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The effect of modified traditional Javanese dance on hand grip strength and walking speed in elderly

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Abstract---Sarcopenia is one of the most common phenomena in the elderly dancing is an alternative to physical therapy to overcome this. The purpose of this study was to see whether there was an effect of giving modified Javanese traditional dance on hand grip strength and walking speed in the elderly. Eleven participants allocated in one group, took part in this study, completed a twelve-week (36 sessions) modified Javanese traditional dance, 35 minutes each session, with moderate aerobic intensity. The outcome measures were hand grip strength as measured by hand dynamometer and walking speed as measured by ten meters walking test (10MWT). Measured before and after 12 weeks intervention. There was a statistically significant increase in hand grip strength ($p=0,003$) and walking speed ($p=0,01$) after 12 weeks of giving modified Javanese traditional dance. The results of the calculation of the mean effect size show large results for both hand grip strength (Cohen's $D = 0.94$) and walking speed (Cohen's $D = 0,88$). Thus, the regular twelve-weeks of modified Javanese traditional dance can increase hand grip strength and walking speed in healthy older adult.

Keywords---elderly, Indonesian dance, Javanese dance, dance movement therapy, walking speed, hand grip strength.

Introduction

Globally the population aged over 65 years is 9% (United Nation, 2019), which is increasing over time, due to the increasing life expectancy. Sarcopenia is one of the most common health problems in the elderly (Dao et al., 2020). The prevalence of sarcopenia ranges from 4-27.1% in males and 2.5-22.1% in females (Cifu et al., 2018). Providing physical exercise is very important to prevent or reduce the severity of sarcopenia (Dao et al., 2020). Sarcopenia has many negative impacts on the elderly. Sarcopenia was assessed by hand grip strength, muscle mass and physical performance as measured by walking speed. Hand grip strength is a valid and practical measuring tool for assessing overall muscle strength, especially in the elderly (Wiśniowska-Szurlej et al., 2019). Decreased walking speed correlates with functional ability, balance and falls (Fritz & Lusardi, 2009). The recommended and valid test as a clinical assessment to assess walking speed in healthy elderly people is the 10 meter walking test (10-mWT) (Peel et al., 2013).

Dancing has the potential to be an alternative physical exercise for the elderly with sarcopenia. Dance can improve psychological aspects that can improve practice compliance so that the training objectives can be achieved. Dance has a multicomponent intervention that integrates physical functions, cognitive and social elements, which provides stimulation of balance, coordination, flexibility, and cardiorespiratory (Payne, 2003; Meng et al., 2020). Modified Javanese traditional dance is a dance based on Javanese dance movements with an intensity that is adjusted to the therapeutic target. Modified Javanese traditional dance combines elements of aerobic exercise and music therapy. Aerobic exercise and music therapy can modulate systemic circulation and increase protein synthesis through increased activation of satellite cells and mitochondrial biogenesis so as to prevent sarcopenia (Yeh et al., 2015; Minutillo et al., 2021; Joannis et al., 2018). This study aims to determine the effect of modified Javanese traditional dance on hand grip strength and walking speed in the elderly in nursing homes.

Method

This study was experimental with one group pre-post test design in one group sample, to investigate effect of 12 weeks modification Javanese traditional dance on handgrip strength and walking speed in elderly. Parameters related to the sample size calculation were taken from a similar study (12). The sample size was estimated as 11 (n=11) with an alpha of 0.05, effect size using Cohens D. This study was conducted between February-April 2022 at nursing home hargodedali Surabaya, Indonesia.

Written informed consent was obtained from all study participants. All participants were assessed at baseline for eligibility criteria by a medical doctor (researcher). The elderly who fulfilled the inclusion and exclusion criteria follow this study. This research received ethical approval (26/EC/KEPK/FKUA/2022) from the Health Research Ethics Committee, Faculty of Medicine, Airlangga University, Surabaya Indonesia.

