Effects of Japanese drum exercise on depression and physical function in community-dwelling older women

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Abstract

Background/Purpose: We examined whether a 3-month Japanese drum exercise program can ameliorate depressive mood and improve physical fitness in community-dwelling older women.

Methods: The participants were 40 community-dwelling older women aged 65 years and older who satisfied one or more of the mood items on the Kihon checklist. They were divided into two groups: a 3-month Japanese drum exercise group and a control group. The study included 21 women who participated in Japanese drum exercises (mean age, 76.8 ± 5.2 years) and 19 control participants (79.8 ± 5.4 years). To evaluate the participants' psychological status, we used the depression item (D) on the short form of the profile of mood states. The body composition of participants was determined using bioelectrical impedance analysis. In addition, gait speed, grip strength, and scores on the morale scale, the geriatric depression scale, the trail making test, and the mini-mental state examination were measured before and after the intervention.

Results: After the 3-month intervention, we found no significant main effect-induced differences (p = 0.135) in Profile of Mood States between the groups. No significant difference was found between groups for any of the psychophysiological or physical fitness measures after the intervention.

Conclusion: Our results did not support the hypothesis that the Japanese drum exercise can improve depressive mood in older women. However, depressive mood showed a slight improvement in the intervention group, suggesting that a longer or more frequent session of intervention might have had an effect.

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1. Introduction

With the current aging population, it is very important to prolong healthy lifespan and prevent frailty and disability to ensure that older people have active and independent lives. If the difference between the average overall life expectancy and healthy life expectancy can be decreased through the prevention of disease, promotion of public health, and reduction of nursing care, the following will be more likely: (1) individuals will be more satisfied with their lives and have something to live for; (2) a decrease in individuals’ quality of life will be prevented; and (3) less financial assistance from the government will be required. Thus, in addition to preventing and treating diseases, the approaches to meeting the needs of an aging society have increasingly focused on overcoming frailty and comorbidities and on maintaining/improving daily functions. Therefore, it is necessary to clarify the causes of age-related changes in daily functions as well as their processes and to adopt measures to prevent such changes.

Among age-related clinical problems, depression is one of the most debilitating geriatric syndromes and an important aspect of geriatrics worldwide. As a result of the high rate of suicide rate among older people, many Japanese researchers have attempted to address the problem of depression in this population. Previous studies attempted to ameliorate depressive symptoms through a variety of relaxation and physical/cognitive interventions. According to recent meta-analyses, both supervised and unsupervised physical activity interventions are effective in reducing depressive symptoms.
symptoms among adults without clinical depression.\textsuperscript{2} Using the
definition of exercise employed by the American College of Sports
Medicine, Cooney et al\textsuperscript{3} reported on the effectiveness of exercise
interventions in \textit{Cochrane Reviews} and concluded that moderate
exercise is effective in relieving depression. However, the optimal
type, intensity, duration, and frequency of exercise for the pre-
vention of depression have yet to be determined.

In addition to exercise interventions, music therapy showed
sustained beneficial effects on study participants' self-esteem,
mood, depression, and psychological distress.\textsuperscript{4,5} Among the
musical interventions, playing Japanese drums is attractive
because it requires the movement of individuals' entire body,
particularly their arms, while both sitting and standing. Thus, like
dancing, playing a Japanese drum is a full-body exercise. It involves
dynamic motions, vocalization (e.g., increasing tone and pitch),
sounds with various intensities, and rhythms with different
tempos. By watching instructors' movements and listening to the
dancing, playing a Japanese drum is a full-body exercise. It involves
particularly their arms, while both sitting and standing. Thus, like
musical interventions, playing Japanese drums is attractive
exercise is effective in relieving depression. However, the optimal
interventions in

2. Methods

2.1. Participants

Prior to recruitment, sample size was calculated using the
depression item of short form of the profile of mood states as the
primary outcome and considering the value from previous litera-
ture on depression improvement by music therapy as reference
with an approximate effect size of 0.31.\textsuperscript{1} To reach a power of 0.8,
with α set at 0.05 and β at 0.2, the required sample size calculated
was 76. We included four more participants as dropout precaution,
totalizing an original plan intended for 80 people.

