Full-Length Article

The Effects of a Program Combining Exercise and Music on Promoting Exercise Continuance and Psychological Factors in Older People

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Abstract

Physical exercise can have a positive effect on physical and cognitive functions in older people. However, the elderly often face difficulties in maintaining exercise routines. Music is reported to effectively improve the subjective experience of physical exercise's intensity, execution, and enhanced capacity related to a sense of accomplishment. We aimed to investigate whether adding music to physical exercise promoted exercise continuance compared with physical exercise alone. The participants were 74 community-dwelling older people who independently maintained activities of daily living. They were either assigned to a music group (MG) or non-music group (NMG). Exercise classes were held once a week for 3 months. The number of times participants participated in the exercise classes, and the number of times they performed exercises at home was assessed. In addition, each participant completed a set of questionnaires assessing exercise self-efficacy (SE) and quality of life before and immediately after the 3-month intervention. After the 3-month intervention, the MG had a significantly higher frequency of participation in the exercise classes and a significantly higher exercise SE score compared with the NMG. Our results show that the combination of physical exercise and music was beneficial for exercise continuance and exercise SE compared with physical exercise alone.

Keywords: ***music, exercise, continuance, exercise self-efficacy, independent older people.***

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Introduction

Physical function markedly decreases in older people; however, this negative effects can be slowed through daily appropriate physical activity[1-3]. Physical activity in older people positively affects both physical [4-6] and cognitive functioning [7,8]. In Japan, group exercise classes are implemented at local municipalities in order to prevent functional decline in older people. Such exercise classes are held as part of projects to prevent the need for long-term care. However, older people frequently face difficulties in continuing and maintaining participation in exercise classes. For instance, within 6 months of starting physical activities, 40%–60% of older people reportedly discontinued [9,10]. Telephone intervention, support from family and friends, good access to exercise facilities, and feedback regarding physical functioning can reportedly help older people effectively continue physical activity; however, introducing these may be difficult [11-14].

Music can effectively improve mental and immune functions in older people [15-19]. Furthermore, music improves subjective exercise intensity and execution [20,21]. We reported that music increases parasympathetic activity and attenuates exercise-induced decreases in parasympathetic activity without altering orthostatic tolerance after exercise [22]. Regarding the effects of adding music to exercises for older people, a previous study showed that physical exercise combined with music produced more positive effects on cognitive function, especially visuospatial function, in older people than exercise alone [23]. However, the efficacy of adding music to exercise on physical and psychological challenges related to exercise continuation in older people has not been investigated thus far. Here, we aimed to investigate the addition of music to exercise as an easy and effective method to promote the continuance of physical exercise in older people.

Material and Methods

Design and Participants

This study was a community-based, non-randomized controlled trial. Seventy-four community-dwelling older people aged ≥60 years from Kasukabe City, an urban area in

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eastern Saitama Prefecture, Japan, participated in the study. Participants were included if they could independently attend group exercise classes held as part of a long-term care-prevention project, were not certified as requiring long-term care, could perform independent instrumental activities of daily living (IADL), and had consented to participate in this study. As of October 2013, the percentage of older people in Kasukabe City was 24.0%, comparable with the national percentage of 25.1%.

Procedure

In a trial lasting over a 3-month period, music was added to an existing group exercise class, which was conducted as part of regional support activities for long-term care- prevention in Kasukabe City. Participants from four different facilities were divided between two venues predetermined by a municipal public servant in the city. The participants were then allocated to a group that engaged in either exercise with music added (music group; MG) or conventional exercise with only verbal instructions (non-music group; NMG). In both groups, exercises were conducted in parallel for 3 months (Figure 1). Posters showing the exercise procedures, movements, and written explanations, along with compact discs (CDs) to be used in the classroom, were distributed to all participants, who were encouraged to perform the exercises at home. The participants in the MG were provided CDs containing music along with commands and instructions for the exercises. The participants in the NMG were provided CDs containing only commands and instructions for the exercises. During the classroom exercises, both groups had instructors standing in front of the participants demonstrating the exercises. The instructors were volunteers with knowledge of and skilled in instruction for group exercise, and one municipal public servant.

