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# Modified traditional dance therapy: An applicative balance therapy for Hargo Dedali's Elderly

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**Abstract**--One of the problems in the elderly is the high prevalence of falls. Prevalence rate falls around 28-35% in the 65-69 years old elderly and increases to 32-42% in the aged over 70 years. Dance is a promising intervention to improve balance and brain structure for the elderly. Dance is a multimodal intervention with multiple components. Dance combines aerobic fitness, sensorimotor skills and cognitive demands with a low risk of injury. One of the dances that have a combination of various movements is the Javanese dance. Javanese dance is a fun physical activity/exercise and can be a therapeutic option to improve muscle strength, flexibility, functional capacity and postural stability. Therefore, the study purpose was to determine modified traditional javanese dance effect on balance function through one-leg stance test and timed up-and-go test examination on female elderly at the Hargo Dedali Nursing Home. The improvement of static balance function in elderly female subjects after being given modified Javanese dance 3x/week with a duration of 35 minutes for 12 weeks. There was also an increase in dynamic balance function in elderly

female subjects after being given modified Javanese dance 3x/week with a duration of 35 minutes for 12 weeks.

**Keywords**---Elderly Fall Prevalence, Balance Therapy, Modified Traditional Dance, Hargo Dedali Nursing Home.

## Introduction

In the last five decades (1971-2019), there has been an increase of about two times the number of elderlies in Indonesia. It's reaching 9.6% (25 million) of the total population of Indonesia. The amount of female elderly among about one per cent more than male elderly (10.10%: 9.10%) ([Badan Pusat Statistik, 2019](#)). Following the population projection for 2020-2010, the elderly population in East Java in 2019 has reached 13.06%. It indicates that the population structure of East Java is classified as an elderly population. A consequence in the form of potential and challenges in development in East Java Province ([Badan Pusat Statistik Provinsi Jawa Timur, 2019](#)). One of the problems in the elderly is the high prevalence of falls. Prevalence rate falls around 28-35% in the 65-69 years old elderly and increases to 32-42% in the aged over 70 years. The nursing homes elderly fall more often than in the community ([World Health Organization, 2021](#)). Female elderly are more prone to decreased motor function than men, so the risk of falling and fracture is higher ([Maeda et al., 2011](#)).

Falls and injuries are health problems that often require medical attention. Falls account for 20-30% of mild to severe injuries and 10-15% of all emergency department visits. More than 50% of hospitalizations related to injuries occur in the elderly aged over 65 years. The common causes of hospitalization are hip fractures, traumatic brain injury and upper limb injuries. The incidence of repeated falls is 40% and will increase by 20% in 2050. WHO Global Report stated that the balance problem causes falls will occur if it is not taken seriously ([World Health Organization, 2021](#)). Prevention and management strategies for balance disorders consist of non-pharmacological and pharmacological. Exercise as well as environmental assessment and modification are non-pharmacological interventions. Exercise recommendations for the elderly include incorporating activities that maintain or improve flexibility, endurance, strength, and balance ([Cuevas-Trisan, 2017](#)).

Balance is the ability to maintain static and dynamic equilibrium of the body when placed in various positions ([Delitto, 2013](#)). Human body must adjust the position continuously so that the COG or COM (centre of mass) is at the BOS (base of support) to control balance. Motor responses to maintain balance include: (1) ankle strategy (anteroposterior plane); (2) Weight shifting strategy (lateral plane); (3) Suspension strategy; (4) Hip strategy; and (5) Stepping strategy. Balance training divided into static and dynamic. Static balance control activity include sitting, half kneeling, and standing on a flat surface. Then, dynamic balance control activities, such as teaching the patient to maintain an equal weight distribution by aligning the correct posture while standing on a moving surface ([Kloos & Heiss, 2007](#)).

Dance is a promising intervention to improve balance and brain structure for the elderly. Dance is a multimodal intervention with multiple components. Dance combines aerobic fitness, sensorimotor skills and cognitive demands with a low risk of injury (Rehfeld et al., 2017). Dancing can address a practical issue found in other therapies when applied. A Randomized Controlled Trial (RCT) showed that group-based Turkish folk dance effected female elderly's physical performance, balance, depression and quality of life (Eyigor et al., 2009). Dance therapy also reduced falls compared to usual care shown in one RCT. Dance therapy can reduce the fear of falling in three RCTs. It also has no fatal side effects from the intervention (Veronese et al., 2017). Dancing is also, to some extent, able to overcome compliance problems that occur in conventional physical rehabilitation exercises (van der Bij et al., 2002). Fun and enjoyable exercises during dance activities can affect long-term participation (Findorff et al., 2009).

Indonesian traditional dances movement adopted from daily-life movements, so they can be performed by various groups. It will always involve elements of the human body, starting from the head, eyes, body, hands, to feet (Chakim, 2020). One of the dances that have a combination of various movements is the Javanese dance. Javanese dance is a fun physical activity/exercise and can be a therapeutic option to improve muscle strength, flexibility, functional capacity and postural stability (Dhami et al., 2014). The challenge of static and dynamic balance applicated in this modified Javanese dance intervention. The dance begins with static balance exercises because it is easier to use good support when in the same position. The shift from static to dynamic balance challenges occurs in the second part. An adaptation is needed when the body moves and shifts it positions. Static and dynamic movements combination require good balance control (Visser & MacFarlane, 2014).

