking time, health promotion

1. Introduction

Although knowledge of the effects of physical activity and exercise on health is spreading among Japanese citizens, the Ministry of Health, Labour, and Welfare (2006) has reported that the percentage of those in the habit of exercising was as low as approximately 30% for adult men and 25% for women. The percentage was the lowest for those in their 30s and 40s. Those who did not exercise or play sports cited “being too busy at work for exercising” as the primary reason for nonparticipation, according to a Cabinet Office (2006) survey. Previously, Kikuchi & Nakamura (2002) had found that 48.5% of those who had not exercised or played sports at all for the past year were interested in engaging in walking. Since an individual can walk at any time and anywhere, it might be important to promote walking as a physical activity among those who do not exercise because of time constraints or other reasons. Although a group-based walking program and remote walking program using print media have been previously developed, most of the participants in these programs were women and the unemployed with aged over 50-60 years, indicating that these programs were not enough to attract men and relatively younger workers (Takeda & Nakamura, 2002; Akiyama et al., 2007). Along with recent infrastructure construction, health promotion programs have been developed utilizing information technology (IT) such as e-mail and the Internet to enhance the immediacy, efficiency, and interactivity of communication (Tate et al., 2001). The effect of IT-based program was evaluated by randomized intervention trials in the late 1990s, mainly in the U.S. and Europe. More recently, the impact of these programs has also been examined in Japan (Adachi & Yamatsu, 2004). Further, health education programs based on the cellular phone technology, popular with a variety of age groups, have been developed and their effectiveness has been studied (Kubota et al., 2004; Ashihara et al., 2006). An
advantage of utilizing cellular phones is that they are likely to encourage the users to respond more readily because they are very portable and easy to reach, which thus can provide people with change health behaviors. In addition, cellular phone text messaging e-mail function is more popular communication tool even with relatively young generation than its phone-calling function. Therefore, they are potentially effective tools for encouraging target groups, who have not participated in conventional walking programs, take up walking for exercise. A weight-loss program, developed by Kubota et al. (2004), which delivered e-mail newsletters to their mobile phones, helped participants lose weight to some extent. However, uniform information were delivered to all participants regardless of their individual differences, the sample size was small, and there was no control group in this previous study. Thus, to increase walking behavior effectively, intervention programs should be developed in accordance with (1) individual walking amount for exercise; (2) specific settings which can easily promote walking behavior, as well as (3) examined its effectiveness and efficiency among a large sample groups. The present study was examined the effect of a walking program utilizing the e-mail function of cellular phones on walking behavior change among 30 s and 40 s Internet users.

2. Methods

2.1. Subjects and recruitment

In the present study, participants of an internet-based cross-sectional survey and a walking program with the cellular phone were recruited from voluntary registered samples (approximately 230,000 registrants as of September 2006) in the Japanese Internet research service organization (hereafter referred to as Company A). The set sample size and attributes of an internet-based cross-sectional survey were as follows: approximately 5,000 male and female adults with an equivalent number of males and females in each age bracket. Potential respondents were randomly and automatically selected in accordance with the eligible attributes from the registered samples and were invited to participate in an Internet-based survey.

To be eligible of the walking program with the cellular phone, the participants had to be male and female adults aged 30-49 years; employee (company workers, self-employed workers, specialists, civil-service workers) and full-time homemakers. Potential participants of a walking program with the cellular phone were recruited from male and female respondents to an internet-based cross-sectional survey. At the end of the survey, a message was included that said, “We are looking for people who hope to start or continue walking for exercise for their health and who can answer a follow-up questionnaire—if you decide to participate, we will e-mail tips to you on enjoying walking for exercise! And by lottery, we will give a pedometer to 30 participants from among the respondents to the follow-up questionnaire.”