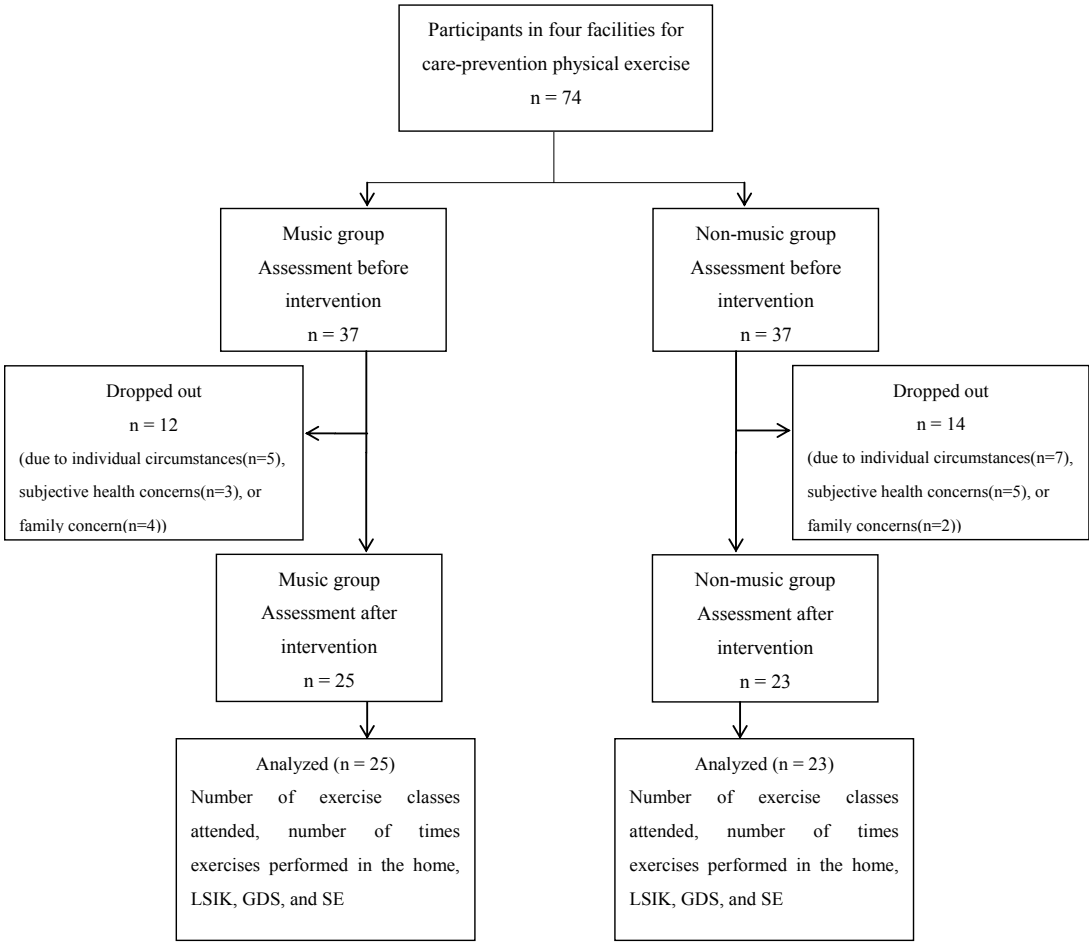

Figure 1. Study flow.

Exercise

An exercise program called "Broad Bean Exercise," which was developed for a long-term care-prevention project in Kasukabe City and incorporated the necessary exercise elements required for disability prevention was used. It was comprised of 22 movements, including exercises for improving muscle strength and swallowing function, stretches, and deep breathing. Each exercise session lasted approximately 18 minutes (Table 1).

