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COMPARATIVE EFFECTS OF LINE DANCING AND ELDERLY GYMNASTICS ON FUNCTIONAL MOBILITY IN COMMUNITY-DWELLING OLDER ADULTS: A PILOT STUDY

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ABSTRACT

Background: The global increase in the elderly population highlights the urgent need for effective interventions to preserve mobility and reduce the risk of sarcopenia. While elderly gymnastics is a commonly recommended physical activity for older adults in Indonesia, line dancing has emerged as a more engaging alternative. However, comparative data on their effectiveness in reducing sarcopenia risk remain limited. **Objective:** To compare the effects of line dancing and elderly gymnastics on functional mobility among community-dwelling older adults with low baseline sarcopenia risk. **Methods:** This quasi-experimental pre-post-controlled study involved 36 participants aged 60–75 years, divided into a line dancing group (n = 20) and an elderly gymnastics group (n = 16). Both groups participated in supervised exercise sessions three times a week for six weeks. SARC-F scores and Timed Up and Go (TUG) test results were assessed before and after the intervention. **Results:** Both groups showed significant improvements in TUG performance, with the line dancing group demonstrating a greater reduction in time (-2.96 ± 1.15 seconds) than the elderly gymnastics group (-1.38 ± 1.17 seconds) ($p < 0.001$). However, no statistically significant improvements were observed in SARC-F scores within or between groups ($p > 0.05$). **Conclusion:** Both improved functional mobility, with line dancing showing superior benefits. While neither intervention significantly affected perceived sarcopenia risk. These findings suggest that line dancing may be a more effective strategy for enhancing mobility in older adults. Further studies with longer duration and objective muscle strength measurements are recommended. This study supports the benefits of line dancing as a community-based physical activity for improving mobility in the elderly.

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BACKGROUND

The rapid growth of the elderly population has significantly reshaped global demographic structures and placed increasing pressure on health care systems worldwide. In Indonesia, the number of individuals aged 60 years and above was recorded at approximately 18 million (7.6%) in 2010 and increased to around 27 million (10.6%) in 2020. This number is projected to grow substantially, reaching an estimated 40 million (13.8%) by the year 2035, according to national projections from Statistics Indonesia (*Badan Pusat Statistik*, BPS) based on the results of the 2020 Population Census.[1] These demographic transitions are not unique to Indonesia. Globally, the World Health Organization (WHO) estimates that the proportion of people aged 60 years and older will almost double from 12% in 2015 to 22% by 2050. The most dramatic increase is expected in the subgroup aged 80 years and above, which is anticipated to triple in size during the same time frame.[2] These changes pose profound challenges to the health sector, especially preservation of physical function, prevention of dependency, and promotion of well-being in older adults. As the aging population expands, effective and sustainable strategies to support healthy aging and prevent age-related conditions

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(sarcopenia, frailty, and decline mobility) have become increasingly important in both community and clinical settings.

Sarcopenia is a progressive and generalized skeletal muscle disorder characterized by the loss of muscle mass, strength, and physical performance. It mostly affects older adults and is influenced by aging, physical inactivity, chronic disease, inflammation, and malnutrition. The European Working Group on Sarcopenia in Older People (EWGSOP2) recommends diagnosing sarcopenia based on low muscle strength (e.g., handgrip or chair stand), with low muscle mass or quality. Severe sarcopenia is established when impaired physical performance is also present.[3] The SARC-F questionnaire is a widely used screening tool. It consists of five components assessing self-reported strength, assistance in walking, rising from a chair, stair climbing, and history of falls. A score of ≥4 indicates elevated risk for sarcopenia.[4] When left untreated, sarcopenia is associated with increased risk of falls, fractures, hospitalizations, disability, loss of independence, and mortality, poorer quality of life and psychological distress in older populations.[5] To mitigate these consequences, a multimodal management approach is needed. Structured physical activity serves as a basis, particularly progressive resistance training and multicomponent programs that incorporate balance, coordination, and aerobic elements. Group-based movement routines that include rhythmic sequencing, cognitive-motor engagement, and social interaction have been shown to enhance neuromuscular coordination, mobility, and adherence.[6,7]

In Indonesia, elderly gymnastics is commonly recommended as a form of aerobic exercise for older adults. Studies have shown that regular participation in aerobic physical activity, including structured group exercises, contributes to improved cardiorespiratory function, reduced blood pressure, and better psychological well-being in older individuals.[8] However, traditional formats of elderly gymnastics often involve repetitive movements and familiar musical routines, which may reduce participant motivation and long-term adherence.

