Journal of Clinical Gerontology & Geriatrics 7 (2016) 158–163

Contents lists available at ScienceDirect

Journal of Clinical Gerontology & Geriatrics

journal homepage: www.e-jcgg.com

Original article

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

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ARTICLE INFO

Article history:
Received 29 January 2016
Accepted 31 January 2016
Available online 24 March 2016

Keywords:
depression
geriatric medicine
intervention
Japanese drum
Kihon checklist
quality of life

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.

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.[1] According to recent meta-analyses, both supervised and unsupervised physical activity interventions are effective in reducing depressive

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http://dx.doi.org/10.1016/j.jcgg.2016.01.001

symptoms among adults without clinical depression.[2] Using the definition of exercise employed by the American College of Sports Medicine, Cooney et al[3] reported on the effectiveness of exercise interventions in *Cochrane Reviews* and concluded that moderate exercise is effective in relieving depression. However, the optimal type, intensity, duration, and frequency of exercise for the prevention 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.[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 sounds that they produce, Japanese drum players can understand the proper rhythms and tempos and play original music using drumsticks in their own way, which could ameliorate depressive mood and improve physical fitness even in frail older adults. Indeed, a study investigating the effects of playing Japanese drums on stress reduction in six Japanese men and women with the average age of 60.6 years showed that the rhythmic sounds of the drums, used for a therapeutic purpose, relieved tension.[6]

Therefore, it is expected that if older people with depressive mood regularly play a Japanese drum, they might improve their psychophysiological and physical functions. However, it is unknown whether playing a Japanese drum effectively reduces depressive symptoms in addition to improving players' physical fitness. Thus, the aim of this study was to investigate the effects of Japanese drum exercise on depressive mood and physical fitness in community-dwelling older women.

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 literature on depression improvement by music therapy as reference with an approximate effect size of 0.31.[7] 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).[8] 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 criterion 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 contest 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 ($\geq$ 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 participants' 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 stretching 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 intention 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[9] 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,[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.[11,12] This is a 30-item (6 subscales) self-completed questionnaire used to evaluate an individual's mood and the following six types of emotions: tension–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 participant's T score. For all these subscales, higher scores indicate higher levels of the corresponding emotion. Yokoyama[13] developed the short Japanese form of the POMS, verified its reliability and validity, and confirmed the appropriateness of the translated terms. Akabayashi et al,[14] who employed the POMS in clinical settings, reported 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[9] was used to assess older people's morale, the GDS[15] to assess mood, the trail making test (TMT)[16] and the mini-mental state examination (MMSE)[17] to assess cognitive function. The International

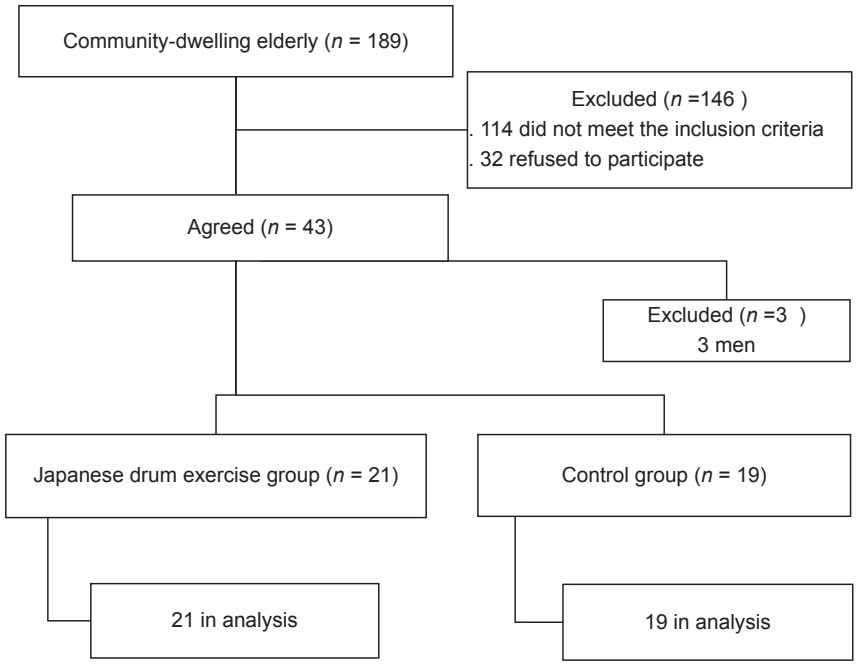

Figure 1. Flow chart showing the distribution of participants throughout the trial.