Stage	Contents	Duration (s)	Song title
1	deep breathing	21	Hallelujah chorus
2	stretching (1) wrists and arms	55	Turkish rondo
3	stretching (2) ankles	58	⇩
4	stretching (3) calf	62	Sekai no kuni kara Konnichiwa
5	stretching (4) shoulder	45	⇩
6	deep breathing	21	Hallelujah chorus
7	stretching (5) rear thigh and abdomen	55	1-syukan
8	stretching (6) side and back	45	⇩
9	stretching (7) neck	95	Furusato
10	resistance training (1) thigh	37	Mura matsuri
11	resistance training (2) calf	37	⇩
12	deep breathing	21	Hallelujah chorus
13	resistance training (3) abdomen	56	Ware wa umi no ko
14	resistance training (4) back	60	Camptown races
15	deep breathing	21	Hallelujah chorus
16	aerobic movement	53	Ue wo muite arukou
17	exercise of arms	58	Tenohiro wo taiyou ni
18	relaxation: vertical motion of the shoulder	25	⇩
19	deep breathing	21	Hallelujah chorus
20	deglutition exercises (1) cheeks	65	Twinkle, twinkle, little star
21	deglutition exercises (2) tongue-1	24	⇩
22	deglutition exercises (3) tongue-2	23	

Table 1. Contents of the exercise classes and accompanying music.

Music

The music and songs were selected on the basis of known trends in older people's musical preference [24,25]. The results from a survey in which municipal public servants interviewed the participants using a questionnaire regarding their favorite songs, suitability of tempo to and length of the exercises, and copyrights. Copyrights for all music used in this study were expired with the exception of one song; permission to use that song was obtained free of charge from the copyright holder. Most of the songs chosen were nursery rhymes and Western classical music since these songs have been used in music education in elementary and junior high school through the ages, and are therefore familiar and popular among Japanese older people. 11 songs were finally selected (Table 1), which we arranged by adjusting repeats or tempo to suit the exercises and participants. All songs were played on a piano by the researcher and were recorded at a music facility in Kasukabe City. The tempo of the exercise elements and deep breathing was 60–72 beats/min and 36 beats/min, respectively.

Measurements

Exercise continuance

Exercise continuance was evaluated using the number of times the participants participated in the exercise classes and the number of times they performed exercises at home. To evaluate the frequency of participation in the exercise classes, the participants were provided recording cards with all of the dates of the weekly classes over 11 weeks. They brought the

cards to each class and had them stamped. The total number of stamps for each participant was assessed at the end of the study period. To evaluate the number of times exercises were performed at home, the participants were asked to draw circles on the recording cards each time they performed exercises at home. The total number of circles for each participant was assessed when they submitted the cards at the end of the study period.

Quality of life

To evaluate the psychological aspects of music and exercise, the levels of satisfaction with life and depression, which are closely related to quality of life (QOL) in older people, along with the level of confidence in exercise continuance, which can affect behavior, were investigated. To evaluate satisfaction with life, the Life Satisfaction Index-K (LSIK), a questionnaire frequently used to evaluate the subjective sense of happiness in older people [26] was used. The reliability and validity of this self-administered questionnaire have been verified, and it comprises nine items regarding satisfaction, mental stability, and aging throughout the subject's life [26]. This assessment uses a scale of 0–9 points, with higher scores indicating higher subjective satisfaction [26].

To evaluate depressive tendencies, the five-item version of the Geriatric Depression Scale (GDS5) [27] was used. A 15-item shortened version [28] of the 30-item GDS is frequently used to evaluate depressive tendencies in older people; however, the GDS5, a simplified version of the 15-item GDS, has comparable sensitivity, specificity, and accuracy [27]. Therefore, considering the burden on older participants, the GDS5 was used. The GDS5 uses a scale of 0–5 points, with higher total scores indicating stronger depressive tendencies [27].

