Social Support as a Moderator in a Fall Prevention Program for Older Adults

ABSTRACT

This study examined the moderating effects of social support in a fall prevention program for community-dwelling older adults. Twenty-six Japanese older adults age 65 and older participated in a 2-month exercise program and were measured in anthropometrical, physical, and psychological functioning at baseline, 2 months (intervention termination), and 5 months (3 months after intervention termination). Analyses indicated that the program did not improve participants’ body mass index, balance, or walking speed. However, participants’ falls self-efficacy significantly increased from baseline to intervention termination and was maintained at a higher level at the 5-month postintervention follow up. This efficacy-improving effect was prominent in the participants who had received less social support at baseline. The findings emphasized the importance of considering participants’ social resources and targeted intervention outcomes when evaluating the effect of exercise.

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Falling and fall-related injuries among older adults continue to be a common and serious public health problem (Means, O’Sullivan, & Rodell, 2003). In the United States, approximately 40% of the population age 65 and older living at home will fall at least once each year, and approximately 1 in 40 of these individuals will be hospitalized (Rubenstein, 2006). The same applies to Japan. Although Japanese people have the world’s longest life expectancy, a large number of the older adult population is now in need of nursing care because of problems related to falling (Statistics and Information Department, Minister’s Secretariat, Ministry of Health, Labour and Welfare, 2004). Figuring out a fundamental countermeasure to prevent older adults from falling is, therefore, a matter of global importance, not only for achieving a higher quality of life in old age, but also for reducing medical costs in an aging society.

**LITERATURE REVIEW**

Exercise is perhaps one of the most promising interventions to prevent falls because it improves strength, endurance, and body mechanics (Rubenstein, 2006). Indeed, a large variety of intervention trials have shown the benefits of exercise in reducing older adults’ risk of falling (e.g., Campbell, Robertson, Gardner, Norton, & Buchner, 1999; Faber, Bosscher, Chin A Paw, & van Wieringen, 2006; Li, Harmer, et al., 2005).

Despite the known benefits of exercise, older adults tend to become less active with age. It is argued that older adults’ sedentary lifestyles are partly due to their lowered falls self-efficacy, a measure of one’s belief in the ability to engage in certain daily activities without falling or losing balance (Tinetti, Richman, & Powell, 1990). A decrease in falls self-efficacy can result in self-induced restrictions in daily activities, which could then lead to depletion of muscle and lower extremity strength in older adults, thereby restricting their mobility and consequently, resulting in a fall. This new experience of falling may initiate further decrements in falls self-efficacy. To break this vicious cycle associated with falling, an exercise intervention aimed at enhancing falls self-efficacy and physical fitness should be made available to older adults.

This study was designed to investigate the benefits of an exercise intervention on anthropometrical and physical functioning as well as falls self-efficacy among Japanese older adults. The investigation extends the current literature by examining the various effects of a treatment in a circumstance. Although an individual’s response to an exercise may vary, the vast majority of published studies have given very little attention to these individual differences (Bouchard & Rankinen, 2001). To understand the effect of a treatment, researchers need to consider moderators that may help identify causal pathways between a treatment and its outcome and consider possible mechanisms through which a treatment might achieve its effects (Kraemer, Wilson, Fairburn, & Agras, 2002).

We addressed this issue by examining the exercise intervention response patterns that differed according to levels of social support. The available evidence indicates the importance of social support in the adoption and maintenance of physical activity regimens (King et al., 1992). However, most of these findings were derived from observational studies (e.g., Salis et al., 1989; Wilcox, Bopp, Oberrecht, Kammermann, & McElmurray, 2003), and little is known about how social support acts as a moderator in an exercise intervention situation. It has been suggested that although age is negatively related to exercise self-efficacy (Wilcox & Storandt, 1996), social support has an indirect effect on exercise behavior through self-efficacy (McNeill, Wyrwich, Brownson, Clark, & Kreuter, 2006). We then hypothesized that social support would promote the performance of the exercise interventions prescribed for older adults.

Another question this study addressed was whether the intervention gains could be maintained for a period of time. In ordinary practice, study participants are exposed to regular exercise of defined mode, intensity, frequency, and duration conditions that are sustained for weeks or months. The baseline outcome measures are then compared with those completed immediately after the final trial (e.g., Arai et al., 2007; Li, Fisher, & Harmer, 2005; Means et al., 2003). However, it is important to track the changes in the outcome measures at some point after the intervention termination to evaluate whether the intervention outcomes extend to the participants’ daily lives. In this study, we investigated the program-associated changes of various outcomes from baseline to both short-term (intervention termination) and long-term (3 months after intervention termination) follow up.