Consultation on Incontinence questionnaire–short form[18] 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.[19] 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.[20,21]

We also conducted the timed up and go test[22] 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),[23] 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 1
Baseline characteristics of the two groups.[a]

	Japanese drum exercise group		Control group		
	n	Mean ± SD	*n*	Mean ± SD	*p*
Age (y)	21	76.8 ± 5.2	19	79.8 ± 5.4	0.079
Weight (kg)	21	48.4 ± 5.6	19	48.3 ± 8.6	0.75
Body mass index (kg/m^2)	21	22.0 ± 2.5	19	21.9 ± 3.0	0.823
Education years	21	11.5 ± 1.8	19	12.0 ± 10.6	0.08
Instrumental ADL	21	12.3 ± 0.8	19	12.0 ± 12.2	0.823
Kihon checklist (depression)	21	1.4 ± 1.2	19	1.0 ± 1.7	0.562

SD = standard deviation.
[a] Control group vs. Japanese drum exercise group by *t* test (age, weight, body mass index); control group vs. Japanese drum exercise group by Mann–Whitney *U* test [education years, instrumental activities of daily living (ADL), Kihon checklist (depression)].

Table 2
Physical performance in two groups at baseline and after 3 months.

	Baseline					Post				
	n	Japanese drum exercise group	n	Control group	p-value	n	Japanese drum exercise group	n	Control group	*p*-value
		Mean ± SD		Mean ± SD			Mean ± SD		Mean ± SD	
Physical performance										
Timed Up & go test (s)	21	8.6 ± 1.6	18	9.3 ± 2.4	0.335	21	9.0 ± 2.2	18	9.7 ± 2.8	0.363
Normal walking time (m/s)	21	1.1 ± 0.2	18	1.2 ± 0.3	0.781	21	1.3 ± 0.2	17	1.3 ± 0.2	0.811
Maximum walking time (m/s)	21	1.5 ± 0.3	18	1.4 ± 0.3	0.165	21	1.6 ± 0.4	17	1.5 ± 0.3	0.263
Shuttle Stamina Test by walking (m)	21	184.6 ± 41.8	17	180.5 ± 48.7	0.779	21	203.2 ± 40.8	18	174.8 ± 47.1	0.051
Hand grip strength (kg)	21	19.8 ± 4.0	18	22.4 ± 4.9	0.075	21	19.2 ± 4.1	18	17.3 ± 5.0	0.191
SMI (kg/m^2)	21	5.7 ± 0.5	19	5.6 ± 0.8	0.656	21	5.6 ± 0.6	18	5.6 ± 0.9	0.871

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.[a]

	Baseline							Post						
	Japanese drum exercise group			Control group			*p*	Japanese drum exercise group			Control group			*p*
	n	Median	IQR	*n*	Median	IQR		*n*	Median	IQR	*n*	Median	IQR	
Functional states														
POMS (D)	21	49.0	45.0–53.0	19	45.0	45.0–51.0	0.411	21	47.0	42.0–50.0	19	47.0	42.0–53.0	0.848
PGC	21	12.0	9.5–14.0	19	11.0	9.0–13.0	0.429	21	13.0	10.0–13.5	19	11.0	8.0–14.0	0.347
GDS	21	4.0	2.5–7.0	19	4.0	2.0–7.0	0.913	21	2.0	0.5–6.0	19	3.0	2.0–9.0	0.199
TMT-A(s)	21	56.0	46.0–60.0	19	56.0	48.0–87.0	0.233	21	45.0	35.5–56.5	17	50.0	43.0–67.0	0.419
TMT-B(s)	21	108.0	96.0–137.0	18	152.5	98.0–207.5	0.151	21	104.0	95.5–144.0	17	122.0	83.5–164.0	0.803
MMSE	21	27.0	26.5–30.0	19	27.0	26.0–29.0	0.366	20	28.5	26.3–30.0	17	28.0	27.0–29.0	0.332
ICIQ_SF	21	1.0	0.0–4.0	19	1.0	0.0–5.0	0.842	18	0.0	0.0–4.3	17	0.0	0.0–4.0	0.914