In contrast, line dancing has emerged as a dynamic and socially engaging alternative that incorporates rhythmic, multidirectional movements synchronized to music. Beyond physical benefits, line dancing also stimulates cognitive and emotional engagement due to its choreographed sequences, promoting greater adherence and enjoyment. Research has demonstrated that dance-based interventions, including line dancing, can significantly improve balance, gait, functional mobility, and quality of life among older adults [9,10]. Studies have shown that line dancing can improve lower limb mobility, cardiovascular endurance, and balance, while also providing a social and entertaining experience for participants. While both elderly gymnastics and line dancing have shown benefits in perceived health, few studies have directly compared the efficacy of these two exercise modalities in managing functional decline. This gap highlights the need for research comparing the effects of elderly gymnastics and line dancing in enhancing functional mobility in older adults.[4]

This study aims to fill this gap by investigating the comparative effectiveness of line dancing and elderly gymnastics in improving functional mobility in older adults. Specifically, the study evaluates functional mobility using the Timed Up and Go (TUG) test, while also monitoring SARC-F scores in a healthy older adult population. By exploring these outcomes, this research aims to provide valuable insights into the relative efficacy of these two exercise programs in improving health outcomes for the elderly population.

METHODS

This study employed quasi-experimental non-equivalent control group design. Since randomization was not feasible, participants were recruited from two pre-existing intact groups to evaluate the comparative effectiveness of line dancing and elderly gymnastics on functional mobility among older adults.

Study Population and Sampling

Participants were elderly individuals aged 60–75 years, recruited from two community groups in Semarang: The Line dancing Senior Mitra Graha group and the Prolanis Elderly Gymnastics group. As this was a pilot study conducted to explore the feasibility and potential effects of the interventions, a formal sample size calculation was not performed. The sample size (n=36) represented the total number of eligible participants available in the two community groups during the study period. Purposive sampling was employed, targeting individuals who met

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inclusion criteria such as being able to understand and comprehend commands, having good vision and hearing, being able to stand for at least 60 minutes without complaint, being able to walk independently without aids, having good cognitive function (MoCA-INA ≥26), and having adequate nutritional status (Mini Nutritional Assessment Short-Form) >7, to exclude malnourished individuals.[11] Participants with musculoskeletal and neuromuscular diseases that cause pain and impairment while standing and walking, uncontrolled comorbidities or conditions affecting mobility, or balance disorders were excluded. Informed consent was obtained from all participants who met the inclusion criteria. Dropout criteria included failing to follow and complete the exercise schedule three times in a row, failing to attend the initial or final assessment, experiencing hemodynamic disturbances such as fatigue or excessive sweating, drowsiness, shortness of breath, pallor, a pulse rate exceeding the maximum heart rate, oxygen saturation <90% (or a decrease of 4% from baseline before the test), or blood pressure >160/100, or the subject withdrawing from the study.

Data Collection Procedures

Data collection was conducted in two phases: pre-intervention and post-intervention. Baseline measurements included demographic data, initial sarcopenia screening using the SARC-F questionnaire, and functional mobility tests such as the Timed Up and Go (TUG) test.

Intervention Protocols

The line dancing intervention consisted of choreographed dance routines tailored to older adults, incorporating gradual increases in complexity and intensity. Sessions included 10 minutes of warm-up, 40 minutes of guided dance, and 10 minutes of cooldown. The elderly gymnastics group followed a standardized low-impact aerobics routine designed to improve cardiovascular fitness and flexibility, similarly, structured with 10 minutes of warm-up, 40 minutes of guided dance, and 10 minutes of cooldown. Both groups underwent a 60-minute exercise program per session, 3 sessions/week for 6 weeks. Subjects were instructed not to engage in any other physical exercise during the study.