Within 5,014 respondents (employees: 69.2%; 30.8%: full-time homemakers) to the internet-based cross-sectional survey, 1,283 (25.6% of the survey respondents) individuals agreed to participate in the walking program with the cellular phone. Before the initiation of the walking program, a test e-mail was sent to the applicants. Of these applicants, those who were confirmed to have received the test e-mail were assigned to the experimental group (n\textsuperscript{11005}1,203) and participated in the walking program for a month. Since 92 participants in the experimental group did not respond the follow-up survey, data of 1,111 participants were finally analyzed. Concurrently, individuals were randomly selected from 3,731 survey respondents who disagreed to participation in the walking program on matching the proportion of gender and age bracket with these in the experimental group, and asked to answer the follow-up survey. Those who completed the follow-up survey (n\textsuperscript{11005}1,190) were assigned to the control group.

2.2. Duration and content of the intervention program

The intervention program lasted a month, from October to November in 2006. During the intervention, e-mail newsletters were delivered to the cellular phones of the applicants at 5:00 p.m., twice a week. Meanwhile, no information were delivered to the control group.

The walking program, delivering newsletters with the cellular phone e-mail function to the applicants, purposed to encourage sedentary people to live an active life by consciously increasing their frequency of walking. It also helped those who already have walked to maintain their walking behavior. In order to provide advice tailored to the awareness and behavior of each participant, the 1,203 subjects in the experimental
group were allocated to 3 subgroups (Figure 1). Subgroup I consisted of respondents who spent less than 7 hours per week in walking, and who had answered that they could spend more time walking “for commuting” or “for work.” Subgroup II consisted of respondents who spent less than 7 hours per week in walking, and who had answered that they could spend more time walking “for shopping,” “for getting to and from place,” or “for exercising,” or those who had answered that they had “no situation that could increase walking time.” Subgroup III comprised respondents who walked 7 hours or more per week. The e-mail newsletters included basic information about the effects of walking on health, and the content of the previous walking program (Takeda et al., 2003) which applied ideas of behavioral science such as goal setting and self-monitoring. For the subjects in subgroups I and II, who had spent less time in walking and were at earlier stages of behavioral change, the e-mails provided a motivator to initiate walking and information required for continuation of walking. Specifically, subgroup I was emphatically provided with information for encouraging walking behavior “for commuting” and “for work.” Subgroup II was mainly provided with information for increasing walking time “for shopping,” “for getting to and from place,” and “for exercising.”

Since it has been suggested that decisional-balance at earlier stages of behavior change is a predictor of transition in later stages (Oka, 2003), both subgroups I and II received information for increasing the benefits from walking and reducing barriers to walking. For the participants in subgroup III, who spent more time in walking for exercise, emphasis was placed on providing information for maintaining their ongoing walking behavior in order to cope with interrupting factors of walking habit (i.e., information to prevent a relapse in behavior).

2.3. Questionnaire content

At the beginning of the questionnaire, the instruction was addressed as follows: “In the following questions, ‘walking’ refers to ambulation which continues for a certain amount of time, and includes sauntering or walking for shopping and commuting; ‘regular’ walking requires for at least 20-30 minutes at a time, twice or more per week.” This definition applied to answering the all questions in the following section.

2.3.1. Walking time

Walking time was assessed using the scale for the evaluation of walking behavior, which had been previously confirmed to be reliable and valid (Yamawaki et al., 2006). Participants were asked to identify the frequency and duration of the following 5 types of walking: “for commuting,” “for working,” “for shopping,” “for getting to and from place,” and “for exercising” during the past week. Based on these answers, Weekly walking time on each type was

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![Figure 1](http://www.soc.nii.ac.jp/jspe3/index.htm)
calculated. In addition, total weekly walking time was calculated as the sum of the walking minutes for the 5 types.