**METHOD**

**Sample**

The trial involved 29 community-dwelling older adults who were recruited via a local public newsletter advertisement. Inclusion criteria for the study were a minimum age of 65 and being able to ambulate independently. All of the participants were

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**Falls self-efficacy** is a measure of one’s belief in the ability to engage in certain daily activities without falling or losing balance.
required to complete a written informed consent form, and the project was approved by the participating institute’s ethics committee.

**Procedure**

Exercise sessions were held in a local community center once every 2 weeks for 2 months (five sessions total). Each session lasted approximately 120 minutes. The participants attended a wellness education program in the first half of the session, which consisted of instructions on fall prevention, diet and nutrition, and mental health issues, such as stress and depression. In the latter half of the session, the participants attended a physical training program generally prescribed to improve balance and mobility. It began with a 10-minute warm-up period followed by 45 minutes of aerobic and resistance exercises, including stretching, postural control, walking endurance, and repetitive muscle coordination. The training concluded with 5 minutes of cool-down exercises. Handouts that demonstrated some of these exercises were distributed to the participants to encourage them to practice at home during the intervention period.

Repeated measurements of outcome variables were performed to examine the participants’ anthropometrical, physical, and psychological changes associated with the intervention. The assessments were conducted at baseline, 2 months (intervention termination), and 5 months (3 months after intervention termination). The 5-month follow up was conducted to confirm the long-term benefits of the program.

**Measures**

*Anthropometrical Measures.* Body weight was measured to the nearest 0.2 kg using a digital scale; height was measured to the nearest 0.1 cm using a stadiometer. For the statistical analyses, body mass index (BMI) was calculated as weight (kg) divided by height squared (m$^2$).

*Physical Performance.* Standing balance and walking speed were used to assess physical performance. The amount of time participants could stand on one leg (with open eyes) was timed in seconds to test muscle endurance for maintaining balance. Walking speed was assessed by measuring the time required for participants to complete a 10-meter walk.

*Psychological Assessments.* Falls self-efficacy was measured with a 15-item questionnaire (Takenaka, Chikagawa, Honda, & Matsuzaki, 2002). The participants were asked to rate their level of confidence performing activities (e.g., “reaching up to a high closet,” “getting in and out of a chair”) without a hazardous fall on a 5-category scale ranging from 1 (very unconfident) to 5 (very confident). Total scores ranged from 15 to 75, with higher scores indicating greater self-efficacy. Acceptable reliability and validity of the scale have been reported elsewhere (Takenaka et al., 2002). For this sample, the internal reliability of the scale (Cronbach's alpha coefficient) was 0.91 (baseline), 0.85 (2 months), and 0.92 (5 months).

*Social Support.* Social support for physical activity was assessed at baseline with a 5-item scale. Participants rated five questions (e.g., “Do your family and friends advise you how to exercise?”, “Do your family and friends praise you when you exercise?”) on the basis of how supportive family members and friends were in their daily physical activity, with responses ranging from 1 (strongly disagree) to 5 (strongly agree). Total scores ranged from 5 to 25, with higher scores indicating greater support. Acceptable reliability and validity of the scale have been reported elsewhere (Itakura, Oka, Takeda, Watanabe, & Nakamura, 2003). Cronbach’s alpha coefficient for this sample was 0.70.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Baseline</th>
<th>Baseline</th>
<th>2 Months</th>
<th>2 Months</th>
<th>5 Months</th>
<th>5 Months</th>
<th>Main Effect of Time$^a$</th>
<th>Time and Support Interaction$^a$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body mass index (kg/m$^2$)</td>
<td>21.8</td>
<td>1.39</td>
<td>22.2</td>
<td>1.39</td>
<td>22.2</td>
<td>1.39</td>
<td>2.88</td>
<td>1.62</td>
</tr>
<tr>
<td>One-leg balancing time (seconds)</td>
<td>25.1</td>
<td>11.84</td>
<td>20.5</td>
<td>12.42</td>
<td>28.3</td>
<td>12.09</td>
<td>0.04</td>
<td>0.03</td>
</tr>
<tr>
<td>Walking speed (seconds)</td>
<td>8.6</td>
<td>0.37</td>
<td>7.7</td>
<td>0.41</td>
<td>8.1</td>
<td>0.38</td>
<td>2.83</td>
<td>1.61</td>
</tr>
<tr>
<td>Falls self-efficacy score</td>
<td>45.4</td>
<td>4.48</td>
<td>50.1</td>
<td>4.66</td>
<td>47.5</td>
<td>4.56</td>
<td>5.78**</td>
<td>3.6*</td>
</tr>
</tbody>
</table>

$SE =$ standard error.