Eleven elderly who met the inclusion and exclusion criteria took part in this study. Inclusion criteria were age 60 years or more, cognition function MOCA-Ina ≥ 20 , ambulate independently without assistive devices, stable hemodynamics, good hearing and vision, and willing to participate in research voluntarily. Exclusion criteria were following other forms of physical exercise regularly, barthel index (BI) score less than 80, dementia, fractures of the upper and lower limbs that interfere with the function of movement and ambulation, have a chronic illness or disease that causes other long-term disability. Dropout Criteria were subjects are not willing to continue the research for any reason, could not complete the exercise according to the established research protocol, as many as 3 consecutive training sessions in one week from the total number of training sessions during 12 weeks of training, or did not fulfill at least two-thirds of all training sessions, and died.

Interventions

Before the intervention was carried out, 3 preparation classes were conducted with an interval of 1 day for 1 week. Each class lasts 1 hour. In the first and second classes, two professional dance instructors teach dance moves from start to finish and instruct participants to practice according to their abilities. After class, participants are allowed to familiarize themselves and get to know more about dance moves by watching dance videos. In the third grade, the two instructors will check whether the participants can dance with the correct movements and give instructions until all participants have mastered the movements adequately.

The study was conducted from February to May 2022. Every time start a training session, the participant's vital and clinical signs are checked. The dance intervention is carried out with frequency 3 times a week for 12 weeks, with intensity 40-60% heart rate reserve (HRR), duration 35 minutes, consist of 10 minutes warm-up, 15 minutes Javanese dance, 10 minutes cooling down. Modified Javanese traditional dance is an exercise program for the elderly that is specially designed on the basis of traditional Javanese dance movements, lasting 35 minutes per session with moderate intensity. The dancing session started with a warm-up exercise in the form of finger gymnastics, joint movements and stretching for 10 minutes accompanied by a slow-tempo national anthem, the core dance with a gradual increase in complexity of the motor sequence for 15 minutes accompanied by folk songs with gradually increasing tempo and cooling down in the form of breathing and stretching exercises for 10 minutes accompanied by a slow-tempo national anthem.

Clinical monitoring is carried out throughout the duration of the exercise. Vital sign checks are carried out after each warm-up, core and cool-down. The intervention was carried out with one instructor leading the dance in front of the group, and the other instructor supervising the movements and guiding the participants to ensure that they performed the dance moves correctly. Two medical doctors (researchers) and two nursing home staff are responsible for supervising the safety of participants during the intervention.

Outcome Measure

Initial subject characteristics such as age, weight, height, body mass index, initial muscle strength and walking speed were measured before starting the intervention. Walking speed is the distance covered in a certain time, usually in meters per second (m/s) or miles per hour (mph). The normal value for walking speed is 1 m/s or more (13). Walking speed in this study was assessed by the 10 meter walking test (10MWT). 10-mWT is a test to assess walking speed, carried out with a total distance of 10 meters, consisting of 2 meters of acceleration, followed by 6 meters of walking measured with a Casio brand stopwatch type AE-1000W in seconds, and ending 2 meters deceleration. The test begins with verbal cues after the participant is in a standing position with both feet behind the starting line. Each participant was given instructions to walk normally at his usual daily pace until the finish line. The measurement time starts when the leading toe crosses the 2 meter mark and the measurement stops when it passes the 8 meter mark. Participants took each test three times with a 1-minute break, the average of the three tests was taken.

Hand grip strength was measured using a Camry EH 101 portable hand-held dynamometer, and was stratified by gender and BMI. Subjects in a sitting position, elbow forming an angle of 90°. Measurements were made on the right and left hands. Data retrieval was carried out 3 times on each hand for a total of 6 times. In 6 times of data collection respondents get a break of 1-2 minutes before taking the next data collection. The values obtained are then averaged.