A total of 189 community-dwelling older people (27 men and
162 women) who regularly visited a community disability-
prevention center in Kyoto, Japan were recruited for the study.
The inclusion criterion for this study was at least one positive
response indicating a depressive mood among answers to the five
mood questions on the Kihon checklist, which has questions
similar to those of the geriatric depression scale (GDS).\textsuperscript{5} Individuals
who were taking medications for depression and those with visual
impairment or physical disability were excluded from the study.

Among the 189 recruited, 114 did not meet the inclusion crite-
ron or were excluded because of meeting the exclusion criteria
stated above. Among the remaining 75 people 43 (3 men and 40
women) agreed to participate in this study. Because most of the
participants were women, we asked only women to participate in
this study. Thus, the planned sample size could not be reached,
unfortunately. Written informed consent was obtained from each
participant in accordance with the guidelines of Kyoto University
Graduate School of Medicine, Kyoto, Japan. The study protocol was
approved by the Kyoto University Graduate School of Medicine
Ethics Committee (No. E 1910-2).

In this study we nonrandomly divided 40 participants of
community-dwelling older women (≥ 65 years) living in Kyoto
City into an intervention group of 3 months of Japanese drum
exercise (21 participants) and a control group (19 participants),
who performed exercise independently for the same period of
time (Figure 1). The allocation to the intervention or control group
was performed by one healthcare professional in a community
disability-prevention center in Kyoto, according to the partici-
pants' willingness to participate in the drum exercise and the
convenience to commute to the drum exercise venue. The exercise
intervention consisted of one 40-minute session consisting of
warming up for 5 minutes, group drum exercise of moderate to
vigorous intensity for 30 minutes, and cooling down and stretch-
ing for 5 minutes and the intervention group participated in this
program once a week for 12 weeks. The control group was
instructed to increase the amount of exercises such as stretching,
and walking, and to maintain the usual level of activity during the
study period according to their own discretion. The intervention
group was also instructed in the same way.

2.2. Measurements

We recorded age, years of education, medication use, sleeping
hours, and medical history (e.g., stroke, heart disease, diabetes, low
back pain, knee osteoarthritis, cancer). Data on self-rated health
status, appetite, sleep disturbance, self-efficacy, behavioral inten-
tion to go out, mood, and lifestyle changes were also collected.
Changes in participants' physical condition were assessed by a
questionnaire, and body mass index (BMI) was calculated as weight
(kg) divided by height (m) squared. The Kihon checklist for frailty
and the Tokyo Metropolitan Institute of Gerontology index of
competence\textsuperscript{7} for instrumental activities of daily living (ADLs)
were administered. The Tokyo Metropolitan Institute of Gerontology
index of competence, developed according to the hierarchical
model of competence proposed by Lawton,\textsuperscript{10} is a multidimensional,
13-item index used to assess advanced life function, which cannot
be evaluated with a scale that assesses ADLs. This index is used to
measure three types of competence: instrumental self-
maintenance, intellectual activity, and social role.

2.3. Psychophysiological function

We used the short form of the profile of mood states (POMS-SF)
to assess psychophysiological function.\textsuperscript{11,12} This is a 30-item (6
subscals) self-completed questionnaire used to evaluate an in-
dividual's mood and the following six types of emotions: ten-
sion—anxiety; depression—dejection; anger—hostility; vigor;
fatigue; and confusion. Each item was scored on a scale from 0 to 4
points (0, not at all; 4, very often). For each subscale, we calculated
the total scores, which were adjusted for age to obtain a partici-
 pant's T score. For all these subscales, higher scores indicate higher
levels of the corresponding emotion. Yokoyama\textsuperscript{13} developed the
short Japanese form of the POMS, verified its reliability and validity,
and confirmed the appropriateness of the translated terms. Akaba-
ayashi et al,\textsuperscript{14} who employed the POMS in clinical settings, re-
ported that the scale facilitates self-evaluation of emotion and
mood in patients with depressive symptoms or anxiety-related
neurosis and that the scale's scores accurately represent patients' emotional state.