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.
[a] Control group vs. Japanese drum exercise group by Mann–Whitney U test.

events in either group. Table 1 shows the baseline characteristics of the participants. The average rate of Japanese drum exercise class attendance was 90%. There was no significant difference in the baseline characteristics, psychophysiological function, physical function, or lifestyle factors (i.e., physical activity and dietary habits) 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.[12] 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).

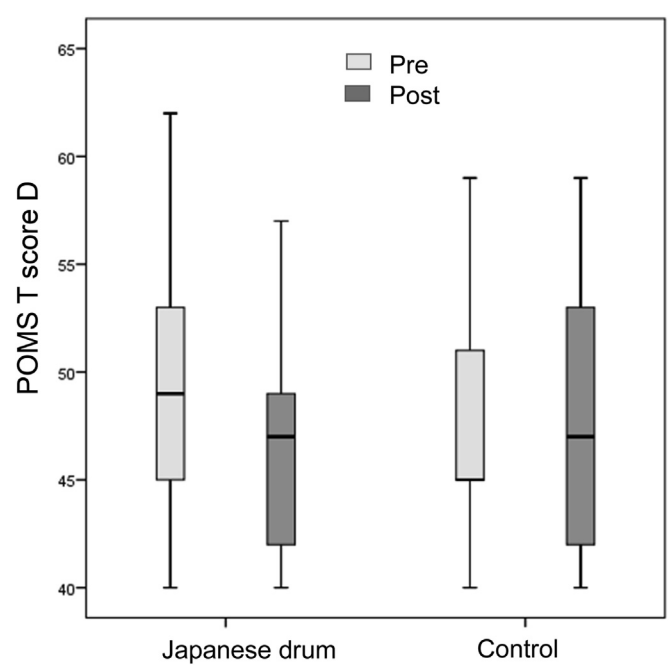

Figure 2. Comparison of profile of mood states (POMS) T score D before and after the intervention. Changes in the POMS-short form T score D in the Japanese drum and the control groups. A repeated-measures analysis of variance was performed to compare the Japanese drum and the control groups ($F = 1.587$, $p = 0.215$). Because the median line and the bottom of the box in the control group overlap, this line cannot be seen clearly.

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

Table 4
Comparison of the difference between the change across the intervention period.

	n	Japanese drum exercise group	n	Control group	*p*-value
		Mean ± SD		Mean ± SD	
Physical performance					
Timed Up & go test (s)	21	0.4 ± 1.2	17	0.4 ± 1.2	0.847
Normal walking time (m/s)	21	0.2 ± 0.2	16	0.1 ± 0.1	0.404
Maximum walking time (m/s)	21	0.1 ± 0.2	16	0.1 ± 0.2	0.928
Shuttle Stamina Test by walking (m)	21	18.6 ± 24.8	16	−3.6 ± 15.9	0.002
Hand grip strength (kg)	21	−0.5 ± 4.5	17	−5.0 ± 3.0	0.001
SMI (kg/m^2)	21	0.0 ± 0.2	18	0.0 ± 0.2	0.398

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 SSTw 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 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 Hirosue, Misao Aihara, and all the staff members at Taiko Center Co., Ltd. and members at Shimogyo Region Disability Prevention Promoting 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.

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