Self-efficacy

To measure exercise self-efficacy (SE), the Exercise SE Scale [29] was used. It is often applied in exercise intervention studies targeting older people and its reliability and validity have been verified [29]. It measures the degree of confidence of an individual engaged in regular exercise based on whether they would continue to exercise even under impeding circumstances. It comprises five items each with five possible responses: (1) "I have confidence that I would exercise even if I was a little tired," (2) "I have confidence that I would exercise even when I wasn't in the mood," (3) "I have confidence that I would exercise even if I was busy and didn't have much time," (4) "I have confidence that I would exercise even on my days off (holidays)," and (5) "I have confidence that I would exercise even when the weather isn't very good." [29]. Because item 4 was not included in the questionnaire used in this study, the range of the total score value was 4–20 [24]. Higher total scores indicated higher exercise SE [29].

Basic attributes

Sex, age, certification for requiring long-term care, and IADL were investigated. To examine IADL, a 5-item questionnaire for instrumental independence, which comprised sub-items from the Tokyo Metropolitan Institute of Gerontology Index of Competence [30] was used. Furthermore, because this study targeted participants with independent IADL, only those who answered that they "can perform" all activities in the 5 question items for instrumental independence were included.

Statistical analysis

For baseline comparison of the MG and NMG before the exercise classes, Fisher's exact test was used to compare sex, whereas the Mann–Whitney U test was used for all other variables and for inter-group comparison of the frequency of participation in classes and performance of exercise at home over the 3-month intervention. To compare LSIK, GDS5, and Exercise SE Scale scores between the groups over the 3-month intervention, we performed analysis of covariance with the value of each variable after 3 months as the dependent variable, the value of each variable at baseline as the moderator variable, and the group difference (MG versus NMG) as the independent variable. R programming language and environment (version 2.14.0; R Foundation for Statistical Computing, Vienna, Austria) was used for statistical analysis. The level of statistical significance was set at <5%.

Ethical considerations

All participants provided written informed consent. This study was approved by the Institutional Review Board of the Tohoku University Graduate School of Medicine (approval number: 20121323).

Results

Finally, 48 older people (MG, n = 25; NMG, n = 23) were assessed before and after the intervention. Most of the reasons for dropping out were individual circumstances, subjective health concerns or family concerns (Figure 1). The age of MG participants was 73.4 ± 6.7 years, with three male participants (13.0%). The age of NMG participants was 72.2 ± 4.3 years, with five male participants (21.7%). Age or sex did not significantly differ between the groups; the LSIK, GDS5, or Exercise SE Scale scores also did not significantly differ between the groups at baseline (Table 2). However, over the 3-month study period, although there was no significant difference between the groups in the frequency of exercise at home ($p = 0.20$; Table 2), the MG had a significantly higher frequency of participation in exercise classes compared with the NMG ($p = 0.008$; Figure 2a, Table 2). Over the 3-month

study period, exercise SE was significantly higher in the MG than in the NMG (p = 0.006; Figure 2b, Table 2).

Table 2. *Inter-group comparisons before and after intervention.*

Evaluation item	Music group (n = 25)		Non-music group (n = 23)		p-value*	p-value**
	before	after	before	after		
	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD		
Number of times exercise classes attended	—	10.0 ± 1.5	—	8.7 ± 1.8	NA	0.008
Number of times exercises performed at home	—	22.4 ± 22.8	—	17.8 ± 25.2	NA	0.20
LSIK†(score)	4.8 ± 2.4	4.7 ± 2.2	5.0 ± 1.6	5.4 ± 1.9	0.95	0.42
GDS5‡(score)	1.4 ± 1.4	1.4 ± 1.4	0.7 ± 0.9	1.2 ± 1.0	0.07	0.34
Exercise SE scale§(score)	13.7 ± 3.7	15.2 ± 2.8	13.4 ± 4.4	12.1 ± 5.3	0.58	0.006

† : Life Satisfaction Inventory K
‡ : Five-item version of the Geriatric Depression Scale
§ : Exercise Self-Efficacy Scale
* : Between-group comparison pre-intervention (Mann–Whitney U test)
** : Between-group comparison post-intervention (Mann–Whitney U test or Analysis of covariance)
NA: Not applicable; SD: Standard deviation.