The Philadelphia Geriatric Center morale scale\textsuperscript{15} was used to
assess older people's morale, the GDS\textsuperscript{15} to assess mood, the trail
making test (TMT)\textsuperscript{16} and the mini-mental state examination
(MMSE)\textsuperscript{17} to assess cognitive function. The International
Consultation on Incontinence questionnaire—short form was used to assess urinary incontinence. We also asked all participants “How do you assess your own health condition?” before and after the intervention.

2.4. Assessment of physical function

We measured fat-free body mass, muscle mass, body fat, and body weight for all participants. A bioelectrical impedance data-acquisition system (Inbody 430; Biospace, Seoul, Korea) was used to determine fat-free body mass, muscle mass, and body fat. Using segmental body composition and muscle mass, a value for appendicular skeletal muscle mass was determined and used for further analysis. Muscle mass was converted into the skeletal muscle mass index by dividing weight by height squared (kg/m^2). This index has been used in several epidemiological studies.

We also conducted the timed up and go test and recorded the time taken to walk 10 m at both normal and maximum walking speeds. To determine the participants' general endurance, we performed the shuttle stamina test—walking (SSTw), in which the participants were instructed to walk as fast as possible for 3 minutes to measure their maximum walking distance. Maximal voluntary isometric strength of handgrip was measured using a JAMAR hand dynamometer (North Coast Medical Inc., Gilroy, CA, USA). The measurement was taken for the dominant hand while the participant was in a sitting position. The muscle strength test was carried out three times. The handgrip strength score was defined as the best performance of three trials.

2.5. Statistical analysis

Analyses were performed on those who completed both the baseline and final evaluations. The Japanese drum exercise group's and the control group's pre- and postintervention scores for item D (depression—dejection), the primary endpoint of this study, were compared using a two-way analysis of variance with a repeated measurement method (split-plot analysis of variance). To conduct between-group comparisons before and after the intervention, we used the unpaired t test (for age, BMI, timed up and go test, normal walking speed, maximum walking speed, SSTw, grip strength and skeletal muscle mass index) and Mann–Whitney U test (for years of education, instrumental activities of daily living, Kihon checklist (depression item), POMS(D), Philadelphia Geriatric Center morale scale, GDS, TMT-A, TMT-B, MMSE, and International Consultation on Incontinence questionnaire—short form). A difference-in-difference analysis was carried out to compare the differences in the change (the values after the intervention minus the values before the intervention) in each of the variables between the two groups using the unpaired t test or Mann–Whitney U test as above.

The data were managed and analyzed using SPSS (Windows version 22; SPSS Inc., Chicago, IL, USA). A p value < 0.05 was considered to indicate statistical significance for all analyses.

3. Results

We analyzed 21 participants in the Japanese drum exercise group [mean age ± standard deviation (SD) 76.8 ± 5.2 years] and 19 in the control group (79.8 ± 5.4 years). There were no adverse
Table 2
Physical performance in two groups at baseline and after 3 months.*

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>Post</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Japanese drum</td>
<td>Control</td>
<td></td>
</tr>
<tr>
<td>exercise group</td>
<td>exercise group</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean ± SD</td>
<td>Mean ± SD</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Physical performance</th>
<th>n</th>
<th>Japanese drum exercise group</th>
<th>Control group</th>
<th>p-value</th>
<th>n</th>
<th>Japanese drum exercise group</th>
<th>Control group</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Timed Up &amp; go test (s)</td>
<td>21</td>
<td>8.6 ± 1.6</td>
<td>18</td>
<td>9.3 ± 2.4</td>
<td>0.335</td>
<td>21</td>
<td>9.0 ± 2.2</td>
<td>18</td>
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<tr>
<td>Normal walking time (m/s)</td>
<td>21</td>
<td>1.1 ± 0.2</td>
<td>18</td>
<td>1.2 ± 0.3</td>
<td>0.781</td>
<td>21</td>
<td>1.3 ± 0.2</td>
<td>17</td>
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<tr>
<td>Maximum walking time (m/s)</td>
<td>21</td>
<td>1.5 ± 0.3</td>
<td>18</td>
<td>1.4 ± 0.3</td>
<td>0.165</td>
<td>21</td>
<td>1.6 ± 0.4</td>
<td>17</td>
</tr>
<tr>
<td>Shuttle Stamina Test by walking (m)</td>
<td>21</td>
<td>184.6 ± 41.8</td>
<td>17</td>
<td>180.5 ± 48.7</td>
<td>0.779</td>
<td>21</td>
<td>203.2 ± 40.8</td>
<td>18</td>
</tr>
<tr>
<td>Hand grip strength (kg)</td>
<td>21</td>
<td>19.8 ± 4.0</td>
<td>18</td>
<td>22.4 ± 4.9</td>
<td>0.075</td>
<td>21</td>
<td>19.2 ± 4.1</td>
<td>18</td>
</tr>
<tr>
<td>SMI (kg/m²)</td>
<td>21</td>
<td>5.7 ± 0.5</td>
<td>19</td>
<td>5.6 ± 0.8</td>
<td>0.656</td>
<td>21</td>
<td>5.6 ± 0.6</td>
<td>18</td>
</tr>
</tbody>
</table>