$^a$ F values were adjusted for age, gender, years of education, and activity level at baseline.

$^* p < 0.05; ^{**} p < 0.01.$

**TABLE**

RESULTS OF MIXED-MODEL ANALYSES ON OUTCOME VARIABLES

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19.9 Contact Hours

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Chikagawa, Honda, & Matsuzaki, 2003). Cronbach’s alpha coefficient for this sample was 0.70.
Demographic Data. Gender, age, and years of education were identified at baseline. In addition, to define the participants’ activity level, individuals who reported regularly exercising in the 6 months prior to study enrollment were categorized as active, and the others were categorized as inactive.

Data Analysis
Repeated-measure analyses using mixed-linear models were performed for each outcome variable. Gender, age, years of education, and activity level at baseline were included as covariates. For each covariate-adjusted analysis, the statistical significance of the main effect of time was estimated to confirm the benefit of exercise on the outcome variables. The two-way interaction of time and social support was estimated to address the question of whether the effect of exercise intervention differed by the levels of social support. All statistical analyses were performed using SAS software, version 9.1.

RESULTS
In this study, 3 of the 29 participants did not complete the intervention program. In addition, 1 participant was excluded because of a diagnosis of Parkinson’s disease that was previously undetected. Therefore, we analyzed the data of 25 participants (3 men, 22 women). The average age was 73.6 (SD = 5.5 years), with 10 years (SD = 2.1) of education. Forty percent of the participants were categorized as active, and the average social support score was 14 points (SD = 4.4). There were no statistically significant differences in these characteristics between the participants who completed the study and those who did not, except for age. Participants who did not complete the study were older compared with their counterparts (p < 0.05).

The changes in the outcome variables with time and the results of mixed-model analyses are presented in the Table. Analyses indicated that BMI, the one-leg balancing time, and walking speed did not change between baseline and the 2-month and 5-month follow ups. On the contrary, in regard to falls self-efficacy, the main effect of time was statistically significant (F[2, 30] = 5.78, p < 0.01), indicating that the changing pattern of efficacy scores at baseline (45.4), intervention termination (50.1), and postintervention (47.5) was statistically significant. However, it was not ed that the interaction between time and social support was also significant (F[2, 30] = 3.60, p < 0.05), indicating that the changing pattern differentiated by social support.

Post hoc analyses using mixed-linear models were performed to examine the pattern differences of changes in falls self-efficacy scores in relation to social support levels (low versus high mean support score). The Figure illustrates the results. When adjusting for gender, age, years of education, and activity level at baseline, the main effect of time was not statistically significant for the higher support group (F[2, 12] = 0.29, p = not significant); however, the effect of time was significant for the lower support group (F[2, 18] = 3.93, p < 0.05). Using the Tukey-Kramer method for multiple comparisons, we found that the participants in the lower support group showed a significant increase in their falls self-efficacy score from baseline to intervention termination (t[18] = –2.72, p < 0.05) and maintained higher falls self-efficacy scores at the postintervention follow up compared with those at intervention termination (t[18] = 1.22, p = not significant).

DISCUSSION
Previous studies have reported that exercising is a convenient and practical strategy to improve physical fitness and, consequently, prevent falling in older adults. In this study, however, no significant effect of exercise intervention was found on participants’ anthropometrical and physical performance measures. One explanation for this unexpected result is that our exercise protocol (1 hour per day, 5 days in 2 months) was not quantitatively enough to change the participants’ body composition and build their physical strength. In fact, previous interventions that achieved improvement in older participants’ physical performance prescribed longer and more strenuous exercises than were used in our study (i.e., 60-minute cobblestone mat walking [Li,
benefits. The results are in line with the hypothesis that involvement in an exercise program can provide psychological benefits. The supervised low-intensity exercise sessions for every other week, as we did in our program, makes the intervention feasible in practice settings. Therefore, investigating the applicability of our exercise program at home, as well as its effect on physical performance measures, would be the next step to developing and refining our findings.

The negative finding could also be attributed to the participants’ characteristics. Because the participants in this study consisted of volunteers who responded to the advertisement, it is possible that older adults who were frail declined to participate in our program. By following the logic that individuals who are far below physical capacity in fitness gain greater benefits from exercise (Fukukawa et al., 2004), we could say that the participants’ physical hardiness might have reduced the effect of exercise in our study. Consequently, the results of this study suggest that we should consider participant characteristics when designing intervention strategies and, if necessary, alter the exercise routine according to the targeted outcomes to detect the effect of the program.

