Medica Hospitalia
Journal of Clinical Medicine
Med Hosp 2025; vol 12 (2) : 140–145

OPEN ACCESS

Original Article

Comparison of Line Dance and *Senam Lansia* to Improve Cardiorespiratory Endurance in Elderly

Stephanie Indrawati Sugiarto[1], Rudy Handoyo[1,2], Rahmi Isma Asmara Putri[1,3]

[1]Departement of Physical Medicine and Rehabilitation, Faculty of Medicine, Diponegoro University, Semarang, Indonesia
[2]Department of Physical Medicine and Rehabilitation, Kariadi Hospital, Semarang, Indonesia
[3]Medical Rehabilitation Installation, Diponegoro National Hospital, Semarang, Indonesia

p-ISSN: 2301-4369 e-ISSN: 2685-7898
https://doi.org/10.36408/mhjcm.v12i2.1343

Accepted: February 28th, 2025
Approved: June 24th, 2025

Author Affiliation:
Departement of Physical Medicine and Rehabilitation, Faculty of Medicine, Diponegoro University, Semarang, Indonesia

Author Correspondence:
Stephanie Indrawati Sugiarto
Dr. Sutomo 16 street, Semarang, Central Java 50244, Indonesia

E-mail:
stephanieis13@gmail.com

Abstract

Background : Physical activity in the elderly has a positive impact on promoting healthy aging. Senam lansia is used to be taught to healthy elderly in community however it is boring because of monotonous movement. Line dance is an alternative aerobic exercise that has been taught to elderly. However, there was not any research that compares the effectiveness of both exercises to cardiorespiratory endurance. This study come to verify that the increase of cardiorespiratory endurance in elderly after line dance was better than senam lansia.
Methods : This study was a quasi-experimental pre-test and post-test- controlled group design on 2 groups which was line dance group (n = 20) and senam lansia group (n = 16). The exercise was given based on each group 3 times a week for 6 weeks and VO_2max measurement were taken with 6-minute walking test before and after intervention in both groups.
Results : The increase of the mean difference/delta VO_2max between groups did not differ statistically between groups (line dance: 2,19 ± 3,54 vs senam lansia: 1,79 ± 1,68; p = 0.683). There was a statistically significant difference in the mean pre- and post-intervention VO_2max values at line dance group (32,20 ± 3,99; p = 0.013) and senam lansia group (27,03 ± 3,77; p = 0.001).
Conclusion : The increase of cardiorespiratory endurance in line dance group and senam lansia group did not differ statistically.

Keywords : elderly, line dance, senam lansia, cardiorespiratory endurance

INTRODUCTION

The elderly are increasing in number every year and cause a shift in population structure.[1] This condition occurs throughout the world and is expected to increase to 22% of the total population by 2050.[2] The healthy aging process is something that needs to be achieved by all elderly people, one of which is by regularly doing physical exercise.[2,3] The recommended physical exercise in the elderly consists of aerobic, strengthening, balance and flexibility exercises.[4] Physical exercise will maintain and improve the level of cardiorespiratory fitness of the elderly which tends to decrease due to reduced muscle mass and O_2 extraction.[5]

Light intensity aerobic exercise that is commonly given to the elderly in Indonesia is *senam lansia*. *Senam lansia* is proven to increase cardiopulmonary endurance, reduce blood pressure, and reduce body fat levels.[6,7] However, monotonous movements with the same music accompaniment make the elderly quickly become bored and lose interest in doing physical exercise. Line dance is an alternative aerobic exercise that focuses on the lower extremities so that it can improve walking ability and independence of the elderly.[8,9] Walking ability assessed by the 6-minute walk test can describe the prediction of a person's cardiorespiratory fitness, especially the elderly.[10]

Currently, research on line dance and *senam* in Indonesia is still limited. Therefore, this study aims to compare the effect of line dance and *senam lansia* on improving cardiorespiratory fitness in the elderly.

METHODS

This study was conducted at Mitra Graha line dance community, Semarang and Soegijopranoto Primary Clinic *senam lansia* community, Semarang in November – December 2023. These two groups were determined based on the cluster sampling method. This study is a quasi experimental pre-test and post-test-controlled group design. Participants in the line dance and *senam lansia* groups received exercise 3 times a week for 6 weeks.