SMI = skeletal muscle mass index.
Control group vs Japanese drum exercise group by t-test.

Table 3
Cognitive function in two groups at baseline and after 3 months.*

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>Post</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>Median</td>
<td>IQR</td>
</tr>
<tr>
<td>Functional states</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>POMS (D)</td>
<td>21</td>
<td>49.0</td>
<td>45.0–53.0</td>
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<tr>
<td>PGC</td>
<td>21</td>
<td>12.0</td>
<td>9.5–14.0</td>
</tr>
<tr>
<td>GDS</td>
<td>21</td>
<td>4.0</td>
<td>2.5–7.0</td>
</tr>
<tr>
<td>TMT-A(s)</td>
<td>21</td>
<td>56.0</td>
<td>46.0–60.0</td>
</tr>
<tr>
<td>TMT-B(s)</td>
<td>21</td>
<td>108.0</td>
<td>96.0–137.0</td>
</tr>
<tr>
<td>MMSE</td>
<td>21</td>
<td>27.0</td>
<td>26.5–30.0</td>
</tr>
<tr>
<td>ICIQ-SF</td>
<td>21</td>
<td>1.0</td>
<td>0.0–4.0</td>
</tr>
</tbody>
</table>

GDS = geriatric depression scale; ICIQ-SF = International Consultation on incontinence questionnaire-short form; MMSE = mini-mental state examination; PGC = Philadelphia Geriatric Center morale scale; TMT = trail making test.
* Control group vs Japanese drum exercise group by Mann–Whitney U test.

The participants’ T scores for item D; the test did not show a significant difference in the psychophysiological or physical indices between the two groups (Tables 1–3). Using a repeated measurement method, analysis of variance was performed on the participants’ T scores for item D; the test did not show a significant difference between the drum and control groups (main effect: F = 2.334, p = 0.135; interaction: F = 1.587, p = 0.215; Figure 2). In healthy individuals, the score for item D generally ranged from 40 points to 60 points. The item D score showed a larger decrease in the intervention group than in the control, although the difference did not reach statistical significance. Concerning the other psychophysiological measures, no significant difference was found between groups before or after the intervention. As seen in the item D score, the GDS scores had a larger decrease in the intervention group than in the control, although the difference did not reach statistical significance (Table 3). The difference-in-difference analysis showed that SSTw performance and grip strength were significantly improved by the intervention (Table 4).

4. Discussion

In this study, we examined the effect of playing the Japanese drum on depressive mood and on psychophysiological and motor functions after the intervention in Japanese older women (see Supplemental Table). However, we did not observe a significant effect of the Japanese drum exercise intervention after 3 months. No significant difference was noted in the psychophysiological or physical indices between the intervention and control groups. However, when we performed a difference-in-differences analysis
received a favorable response. Therefore, we propose that more frequent and longer interventions would be effective in ameliorating depressive mood and hopefully increasing physical fitness in older adults with mild depressive mood.

**Conflicts of interest**

The authors declare no conflict of interest.