2.3.2. Stages of change in walking behavior
The scale to measure the stages of change in walking behavior was developed in order to examine actual walking behavior in the past and present as well as motivational readiness to change walking behavior, based on the scale to assess the stages of exercise adaptation developed by Oka (2003). Participants were asked to select the one item which best described their belief and behavior out of the following five items: “I do not walk for exercise and do not intend to in the future” (precontemplation); “I do not walk for exercise but I intend to in the near future (within 6 months)” (contemplation); “I am walking for exercise but do not regularly do it” (preparation); “I am walking for exercise regularly, but have been doing it for less than 6 months” (action); and “I am walking for exercise regularly and have been doing it for 6 months or longer” (maintenance).

2.3.3. Waking self-efficacy
Self-efficacy for walking was measured with a four-item scale that assessed the confidence of participants in engaging in walking when faced with common barriers, which was modified from the scale for exercise self-efficacy developed by Oka (2003). The participants were asked to rate their level of confidence, using a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree), in terms of their ability to walk under the following conditions: “when feeling slightly tired,” “when not feeling so motivated,” “when too busy,” and “when the weather is not good” (where an unrelated situation is excluded). All of the items were subsequently summed in the range of 4-20 points.

2.4. Ethical considerations
The privacy of the participants was protected by a contract between the enrolled monitors and Company A regarding personal information. The recruitment for participation in the intervention program was subject to no disclosure of the e-mail addresses of the cellular phones used by the study's organizers, and the e-mail newsletters were delivered to the participants via Company A. The present study was approved by the Institutional Review Board of Waseda University Faculty of Sports Sciences.

2.5. Statistical analysis
To compare the experimental and control groups, socio-demographic characteristics (age group, gender, academic background, family income, and occupation) as well as the stages of change in walking behavior at baseline were analyzed using a chi-square test. Walking time and walking self-efficacy at baseline were analyzed using analysis of variance. Significant differences were observed in the academic background, family income, and occupation as well as all outcome variables (walking time, stages of change in walking behavior, and walking self-efficacy) between the experimental and control groups. To examine the effects of the intervention program on walking time and walking self-efficacy, a paired t test was used for intra-group comparison. Analysis of covariance was utilized for inter-group comparisons, in which the covariates were academic background, family income, occupation, and a baseline value for each outcome variable. Furthermore, to compare the stages of change in walking behavior between the experimental and control groups, the percentage of those who progressed to a higher stage of change as well as the percentage of those who progressed from the precontemplation or contemplation stage to the preparation or higher stages were calculated. The percentages in both groups were compared using a chi-square test. For statistical analysis, The Statistical Package for Social Science (SPSS) for Windows 13.0 was used. The statistically significant level was $p<0.05$.

3. Results
3.1. Characteristics of the subjects
For the characteristics of the subjects obtained from the questionnaire before the intervention program, no significant differences between the experimental (N=1,111) and control (N=1,190) groups were observed in the distributions by age group and gender, whereas significant differences between them were found in the distributions by academic background, family income, and occupation (Table 1).

3.2. Program continuing rate
In cases where those who responded to the follow-up questionnaire were defined as “program continuator”, 1,111 (554 men and 557 women) were “program
continuator” of the 1,203 participants in the experimental group who received the e-mail newsletters. Thus, the program continuing rate was 92.4%.

3.3. Changes after the intervention program

3.3.1. Walking time

Table 2 presents the results for changes in walking time. After the intervention period, the experimental group significantly increased the total weekly walking time (pre-post mean difference: 41.2 minutes/week), which was obtained by summing the walking times for the 5 walking types, compared to those in the control group (pre-post mean difference: 10.8 minutes/week). Significant group-by-time interaction was found in the total weekly walking time between the experimental and control groups (mean difference: 70.1 minutes/week, \( p < 0.05 \)).

As a result for each of 5 walking types, significant inter- and intra-group differences were found in the walking times “for commuting,” “for shopping,” “for getting to and from place,” and “for exercising” \( (p < 0.05) \), indicating that the experimental group had increased walking times for all walking types except walking “for working.”