The population in this study were elderly people aged 60–75 years. Inclusion criteria include: (1) ability to walk independently without assistive devices; (2) lower extremity muscle strength, MMT [Manual Muscle Testing] ≥4; (3) ability to do light activities for 60 minutes without complaints (PASE [Physical Activity for the Elderly] score >65); (4) Montreal Cognitive Assessment score ≥26; (5) Mini Nutritional Assessment score >7; (6) participated in line dance or *senam lansia* groups for the previous 6 months to 1 year, with a frequency of less than 8 times per month. Exclusion criteria included: (1) musculosceletal and neuromuscular problems that cause pain (NRS ≥4), impaired standing and walking; (2) leg length discrepancy >5 cm; (3) uncontrolled comorbidities (blood glucose <80 mg/dL or >250 mg/dL, blood pressure <100/80 mmHg or >180/100 mmHg, unstable angina); (4) fear of falling (fall efficacy scale >70). Drop out criteria included: (1) failure to following and complete the schedule for 2 consecutive times or 3 times during the study; (2) failure to show up to the initial or final examination of the study; (3) hemodynamic

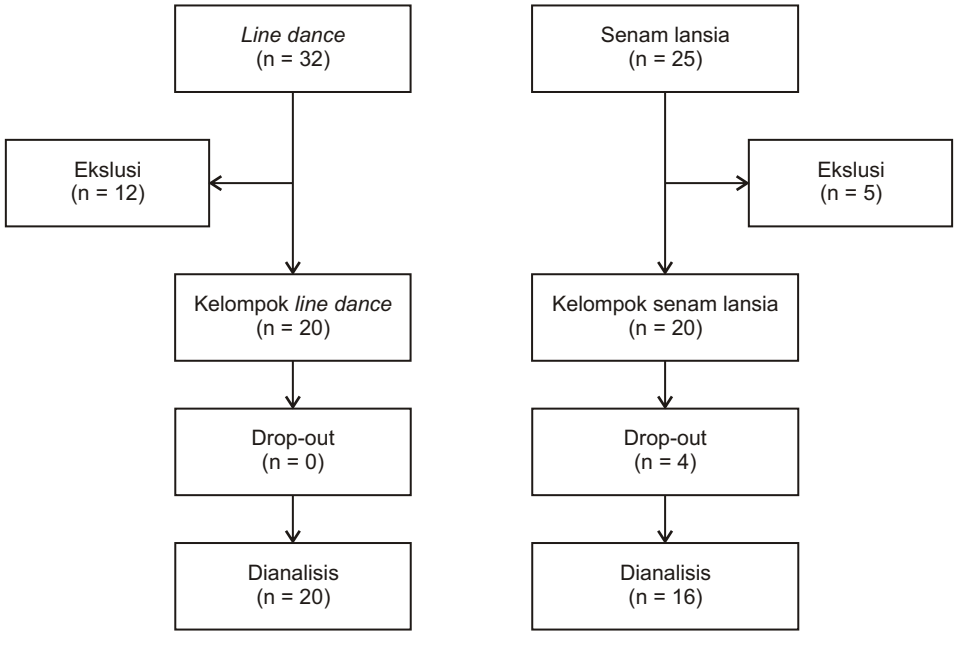

Figure 1. Diagram Consort

TABLE 1
The Baseline Characteristics of Data Subjects

Variabel	Group		*p*
	Line Dance (20)	Senam Lansia (16)	
Age	64.90 ± 5.45	68.75 ± 4.99	0.025‡*
Gender			
Male	0 (0)	4 (25)	0.031¥*
Female	20 (100)	12 (75)	
Education			
Elementary school	0 (0)	4 (25)	0.001¥*
Junior high school	1 (5)	7 (43.8)	
Senior high school	15 (75)	3 (18.8)	
Bachelor	4 (20)	2 (12.5)	
Comorbidities			
Hipertension	11 (55)	10 (62.5)	0.910¥
Diabetes Mellitus	1 (5)	2 (12.5)	0.574¥
Heart disease	2 (10)	0 (0)	0.492¥
Extremities weakness	0 (0)	0 (0)	–
Lung problems	0 (0)	1 (6.3)	0.910¥
Internal fixation	0 (0)	2 (12.5)	0.190¥
Body weight	53.08 ± 8.43	54.63 ± 8.15	0.581§
Body height	151.13 ± 7.14	149.88 ± 9.23	0.245‡

* Significant ($p < 0.05$); ¥Chi-Square; ‡Mann-Whitney; §Independent t

disturbances during exercise (shortness of breath, excessive fatigue, oxygen saturation <90% or decreased by 4%, blood pressure >200/100 mmHg); (4) subject is withdrawn from the study. Subjects were recruited by purposive sampling method and grouped into line dance and *senam lansia* groups.