On the contrary, our findings (i.e., the intervention program improved participants’ falls self-efficacy at a statistically significant level) suggest that involvement in an exercise program can provide psychological benefits. The results are in line with studies that suggest the usefulness of exercise in improving self-efficacy (Li, Fisher, Harmer, & McAuley, 2005; Netz, Wu, Becker, & Tenenbaum, 2005). Fuzhong et al. (2002) argued that falls self-efficacy could mediate the relationship between exercise and the fear of falling in older adults. Thus, even if the exercise program was not intense enough to enhance participants’ physical fitness, as was the case in our study, it may still contribute indirectly to reduce fall risk by improving self-efficacy.

However, not every participant’s falls self-efficacy improved through exercise. Rather, our analyses indicated that participants with less social support experienced greater benefit of exercise in improving self-efficacy. In this respect, the current study extends earlier studies by highlighting the role of social support as a moderator influencing the exercise intervention process for older adults. In general, intervention situations can provide participants with not only optimally challenging exercise tasks but also an opportunity to receive social support from staff and other participants. It is possible that the social support provided during our exercise sessions had improved the participants’ self-efficacy. Researchers with a social cognitive perspective (Bandura, 1986) would argue that persistence in activities that are subjectively threatening but are in fact relatively safe produces, through experiences of mastery, further enhancement of self-efficacy. This mechanism would probably work better for participants with less support at baseline, as they are not clinically frail and, with some help that serves as a source of efficacy information, would fulfill their potential for exercise.

Another finding that adds a specific point to the literature relates to the duration of the intervention effect. That is, participants in the lower support group not only had improved falls self-efficacy at the intervention termination but also maintained the confident psychological benefits. The findings emphasized the importance of considering participants’ social resources and targeted intervention outcomes when evaluating the intervention effect of exercise.
status at the 5-month follow up. This suggests that the effect of exercise on self-efficacy is more sustainable than previous studies have shown (Arai et al., 2007; Lee, Arthur, & Avis, 2007; Resnick, 2002). Indeed, one intervention study (Hughes et al., 2006) in which older individuals’ self-efficacy for exercise that had improved with physical training was maintained at the 12-month postintervention follow up supports our finding. A matter of deep interest in this study is that self-efficacy was also associated with exercise adherence over time, suggesting that the long-term maintenance of higher self-efficacy could encourage participants’ voluntary exercising at home on a regular basis, even after the intervention termination period. To prevent falling and fall-related injuries in older adults, prescribing exercise that helps participants develop an exercising habit would be required. In this regard, our study provides a possible pathway in which exercise intervention serves as a trigger for older adults to avoid sedentary lifestyles via the improvement of falls self-efficacy.

LIMITATIONS

There are several limitations to this study. First, male participation in the study lacked a control group of population. Results may not generalize to the entire population. Although gender was adjusted for all statistical analyses, the study results may not generalize to the entire population.

Another limitation is that this study lacked a control group of older adults who did not exercise. A more strictly designed study, such as a randomized, controlled trial, would be required to confirm our findings. The final constraint is that we did not investigate the possibility that moderators other than social support would influence the intervention process. For example, Bouchard and Rankinen (2001) argued that there is an interindividual variation in responsiveness to exercise training because it is characterized by genetic factors. Although their arguments are limited to physical and physiological issues, such as submaximal exercise heart rate and blood pressure, hereditary predisposition may also serve as a moderator of psychological responsiveness to exercise. An elaborate analysis of these issues would modify and extend our findings.

IMPLICATIONS FOR NURSES

Despite these limitations, our findings suggest that exercise training is effective for older adults in improving falls self-efficacy, especially in those who are not well supported by their social environment. This implies that because of lack in social support, many older adults may perceive self-induced barriers that could lead to restrictions in exercise. By educating older adults about the benefits of exercise, as well as encouraging them to overcome barriers to exercise, nurses could intervene in preventing patients from falling. The education should be done in a group setting, rather than one on one, because it would provide older adults with opportunities to become peer supporters of each other. Exchanging social resources allows older adults to foster a sense of common bonds that contributes to maximizing exercise adherence. From that perspective, exercise intervention that includes a program for building participants’ social support network would be more promising than a general intervention targeted only at enhancing participants’ fitness.

SUMMARY

Decreases of psychological and physical functioning can hamper the quality of life in old age, thus useful and low-cost strategies are required to help older adults remain active in both of these areas. This study addressed the issue by examining the effects of a fall prevention program among Japanese community-dwelling adults age 65 and older. The results indicated that although the program did not improve participants’ anthropometrical and physical functioning, it improved their falls self-efficacy for a longer period of time, especially among those who had received less support from their family and friends at baseline. The findings emphasized the importance of social resources as moderators in the intervention process of a program.

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Because of lack in social support, many older adults may perceive self-induced barriers that could lead to restrictions in exercise.


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