Statistical Analysis

Statistical analysis using SPSS 23. The normality test used the Shapiro-Wilk test, if the data was normally distributed then parametric statistical observations were carried out, and if the data were not normally distributed then non-parametric statistical observations were carried out. The hypothesis test of the effect of giving modified Javanese traditional dance on hand grip strength and walking speed in elderly women will be analyzed by paired sample t test. If the normality test shows that the data distribution is not normal, then a hypothesis test will be carried out with the Wilcoxon signed rank test. The p value is considered significant if $p < 0.05$.

Result

There was 12 elderly who met the inclusion and exclusion criteria, and were willing to voluntarily participate in this study. Only 11 elderly were able to complete the study, 1 person dropped out because they did not participate in the exercise 3 times in a row, for no apparent reason. The normality test and initial characteristics of subjects can be seen in table 1.

Table 1
Characteristics subjects and normality test

Variable	Mean±SD	p-value
Age (years)	75,33±7,9	0,540
60-70 (n=4)		
71-84 (n=5)		
≥85 (n=3)		
Weight (kg)	52±12,83	0,295
Height (cm)	154,25±7,35	0,057
BMI (kg/m ²)	19,76±6,17	0,127
Underweight (n=4)		
Normal (n=4)		
Overweight (n=2)		
Obese (n=2)		
Handgrip strength (Kg)	21,48±24,25	0,021
10MWT (second)	19,18±10,08	0,418

*SD: Standard deviation; BMI: Body mass index; *The Saphiro Wilk test is normally distributed if the p value>0.05

The results of the Wilcoxon signed rank test showed a significant increase in the hand grip strength variable before and after the intervention (p = 0.003) (Table 2). The effect size shows large results (Cohen's D = 0.88).

Table 2
The Effect of Modified Traditional Javanese Dance program on hand grip strength

Variable	Before 12 weeks (Kg)	After 12 weeks (Kg)	p-value
Handgrip strength (Kg)	8,57	12,50	0,003*

* The Wilcoxon signed rank test was significant if the p value <0.05

The results of the paired T-test showed a significant increase in walking speed assessed by 10MWT, before and after the intervention (p=0.01) (Table 3). The effect size shows large results (Cohen's D = 0.94).

Table 3
The Effects of Modified Traditional Javanese Dance on Walking Speed

Variable	Before 12 weeks (Kg)	After 12 weeks (Kg)	p-value
10MWT (Detik)	15,63	13.09	0,01*

*10MWT: ten meter walking test; * The paired T-test is significant if the p value <0.05

Discussion

Assessment of age, height, weight and body mass index was carried out because they contribute to muscle strength and walking speed. According to research by

Lee et al in 2012 in Korea, hand grip strength is related to age, weight, height and body mass index (Lee et al., 2012). In this study, the elderly with age range more than 75 years old were around 67.7%. Study by Rivianti et al in 2017 at Ciptomangunkusumo Hospital Jakarta stated that the elderly with age more than 75 years had a high risk of decreasing hand grip strength about 2-3 times (Rivianti et al., 2017). Another study from Led et al in 2013 stated that underweight and overweight groups of subjects had lower hand grip strength than normal body mass index (Lad et al., 2013).

Increasing age is also associated with a decrease in walking speed. Walking speed decreases starting at the age of 60 years old and decreases 0.0037 m/s every year (Jimenez, 2017; Schimpl et al., 2011). The age range in this study is quite varied, so it can cause the variation in walking speed of the respondents. Height and weight was contributed to differences in walking speed and stride length (Samson et al., 2000). An increase in body mass index cause a decrease postural control and changes the center of gravity, affect balance and walking speed (Corbeil et al., 2001).

Modified traditional Javanese dance program is a type of aerobic exercise. Aerobic exercise can affect muscle strength and walking speed by increasing systemic circulation, increasing mitochondrial biogenesis and increasing protein synthesis, which then affects the incidence of sarcopenia with components muscle mass, muscle strength and walking speed (Beas-Jiménez et al., 2011). Modified traditional Javanese dance exercises were statistically proven to provide improvements in hand grip strength assessed using a hand-dynamometer.