The line dance group received a 60-minute workout consisting of 10 minutes of warm-up, 40 minutes of core movements, and 10 minutes of cool-down. The workout is given 3 times a week, for 6 weeks. The first 2 weeks they were given beginner movements (100 – 160 beats per minute, 32 – 48 counts), the next 3 weeks were improved movements (160 – 200 beats per minute, 64 counts), and in the last week an evaluation of all movements. The *senam lansia* group received the 2013 KEMENPORA *Senam Lansia* Bugar exercise which consisted of 10 minutes of warm-up, 40 minutes of core movements, and 10 minutes of cooling down. Both groups were guided by certified instructors. Participants of each group were reminded via whatasapp group, 1 day before the training schedule.

Cardiorespiratory fitness was assessed with a 6-minute walk test before and after the exercise. The mileage obtained was converted to predicted VO_2max (Volume Oxygen Maximum) using the Nury formula. The Nury formula is a predictive VO_2max calculation specific to the Indonesian population that takes into account the distanced walked for 6 minutes on a 15-meter track, age, height, weight, and gender.[11,12] Data analysis included descriptive analysis and hypothesis testing. Data normality test using Shapiro-Wilk test. A *P value* of ≥ 0.05 indicates normally distributed data.

Differences in predicted VO_2max values before and after training in each group were tested with a paired t-test if the data was normally distributed and the Wilcoxon test if the data was not normally distributed. The difference in cardiorespiratory fitness values between groups was tested by unpaired t-test if the data was normally distributed and Mann-Whitney test if the data was not normally distributed. All data was analyzed with SPSS ver 20.00 software. The significance value was *p value* <0.05.

TABLE 2
Analysis of 6 Minutes Walking Distance

6MWD	Group		*p*
	Line Dance (20)	Senam Lansia (16)	
Pre test (meter)	455.25 ± 64.25	344.06 ± 53.52	<0.001§*
Post test (meter)	496.50 ± 83.72	377.81 ± 42.15	<0.001§*
p	0.013¶*	0.001¶*	
Delta (meter)	41.25 ± 66.88	33.75 ± 31.70	0.683§

* Significant ($p < 0.05$); § Independent t; ¶ Paired t

TABLE 3
Analysis of VO_2max prediction

VO_2max prediction	Group		*p*
	Line Dance (20)	Senam Lansia (16)	
Pre test (mL/kg/min)	30.01 ± 2.95	25.24 ± 4.31	<0.001§*
Post test (mL/kg/min)	32.20 ± 3.99	27.03 ± 3.77	<0.001§*
p	0.013¶*	0.001¶*	
Delta (mL/kg/min)	2.19 ± 3.54	1.79 ± 1.68	0.683§

* Significant ($p < 0.05$); § Independent t; ¶ Paired t

This study was reviewed and accepted by the Health Research Ethics Commission (KEPK), Faculty of Medicine, Diponegoro University with Document No. 532/EC/KEPK/FK-UNDIP/X/2023.

RESULTS

There were 32 participants in the line dance group and 25 participants in the *senam lansia* group. A total of 12 participants in the line dance group were excluded because 11 participants did not meet the inclusion criteria and 1 participant refused to participate. In the *senam lansia* group, there were 5 people who did not meet the inclusion criteria. The data sample selection consort diagram is shown in Figure 1.

The data characteristics of both groups are shown in Table 1. The table shows the homogeneity test of the data characteristics of the two groups consisting of age, gender, education, comorbidities, weight, and height. There were significant differences in age ($p = 0.025$), gender ($p = 0.031$), and education level ($p = 0.001$) between the two groups.

Analysis of the increase in 6-minute walk distance before and after training in each group and between groups is shown in Table 2. The 6-minute walk distance before and after exercise increased significantly in the line dance ($p = 0.013$) and *senam lansia* ($p = 0.001$) groups. However, this increase in distance was not significantly different between the two groups ($p = 0.683$).

Analysis of the improvement of cardiorespiratory endurance as indicated by the predicted VO_2max value before and after exercise in each group and between groups is shown in Table 3. There was a significant increase in the predicted VO_2max value before and after exercise in each group (line dance, $p = 0.013$; *senam lansia*, $p = 0.001$). The increase in predicted VO_2max between groups was not significantly different ($p = 0.683$).