**Acknowledgments**

This study was supported by Grants-in-Aid for Comprehensive Research on Aging and the Kyoto Academia Public Cooperation Mechanism of Japan. We would like to thank Munenori Higashi, Hideo Hirousse, Misao Aihara, and all the staff members at Taiko Center Co., Ltd. and members at Shimogyo Region Disability Prevention Promotion Center, Kyoto, Japan for the Japanese drum training and recruiting the participants of this study.

**Appendix: Supplementary material**

Supplementary material associated with this article is available at http://dx.doi.org/10.1016/j.anbehav.2016.03.004.

**References**


**Table 4**

Comparison of the difference between the change across the intervention period.

<table>
<thead>
<tr>
<th></th>
<th>Japanese drum exercise group</th>
<th>Control group</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical performance</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Timed Up &amp; go test (s)</td>
<td>21 ± 1.2</td>
<td>17 ± 1.2</td>
<td>0.847</td>
</tr>
<tr>
<td>Normal walking time (m/s)</td>
<td>0.2 ± 0.2</td>
<td>0.1 ± 0.1</td>
<td>0.404</td>
</tr>
<tr>
<td>Maximum walking time (m/s)</td>
<td>0.1 ± 0.2</td>
<td>0.1 ± 0.2</td>
<td>0.928</td>
</tr>
<tr>
<td>Shuttle Stamina Test by walking (m)</td>
<td>18.6 ± 24.8</td>
<td>16 ± 3.6 ± 15.9</td>
<td>0.002</td>
</tr>
<tr>
<td>Hand grip strength (kg)</td>
<td>0.5 ± 4.5</td>
<td>5.0 ± 3.0</td>
<td>0.001</td>
</tr>
<tr>
<td>SMI (kg/m²)</td>
<td>21 ± 4.5</td>
<td>18 ± 0.0 ± 0.2</td>
<td>0.398</td>
</tr>
</tbody>
</table>

Control group vs Japanese drum exercise group by t-test. SMI = skeletal muscle mass index.

(Table 4), we found a significant effect of the Japanese drum exercise intervention on SS7w and handgrip strength.

Although our primary results did not support the hypothesis that depressive mood can be ameliorated by participating in a Japanese drum exercise class once per week, the T score for item D of the POMS-SF showed a larger improvement in the intervention group than in the control group; however, this difference did not reach statistical significance. This result is consistent with a previous study in which the participants with a normal baseline score for depression showed little change in their mood after a music intervention. 24

Although we recruited participants with depressive mood based on the Kihon checklist, the POMS-D scores were in the normal range and the mean GDS scores were relatively low in both groups, potentially affecting the outcome of this study. Although exercise has been reported to be effective in improving cognitive function, 25 individuals with cognitive dysfunction can face difficulties in understanding how to perform tasks with specific exercise patterns, which might preclude the effects of exercise on several outcomes. 26–29 However, because the mean MMSE scores in this cohort were relatively high before the intervention (i.e., 27.3 ± 2.2) it is likely that the participants were able to understand the exercise program. Because the participants in the Japanese drum exercise group were eager to continue the program and did not complain about severe bodily pain caused by the exercise, we might have obtained a positive result with a program of higher frequency and longer duration.

The study had several limitations. First, the intended sample size could not be reached. Thus, the achieved number of participants has insufficient statistical power to delineate meaningful effect size. Second, the nonrandom allocation could cause some confounding. Third, we evaluated mental health status only in a subjective manner using a questionnaire. Therefore, it would be necessary to evaluate mental health in a more objective manner, such as by using physiological techniques, such as cortisol concentration. Fourth, there was only one exercise session per week due to the limited space and time availability in the community center, while two or three sessions per week are usually recommended. Fifth, given that the participants were regular visitors to a community disability-prevention center, many of them must have been interested in exercise. Thus, the study participants may have had a high level of health literacy prior to the study, potentially making it difficult to obtain a positive result. Targeting a more vulnerable population might be a more appropriate approach. Personalized programs tailored to each individual’s abilities, behavioral stage, and environment should be addressed in future studies.

In conclusion, we addressed the effect of Japanese drum exercise on mood, physical fitness, cognitive function, quality of life, and urinary incontinence in Japanese older women and did not obtain positive results. However, the exercise was well tolerated and