Outcome Measures

The primary outcomes focused on improvements in functional mobility as measured by the TUG test. The secondary outcome was the change in SARC-F scores pre and post-intervention. Measurements were conducted by trained assessors blinded to group assignments to ensure objectivity.

Data Analysis

Data normality was assessed using the Shapiro-Wilk test. Within-group changes were analyzed using the Paired t-test for normally distributed data and the Wilcoxon Signed-Rank test for non-normally distributed data. Between-group differences were compared using the independent t-test for normally distributed data and the Mann-Whitney U test for non-normally distributed data. All analyses were performed using SPSS software, with statistical significance set at $p < 0.05$.

RESULTS

The demographic characteristics of participants are presented in Table 1. All 36 participants completed the full 6-week intervention. The average attendance was 99% for the line dancing group and 97% for the elderly gymnastics group. No subjects met the predefined dropout criteria or withdrew voluntarily during the study period. Statistical analysis revealed significant differences between the elderly gymnastics and line dancing groups in terms of age, sex, and educational level. Participants in the line dancing group were younger on average (64.90 ± 5.45 years) than those in the elderly gymnastics group (68.75 ± 4.99 years). The line dancing group consisted entirely of women (100%), while the elderly gymnastics group included 25% men. In terms of education, the line dancing group had a higher proportion of participants with secondary and tertiary education levels.

No significant differences were observed between the groups in terms of employment status, comorbidities, body weight, height, glucose levels, or pain perception (VAS).

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Table 1. Demographic characteristics of participants

Variables	Groups		p-value
	Elderly Gymnastics (n=16)	Line Dancing (n=20)	
Age (years)	68.75 ± 4.99	64.90 ± 5.45	**0.035***
Gender			**0.024***
Man	4 (25)	0 (0)	
Woman	12 (75)	20 (100)	
Education			**0.001***
Elementary School	4 (25)	0 (0)	
Junior High School	7 (43.8)	1 (5)	
Senior High School	3 (18.8)	15 (75)	
College	2 (12.5)	4 (20)	
Work Status			0.546
Unemployed	8 (50)	8 (40)	
Work	8 (50)	12 (60)	
Comorbidities			
Hypertension	10 (62.5)	11 (55)	0.648
DM	2 (12.5)	1 (5)	0.418
Heart disease	0 (0)	2 (10)	0.191
Visual disturbances	12 (75)	16 (80)	0.716
Hearing impairment	1 (6.3)	0 (0)	0.270
Limb weakness	0 (0)	0 (0)	-
Lung disease	1 (6.3)	0 (0)	0.270
Musculoskeletal	2 (12.5)	0 (0)	0.117
Weight (kg)	54.63 ± 8.15	53.08 ± 8.43	0.584
Height (cm)	149.88 ± 9.23	151.13 ± 7.14	0.654
GDS (mg/dL)	126.25 ± 40.51	113.35 ± 35.22	0.315
VAS (score)	0.25 ± 0.68	0.00	0.141

Table 2 presents the pre-test and post-test SARC-F scores for both groups. The paired difference analysis within each group showed no statistically significant improvement in SARC-F scores after the 6-week intervention (p = 0.655 for elderly gymnastics; p = 0.180 for line dancing, Wilcoxon test). Likewise, the independent comparison between the two groups revealed no significant differences in pre-test scores (p = 0.420), post-test scores (p = 0.181), or the mean change in SARC-F (Δ = −0.06 ± 0.57 vs. −0.15 ± 0.49; p = 0.641).

Table 2. SARC-F pre-test, post-test and difference

SARC-F	Group		p
	Elderly Gymnastics (16)	Line dancing (20)	
Pre-test	0.75 ± 1.24	0.30 ± 0.47	0.420 ‡
Post test	0.69 ± 1.25	0.15 ± 0.37	0.181 ‡
p	0.655 †	0.180 †	
Difference	-0.06 ± 0.57	-0.15 ± 0.49	0.641 ‡

Description: *Significant (p < 0.05); ‡Mann-Whitney; † Wilcoxon

Table 3 summarizes the Timed Up and Go (TUG) test results. A significant improvement in TUG performance was observed within both groups, with pre- to post-test differences showing statistical significance (elderly gymnastics: p < 0.001; line dancing: p < 0.001, paired t-test). Moreover, between-group comparisons demonstrated significant differences in TUG pre-test (p = 0.001), post-test (p < 0.001), and in the mean change (Δ = −1.38 ± 1.17 seconds for elderly gymnastics vs. −2.96 ± 1.15 seconds for line dancing; p < 0.001, independent t-test).