DISCUSSION

This study shows an increase in cardiorespiratory endurance as indicated by the predicted VO_2max value in the line dance and *senam lansia* groups before and after training. In the line dance group, the VO_2max value increased by 2.19 ± 3.54 mL / kg / min, and in the *senam lansia* group there was an increase in predicted VO_2max of 1.79 ± 1.68 mL / kg / min. Both line dancing and *senam lansia* are aerobic exercises that can improve cardiorespiratory fitness when given at the right intensity and duration. In this study, the exercises given adjusted the WHO recommendations regarding aerobic exercise, 3-5 times per week with a duration of 30–50 minutes per

session. Regular physical exercise in the elderly in accordance with the right dose is one of the health promotion and primary prevention efforts that can be carried out together in the community as part of community-based prevention rehabilitation.[13]

Line dance is an interval aerobic exercise due to fluctuations in intensity during exercise. Line dance causes peripheral adaptations characterized by arteriolar vasodilation and increased mitochondrial density as well as central adaptations such as increased maximal volume of the heart, cardiac output, and blood volume.[14,15] Line dance increases hip flexor and abductor muscle strength,[16] trains dynamic stability endurance due to changes in mediolateral CoM (Center of Mass), and improves balance and gait propulsion due to improvements in anteroposterior CoM.[17] Changes in GRF (Ground Reaction Force) while doing line dance will increase greater energy use, increase heart rate and VO_2max.[18] A decrease in VO_2peak (Volume Oxygen Peak) values with age will cause a relative increase in the intensity of a person's walking which is related to a decrease in muscle mass and strength, especially in the lower extremities.[19] *Senam lansia* has a mechanism similar to line dance in improving cardiorespiratory fitness. *Senam lansia* causes vasodilation, an increase in oxygen consumption by 10 - 20% and tidal volume by 2.5 – 3 L / min., cardiac output by 40 – 60%.[20,21] Arm movements in *senam lansia* will increase the sympathetic connection to the heart so that central adaptation occurs in a person's cardiorespiratory endurance.[15] *Senam lansia* increases oxygen demand and blood flow in the muscles.[22,23]

Line dance has an advantage when compared to *senam lansia*, of which it can be increase in intensity and difficulty of movement according to the ability of the participants. This increase in intensity needs to be done to be able to maintain optimal cardiorespiratory endurance of the elderly. Line dance in this study proved to be safe for the elderly group, as evidenced by the absence of injuries and severe symptoms such as shortness of breath and chest pain during exercise. Previous study conducted by Honglian showed a significant improvement in blood pressure and quality of life of elderly people with cardiovascular and cerebrovascular disease after receiving low and middle intensity line dance compared to those in control group who only get pharmacological therapy alone.[24] Another study comparing line dance and daily physical activity showed that line dance significantly improved knee muscle strength, lower extremities function, walking speed, endurance, and perceived mobility limitation.[25]

Comparison of delta VO_2max between the two groups did not differ significantly (p = 0.683). This is related to the difference in baseline values in the two groups before training. Individuals with low VO_2max values before exercise will obtain significant improvements in cardiorespiratory endurance with low exercise intensity (40 – 50% VO_2max) due to central adaptation, while individuals with high VO_2max values require higher exercise intensity (>70% VO_2max) to obtain similar results.[15] Gender will also affect the decline in VO_2peak, heart rate, ejection fraction, and cardiac index. Men have a greater VO_2max than women at various ages so that the fitness function of elderly men will tend to be better than elderly women.[26]

The *senam lansia* group had male participants although almost 80% of the participants were dominated by women, while the line dance group consisted entirely of female participants. This condition may be due to the lack of socialization and public understanding of line dance as a physical exercise not just as a dance exercise and the importance of physical exercise in the elderly as an effort to maintain health and prevent disease. A higher level of education was found in the line dance group. This suggests that a high level of education will help a person to get health information and the latest types of physical exercise that can maintain their health condition. The gender distribution and education level of the research subjects in both groups were able to provide a general picture of elderly participation in the community. This study had some limitations that might affect the study results. This study did not randomize the sample so that the distribution of age, gender, and education levels in the two groups were significantly different. The duration of exercise given is still unable to show the long-term effects of improving cardiorespiratory endurance.

CONCLUSION

The increase of cardiorespiratory endurance in line dance and *senam lansia* group did not differ statistically. Both line dance and *senam lansia* can significantly improve cardiorespiratory endurance in the elderly.

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