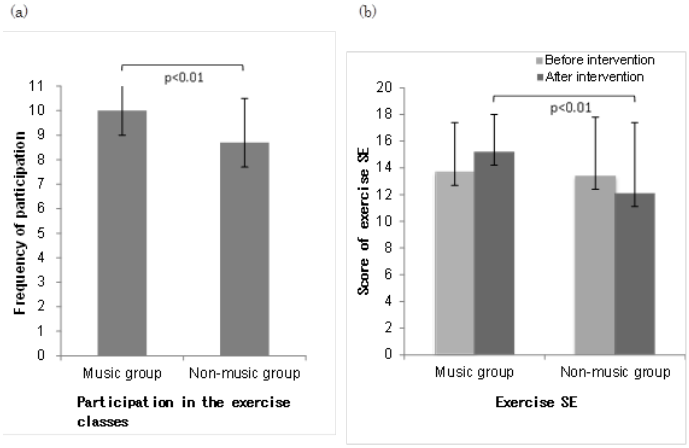

Figure 2. The frequency of participation in the exercise classes(a), and the score of exercise SE(b).

Taken together, after adding music to exercise, the frequency of participation in exercise classes and the degree of confidence in exercise continuance increased.

Discussion

To our knowledge, this is the first study showing that adding music to exercise for independent older people living in local communities resulted in markedly increased participation in exercise classes and confidence in exercise continuance. That is, music favorably affected the psychological aspects related to the implementation of exercise and its continuance in independent older people.

Although the exact mechanism by which music affects the frequency of exercise participation and exercise SE was not clarified, a plausible contributing factor is that music was selected using the criteria that matched the participants' preferences and exercise movements. For continuance of physical exercise, the content of the activities should be interesting, attractive, and motivating [31]. Older people that are ≥60 years old are interested in listening to music and have more opportunities to do so than younger people [16]. Furthermore, music is related to positive feelings such as happiness in older people [16,17] and improvement in the perception of QOL [15].

In a review of the influence of music on exercise, Schutzer et al. [32] indicated that music reduces difficulty, monotony, and anxiety associated with exercise in older people. Moreover, in the present study, the music added to the exercises was synchronized with the rhythm and tempo of the movements. Auditory rhythms rapidly entrain motor responses into stable steady synchronization [33] and exercise is more efficient when performed synchronously with music [34] or rhythmic sound [35]. These findings support the possibility that in the present study, adding music enhanced the performance of physical exercise movements. Our results showed that participation in the exercise classes and exercise SE were significantly higher in the MG, suggesting that the interest and enjoyment in the music and prompting of movements along with music may have made the exercises more fun and easier to understand. No statistically significant differences between the two groups with regard to depression after the 3-month intervention were observed. On reviewing the literature, we found that physical exercise alone can reduce depressive tendencies in older people [36]. Therefore, the effects of adding music may have been less marked.

This study has several limitations. First, the sample size was relatively small; therefore, to more accurately evaluate the effects of adding music to exercise, further large-scale studies are required. Second, this study was a non-randomized trial. However, we consider the influence of non-randomization to be minimal since a municipal public servant in the city allocated the participants randomly and equally into the MG and NMG. Therefore, it is thought that the quality of non-randomization in this study was similar to randomization. Third, the intervention period was 3 months. A longer intervention period may produce other potentially beneficial effects and other significant positive effects which could not reach a level of statistical significance, such as the frequency of performing exercises at home. Fourth, there might be a selection bias as the participants were willing to attend the exercise program provided by their community and were

healthy; therefore, the results may not be representative of the overall population of older people.
Future investigations should focus on the mechanism of the effects of combining exercise with music, such as brain activity and memory of exercise movements both with and without music.

Conclusion

Appropriate musical accompaniment can increase the frequency of participation in exercise classes and exercise SE, a measure of the degree of confidence in exercise continuance. Our results showed that even without the systematic incorporation of music, such as music therapy, simple addition of music to an exercise class can be effective in increasing motivation to participate in exercise. These findings are simple to apply and could be easily incorporated into regional group exercise classes for long-term care-prevention projects.

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