Table 3. TUG pre-test, post-test and differences

TUG	Group		p
	Elderly Gymnastics (16)	Line dancing (20)	
Pre-test	10.36 ± 1.10	9.30 ± 1.20	0.001‡ *
Post test	8.98 ± 0.85	6.34 ± 1.17	<0.001§*
p	<0.001¶ *	<0.001¶ *	
Difference	-1.38 ± 1.17	-2.96 ± 1.15	<0.001§*

Description: *Significant (p<0.05); ‡Mann-Whitney; § Independent t; ¶ Paired t

DISCUSSION

This study aimed to evaluate the effects of line dancing and elderly gymnastics interventions on sarcopenia risk and functional performance among older adults. The primary outcome was assessed using the Timed Up and Go (TUG) test and the secondary outcome was evaluated with the SARC-F questionnaire. While both interventions were implemented over a 6-week period with a high training frequency (three 60-minute sessions per week), the findings revealed that neither group experienced a statistically significant change in SARC-F scores.

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However, both groups demonstrated significant improvements in TUG performance, with the line dancing group exhibiting greater gains than the elderly gymnastics group.

Functional Performance with TUG

The Timed Up and Go (TUG) test revealed statistically significant improvements both within and across intervention groups. Specifically, the line dancing group experienced a greater reduction in TUG completion time (-2.96 ± 1.15 s) compared to the elderly gymnastics group (-1.38 ± 1.17 s), with the between-group difference reaching high significance ($p < 0.001$). These outcomes suggest that both moderate-intensity programs enhance real-world mobility, with line dancing yielding superior neuromotor benefits.

The TUG test is considerably more sensitive than SARC F for capturing short-term changes in dynamic mobility, as it encompasses successive neuromuscular coordination tasks (standing up, walking, turning, and sitting down) reflecting gait speed, agility, and reactive balance. These aspects are often inadequately captured by self-reported instruments, particularly in relatively healthy older populations.[15] The structured components of line dancing (including directional changes, rhythm synchronization, and complex stepping patterns) provide rich neuromotor stimulation that likely accelerates adaptation more effectively than the comparatively static movements of elderly gymnastics.[9,16] Furthermore, dance-based interventions have demonstrated measurable benefits in older adults' functional outcomes. A recent systematic review of healthy older individuals found that dance training significantly enhanced mobility and endurance performance compared to non-exercise controls.[9,10]

SARC-F

The SARC-F questionnaire is a validated, widely used tool for screening sarcopenia, capturing self-reported impairments in strength, ambulation, rising from a chair, stair climbing, and history of falls. In the present study, SARC-F scores remained low at both pre- and post-intervention across both groups, with no statistically significant change ($p > 0.05$). This suggests that while participants engaged in regular physical activity, the intervention intensity or specificity may have been insufficient to induce significant perceived improvement in sarcopenia risk. These findings are consistent with previous research showing that SARC-F, despite its ease of use and high specificity, has limited sensitivity in detecting subtle functional changes in healthy populations. This phenomenon, known as the 'floor effect,' was evident in our study as participants exhibited extremely low baseline scores (<1), leaving little room for measurable improvement. Consequently, SARC-F may be more suitable for screening frail populations rather than evaluating intervention efficacy in robust community-dwelling older adults.[4,12]

Sarcopenia is most effectively addressed through resistance-based exercises that stimulate muscle hypertrophy and neuromuscular adaptation. In contrast, both elderly gymnastics and line dancing, as applied in this study, are moderate-intensity aerobic exercises focused on balance, coordination, and endurance. While beneficial for overall health and fall prevention, such interventions may not deliver sufficient mechanical overload to provoke notable gains in muscle strength or mass in relatively healthy older adults.[13,14]