Modified traditional Javanese dance movements that use a lot of the upper limbs movement, especially the fingers that maintain the scarf during the dance process, can increase the strength of the flexor muscles of the fingers, which affects the increase in hand grip strength. The results of this study are in line with study by Wołoszyn et al in 2021, by providing aerobic exercise in the form of dance movement therapy (DMT) for 12 weeks showed a significant increase in hand grip strength, balance, cardiorespiratory function, and independence (Wołoszyn et al., 2021).

This study also showed a significant improvement in walking speed ($p=0.01$) after intervention. These results are in accordance with research conducted by Joung & Lee in 2019, showed an increase in walking speed and balance in the elderly after 8 weeks of creative dance intervention (Joung & Lee, 2019). Another study from Meng et al, by giving square dance to the elderly for 12 weeks, showed a decrease in the incidence and severity of frailty after the intervention. One of the variables assessed was walking speed. there was a significant increase in the walking speed of the elderly after the intervention with $p = 0.0002$ (Meng et al., 2020).

The increase in walking speed after the modified traditional Javanese dance program for 12 weeks is mainly due to an increase in balance and coordination. Movement sitting to standing, walking sideways to the right and left, with upper limb movements that require coordination and balance. Exercise sitting to standing and walking sideways also triggers the activity of the hip flexor muscles

and ankle muscles which causes an increase in muscle strength, coordination and affects the increase in walking speed. The subjects worked on speed, distance, direction, rhythm and muscle tone, and strength while walking. The movement of dance is also improve coordination ability and body mass transfer in the lower limbs, results in increased walking speed and cadance ([Yoo et al., 2013](#); [Leem et al., 2019](#)).

Music therapy contained in this intervention is also considered to have an effect on increasing hand grip strength and walking speed. The music given in this study was Javanese-themed music, familiar with most of the research subjects, who 92% were Javanese. Before starting the intervention, we also gave a preparatory class so that the subject had been exposed to music and dance moves several times before starting the intervention.

Familiar music reduces the demands of cognitive synchronization, so adaptation to movements and beats will be faster. Familiar music also make the patient more enjoy the movement so as to achieve the goal of therapy ([Leow et al., 2015](#)). Van den zen et al in 2019, stated that listening to familiar or favorite music in the elderly could increase maximum hand grip strength compared to a group that did not listen to music ([Van den elzen et al., 2019](#)). Music therapy can elicit an emotional response. Moving with music activates endorphins-related brain's pleasure circuits. Dance moves to the rhythm of the music improve pleasant movement pattern, and distract from fatigue, so that the elderly can follow the intervention according to instructions ([de Dreu et al., 2012](#)).

Familiar music also results in increased stride speed, reduced gait variability, and better stride synchronization. Fast tempo music is reported to increase speed better than slow tempo music ([de Dreu et al., 2012](#)). De Bruin et al, giving intervention walking with music for 13 weeks to patients with parkinson, showed that walking with music improved gait speed, stride time and cadence ([de Bruin et al., 2010](#)).

Music therapy components can also activate protein synthesis pathways by increasing insulin resistance, increasing IGF-I, and stimulating the release of IRISN and BDNF. Van Nieuwpoort et al in 2018 it was stated that there was a relationship between low levels of IGF-I and a decrease in hand grip strength ([Van Nieuwpoort et al., 2018](#)). Limitations in this study include: This study only assessed the parameters before and immediately after exercise, so the long-term effect of this exercise program is not known.

Conclusion

The hand grip strength and walking speed of the elderly increased after giving the Modified traditional Javanese dance program for 12 weeks. Further research is needed to assess the long-term effects after giving the Modified traditional dance program.

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Conflicts of interest

The authors declare no conflict of interest.

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