<table>
<thead>
<tr>
<th>Table 1 Characteristics of participant at Baseline.</th>
<th>Number (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Experimental</td>
</tr>
<tr>
<td>(n=1,111)</td>
<td>(n=1,190)</td>
</tr>
<tr>
<td>Age</td>
<td></td>
</tr>
<tr>
<td>30-39</td>
<td>519 (46.7)</td>
</tr>
<tr>
<td>40-49</td>
<td>592 (53.3)</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>554 (49.9)</td>
</tr>
<tr>
<td>Female</td>
<td>557 (50.1)</td>
</tr>
<tr>
<td>Education*</td>
<td></td>
</tr>
<tr>
<td>College degree</td>
<td>578 (52.0)</td>
</tr>
<tr>
<td>Junior college/Professional school</td>
<td>292 (26.3)</td>
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<tr>
<td>Middle school/High school</td>
<td>241 (21.7)</td>
</tr>
<tr>
<td>Household income*</td>
<td></td>
</tr>
<tr>
<td>&lt;5,000,000</td>
<td>345 (31.1)</td>
</tr>
<tr>
<td>5,000,000-10,000,000</td>
<td>614 (55.3)</td>
</tr>
<tr>
<td>≥10,000,000</td>
<td>152 (13.7)</td>
</tr>
<tr>
<td>Occupational status*</td>
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<tr>
<td>Employed</td>
<td>785 (70.7)</td>
</tr>
<tr>
<td>Homemaker</td>
<td>326 (29.3)</td>
</tr>
<tr>
<td>Stages of change in walking behavior*</td>
<td></td>
</tr>
<tr>
<td>Precontemplation</td>
<td>108 (9.7)</td>
</tr>
<tr>
<td>Contemplation</td>
<td>279 (25.1)</td>
</tr>
<tr>
<td>Preparation</td>
<td>400 (36.0)</td>
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<tr>
<td>Action</td>
<td>85 (7.7)</td>
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<tr>
<td>Maintenance</td>
<td>238 (21.4)</td>
</tr>
<tr>
<td>Analysis of variance</td>
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<tr>
<td>Self efficacy in walking behavior*</td>
<td>10.2±3.9</td>
</tr>
<tr>
<td>Walking time (min/week)</td>
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<tr>
<td>Total*</td>
<td>276.3±378.9</td>
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<tr>
<td>Commute*</td>
<td>57.1±90.0</td>
</tr>
<tr>
<td>Work</td>
<td>76.2±258.5</td>
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<tr>
<td>Shopping*</td>
<td>70.6±120.1</td>
</tr>
<tr>
<td>To get to places*</td>
<td>25.5±57.5</td>
</tr>
<tr>
<td>Exercise*</td>
<td>46.9±110.7</td>
</tr>
</tbody>
</table>

* vs. Control
3.3.2. Stages of change in walking behavior

Table 3 presents the distributions in the stages of change in walking behavior before and after the intervention period in the experimental and control groups. Significant inter-group differences were observed in the distributions after the intervention period (before: $\chi^2=207.88$, after: $\chi^2=400.65$, $p<0.05$). In order to examine the effect of the intervention program on the stages of walking behavior change, the proportion of advancement in the stage from the precontemplation, contemplation, preparation, or action stage to a higher stage was calculated. The proportion of progression from the lower stages (precontemplation or contemplation) to the higher stages (preparation, action, or maintenance stages) were also determined (Figure 2). The percentage of those who advanced to the higher stage were 38.5% for the experimental group and 22.3% for the control group ($\chi^2=60.52$, $p<0.05$). The percentage of those who progressed from the lower stages to the higher stages were 53.0% for the experimental group and 21.4% for the control group ($\chi^2=111.26$, $p<0.05$).

3.3.3. Walking self-efficacy

Table 2 presents the results of changes in the walking self-efficacy. The score for walking self-efficacy significantly decreased after the intervention period in both the experimental and control groups ($p<0.05$).