Relationship Between SARC F and TUG

Although SARC F and the Timed Up and Go (TUG) test evaluate different domains, subjective self-reported functional status versus objective mobility performance, they are physiologically linked in the context of aging and sarcopenia. Sarcopenia contributes to declining physical performance, increased risk of fall, and functional dependency in older adults. Several studies have shown moderate associations between higher SARC F scores and slower TUG performance, particularly in frail or clinically at-risk populations.[10,15]

In the present study, despite both intervention groups showing significant improvement in TUG times, changes in SARC F scores were not statistically significant. This divergence may reflect the relatively short intervention period (six weeks), which may not have been sufficient to alter participants' self-perception of functional status. These findings are consistent with previous evidence suggesting that objective measures such as TUG are more responsive to short-term interventions, especially those targeting balance, gait, and neuromotor coordination, while

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subjective tools like SARC F may require longer durations or more intensive interventions to detect significant changes.[9]

Furthermore, it is well established that resistance-based or multimodal training programs spanning at least 12 weeks are typically necessary to elicit meaningful improvements in sarcopenia-related outcomes, including SARC-F scores. In contrast, short-term aerobic or dance-based interventions can enhance physical function and mobility without necessarily increasing muscle mass.[17] This supports the need to combine both subjective and objective assessments in sarcopenia research to fully capture the multidimensional nature of functional health in older adults.

Importantly, the more pronounced improvement in TUG scores observed in the line dancing group highlights its potential as a functional, engaging, and socially motivating exercise modality for enhancing lower limb performance and mobility in community-dwelling older adults.

A key limitation of this study is the use of non-randomized, intact community groups, which resulted in significant baseline differences in age and educational level. The line dancing group was significantly younger (mean age 64.9 vs. 68.75 years) and had a higher proportion of participants with tertiary education compared to the elderly gymnastics group. Age is a known determinant of gait speed and mobility, and this age gap may have contributed to the superior TUG performance observed in the line dancing group. Future studies should employ randomized controlled trials (RCT) or statistical adjustments (e.g., ANCOVA) to control for these confounding variables.

Limitations

This study has several limitations. First, the 6-week intervention period may have been too short to produce measurable changes in perceived health status. Second, SARC-F is a subjective tool and showed a clear floor effect in this healthy population. Third, objective assessments of muscle strength or body composition were not included.

Crucially, the use of non-randomized, intact community groups resulted in significant baseline differences in age, educational level, and functional mobility (TUG scores). The line dancing group was significantly younger and exhibited faster baseline gait speed compared to the elderly gymnastics group. Although both groups showed improvement, this initial disparity in baseline mobility suggests that the line dancing group started with a physiological advantage, which limits the ability to attribute the superior outcomes solely to the intervention type. Future studies should employ randomized controlled trials (RCT) or statistical adjustments (e.g., ANCOVA) to control for these confounding variables.

CONCLUSION

Both groups showed improvements in TUG scores, with the line dancing group experiencing a more pronounced improvement, however, neither exercise intervention significantly impacted SARC-F scores. This suggests that line dancing may be particularly beneficial for enhancing functional mobility in elderly individuals. Future research should explore these variables to develop more effective strategies for sarcopenia prevention and management.

ETHICAL APPROVAL

The study protocol was approved by the ethics committee of Universitas Diponegoro No.201/EC/KEPK/FK-UNDIP/V/2024, and all procedures adhered to ethical guidelines for research involving human participants. Potential risks, such as exercise-related fatigue, were mitigated through proper supervision and gradual progression of exercise intensity. All subjects gave written informed consent in accordance with the Declaration of Helsinki.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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AUTHOR CONTRIBUTIONS

Conceptualization, all authors; methodology, all authors; software, all authors; validation, all authors; formal analysis, all authors; investigation, all authors; resources, all authors; data curation, all authors; writing—original draft preparation, all authors; writing—review and editing, all authors; visualization, all authors; supervision, Hari PJ., Tanti A,; project administration, all authors.

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