4. Discussion

The purpose of the present study was to implement a walking program that delivered e-mail newsletters to cellular phones and examined whether this program could encourage program participants aged 30’s and 40’s to engage in walking. The previous study observed that education, income, and socioeconomic status were the correlates of engaging in physical activity (Sallis & Owen, 1999). When male internet monitors in their thirties and forties were invited to participate in the present intervention program, many of those who applied to the intervention program tended to have a higher educational status and income levels. Thus, the effect of the intervention program was examined by adjusting confounding factors which might have influenced the outcome in the present study. Generally,
young people, those with occupation, and men are known to be less likely to participate in health education projects implemented by communities (Okayama & Nishi, 2002). For example, in the group-learning type of walking program developed by Itakura et al. (2005), participants were recruited using posted leaflets, resulting in participants with an average age of 60.9±7.3 years and including only 33.8% men and 15.9% people with an occupation. In a weight-loss program where e-mail messages were delivered to their mobile phones, many people in their 30s and 40s participated in the program after recruitment via public relations magazines, radio, and newspaper advertisements. However, the percentage of men joining was low, only 20.6% (Kubota et al., 2004). On the other hand, 49.9% and 70.7% of the program participants in the present study were men and those with an occupation, respectively, which were quite high proportion. These results suggest that group characteristics of participants in the present study might be different from those of participants in conventional programs. Regarding the stages of change in walking behavior, most of the participant on the present study was at the contemplation or higher stages. However, 9.7% of the participants were classified into the precontemplation stage. In conventional group-learning walking programs (Takeda & Nakamura, 2002; Itakura et al., 2005), no one at the precontemplation stage participated. In the remote walking program using print media (Akiyama et al., 2004), in which the course materials were delivered by mail and recruitment was done by newspaper insert advertising, those who were classified into the precontemplation stage was just 5.1% of all participants. In the present study, the scale assessing the stages of change utilized was specific to walking behavior. Thus, it might not simply compare the results on this scales with those on the scale assessing the stages of change in exercise behavior. However, the results in the present study implies that the recruitment of the intervention program utilizing Internet may more effective for those at the precontemplation stage, younger generation, and those with a occupation than that of the conventional walking programs distributing utilizing leaflet.

The program continuing rate on non-face-to-face programs have been reported to be 58% at 12 weeks for a Internet-based program to establish habitual exercise behavior (Kubota et al., 2003), 61% at 12 weeks for a weight-loss program utilizing the e-mail function of mobile phones (Kubota et al., 2004), and 86% at 4 weeks for a lifestyle modification program via mail (Kunitsuka et al., 2002). Although it could not simply compare the program continuing rate between the previous studies and the present study due to the differences among the programs such as program contents and definition of continuation, the program continuing rate in the present study was higher than the program by Kunitsuka et al. (2002), which had the same intervention period. On the other hand, describing that a pedometer would be given by lottery to respondents to the follow-up questionnaire in the

![Transition rate between each stage in both groups.](http://www.soc.nii.ac.jp/jspe3/index.htm)

**Figure 2** Transition rate between each stage in both groups.
recruitment information might be influenced with the result of program continuing rate in the present study.

The total walking time of the experimental group was found to have increased after the intervention period, suggesting that this program would be effective to increase the walking time. The effect of the walking program on the walking time for 5 walking types was also investigated in the present study. The program effects to increase walking time were observed on walking “for commuting,” “for shopping,” “for getting to and from place,” and “for exercising.” Because more men and those with occupation participated in the present intervention program than in conventional programs, the finding of the present study suggests that increasing walking time at work is difficult for these groups. It may be effective to develop the program to promote walking behavior which would focus on the situations for walking except work situations.

The increase in walking time after the intervention period was 10.8 minutes per week for the control group whereas 41.2 minutes per week for the experimental group. A previous review of walking promotion reported that interventions were expected to increase walking time by approximately 30-60 minutes per week (Ogilvie et al., 2007). The sample size in the present study was very large. Thus, a significant difference was presumed to be easily observable. Nevertheless, the difference in the walking time observed between the experimental and control groups was considered significant based on previous studies.

Walking time increased after the intervention period, whereas walking self-efficacy was not found to have increased. A possible reason for this is that even participants who had been highly confident in walking at baseline assessment might have encountered a difficult situation that prevented them from continuing to walk daily during the intervention program. After a month, their self-efficacy would have decreased.

In the experimental group, 53.0% of the participants at the precontemplation and contemplation stages progressed to the preparation stage or higher, indicating that those who had not been interested in walking, or those who had been interested in walking but had not been doing it, actually began to walk for health only upon participating in the intervention program. Although the walking program was not enough time to promote regular walking behavior due to immediate assessment of outcome following the 1-month intervention program, Delivery of e-mail messages to cellular phones could presumably have motivated the participants to progress walking behavior. Marcus et al. (1998) have mentioned that intervention methods tailored to specific stages were effective, especially for participants at the precontemplation, contemplation, and preparation stages. The present intervention program delivered different e-mail newsletters depending on the circumstances in which participants were walking, and depending on the situations available to them that most easily increased their walking time. This approach was similar to that of previous studies in terms of its effectiveness for participants at the earlier stages of change.

Meanwhile, since the number of participants at the maintenance stage decreased in both groups after the intervention period, the e-mail newsletters alone may not be effective to prevent a relapse. For those at this stage, the message content of e-mails should be examined in the future to develop more effective intervention programs. This is because introducing a special event or providing information about physical activity in cold weather has been reported to enhance motivation to maintain the activity (Glaros, 1997). Consequently, the findings in the present study demonstrated that e-mail newsletters delivered to cellular phones increased walking time by encouraging the participants at earlier stages of behavior change to progress to a higher stage.

Limitations of the present study were (1) that the outcome of the intervention program was derived from Internet-enrolled monitor of Company A who were interested in signing up for program participation; (2) that the effects of program were examined for quite short period, only a month; (3) walking time administered using only a self-reported questionnaire; and (4) reliability and validity of both the scale for stages of change in walking behavior and the scale for walking self-efficacy have not been examined. As for the first limitation, it is basically nonsensical to force those who did not wish to participate in the program to participate, but the participants in this program were selected from Internet social survey monitors. Although surveys at the Internet setting are characterized by their great convenience for both investigators and respondents, and rapid and accurate data collection, Yasunaga et al. (2006) have indicated that there could be sampling errors due to the non-representative nature of the Internet population. Therefore, the attention should be paid to generalizations from the findings of the present study to other walking intervention programs. Furthermore, Further randomized control
studies in which program applicants would be randomly assigned to either experimental or control groups should be conducted to verify the effectiveness of the intervention programs themselves. Regarding the second limitation, programs for a longer period should be conducted for the program effect. As for the third limitation, although it is difficult to measure walking time objectively on a large sample group, the combination of self-reported and objective indices can enhance their precision, which may be required. To address the final limitation, the scales utilized in the present study were modified from existing scales for evaluating exercise self-efficacy and stages of change in exercise behavior (Oka, 2003). Thus, these scales should be examined for their reliability and validity in the future.

The present study conducted an Internet-based survey and recruited the program participants from respondents of the Internet-based survey. Newsletters were delivered to the cellular phones of the participants via E-mail function for a month. As a result, the participants in the walking program with the cellular phone significantly increased the walking time, progressed the stages of change in walking behavior to a higher stage. Furthermore, higher proportion of men and those with occupations participated in the present program compared to previous studies, suggesting that walking programs utilizing the e-mail function of cellular phones could promote the walking behavior of individuals who would otherwise be less likely to participate in conventional intervention programs.

References


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