The application this therapy is often used in nursing homes. In Surabaya city, there are six nursing homes that are still active today. One of them is government-owned and the rest belongs to private sector. One of the three private nursing homes is Hargo Dedali Nursing Home. It accepts elderly who entrusted by their children, relatives, or friends. As a place that accommodates elderly, Hargo Dedali Nursing Home as its capacity is provide care and attention. As a nursing home recognized by the Government of Surabaya, various therapies provided to support their health. Therefore, the study purpose was to determine modified traditonal javanese dance effect on balance function through one-leg stance test and timed up-and-go test examination on female elderly at the Hargo Dedali Nursing Home.

## **Materials and Methods**

The research method in this study was experimental pre and post-treatment in 1 group of elderly. The treatment given is the provision of modified Javanese dance. The research was carried out for 12 weeks, starting from February to April 2022. The research site was at the Hargo Dedali Nursing Home, Manyar Kartika IX Street No. 22, Surabaya. The research subjects were female elderly who met the inclusion criteria and were domiciled at the Hargo Dedali Nursing Home. The population is 40 people. The sampling method was consecutive sampling, so all research subjects who met the research criteria were included in the study until

the subject needs were met. Then, variable operationalization is described in table 1 as follows.

Table 1  
Variable Operationalization

No.	Variable	Measurement Method	Unit	Data Scale
1.	Elderly	Age is determined from the date of birth when the study begins according to identity (Driving Licence or ID Card) and is stated in years.	Year	Ratio
2.	Female	Gender is determined according to identity (Driving Licence or ID Card) and is stated in the female category.	Female	Nominal
3.	Balance Function	Timed up and go test to assess dynamic balance function. One leg stance test was used as a predictor of static balance function.	Second	Ratio
4.	Modified Javanese Dance	The dance intervention is conducted by following prescription: <ul style="list-style-type: none"> <li>• Frequency: 3x/week</li> <li>• Intensity: 40-60 % HRR</li> <li>• Time: 10 minutes warm up, 15 minutes core (dance), 10 minutes cool down</li> <li>• Type: Modified Javanese Dance</li> </ul> The dance movements were led by 2 dance instructors and supervised by 2 researchers and 2 nursing home staff.	Frequency of attending training: times/week	Nominal
5.	<i>MoCA</i>	A test consists of 30 questions and requires an examination time of 10 minutes. The items on the MoCA consist of short-term memory recall, visuospatial ability, executive function, attention, concentration, language and place and time orientation. MoCA scores range from 0-30. Higher scores indicate better cognition and below 26 indicate cognitive impairment associated with MCI and Alzheimer's.	Total score in number	Ratio
6.	Vision Function	Using a Snellen Chart card at a distance of 6 meters where the	6/6	Ratio

No.	Variable	Measurement Method	Unit	Data Scale
		subject's visual acuity is 6/6 with or without eyeglass correction.		
7.	Hearing Function	The modified whisper test is normal if the subject can hear 80% of all the words tested according to the procedure.	% Number of words	Ordinal
8.	Hemodynamic Stable	Subject's vital signs: <ul style="list-style-type: none"> <li>• Resting blood pressure 180/110 mmHg (Fernhall et al., 2014)</li> <li>• Pulse 100x/m (Al Haddad et al., 2016)</li> <li>• Body temperature 37.5°C (Porat et al., 2015)</li> <li>• O2 saturation 95% (Mayo Clinic, 2018)</li> </ul>	<ul style="list-style-type: none"> <li>• Blood pressure: mmHg</li> <li>• Pulse: x/min</li> <li>• Body temperature: °C (celsius)</li> <li>• Saturation: %</li> </ul>	Blood pressure and saturation in ratio, heart rate and respiration in nominal.
9.	Uncompensated Heart Failure	Based on the anamnesis, there were complaints of shortness of breath when carrying out activities according to the NYHA criteria accompanied by physical examination. The heart border enlarged and oedema where the subject was included in the NYHA criteria grades III and IV.	Grades I-IV according to NYHA criteria	Ordinal
10.	Upper and Lower Limbs Pain	WBFS and clinical	WBFS: 1-10	Ordinal
11.	Knee OA	Subjective pain measurement was based on WBFS (Wong Baker Face Scale) 4 and clinical signs were swelling, redness and warmth to the touch.	WBFS: 1-10	Ordinal
12.	Persistent Asthma	Through anemnesis, symptoms that match the category of persistent asthma according to the classification of asthma degrees by the PDPI in 2008, the subjects were excluded.	There are/no symptoms	Ordinal
13.	Chronic Obstructive	History using COPD criteria was based on GOLD criteria. Subjects	There are/no symptoms	Ordinal

No.	Variable	Measurement Method	Unit	Data Scale
	Pulmonary Disease (COPD)	were excluded if 4 Gold criteria were met.		
14.	BPPV ( <i>Benign Peripheral Paroxysmal Vertigo</i> )	Dix-Hallpike test with a positive interpretation if symptoms of vertigo recur or nystagmus is present	There are/no symptoms	Numeric
15.	Balance function interfere neurological disorders	Measuring tactile sensation and joint position sensation on the toes of both right and left feet according to the physical examination procedure.	Tactile sensation: % Joint position sensation: good/bad	Nominal

Sources: Research result, 2022.

Movements in modified Javanese dance in this study include *deleg deleg*, *lembahan lombo*, *ukel ngrayung*, *menthang miwir sampur*, *ogek lambung*, *lembahan ayun-ayun*, *ndayung kanan-kiri*, *engkol pundak kanan-kiri*, *tebah pundhak*, *lombo kanan-kiri*, *okel ogkek pundhak*, *jinjit ungkit (engkol) kaki*, *singget menthang*, *ogek lambung mendhak*, *jingket jingket*, *mentang miwir sampur putar* and *laku lombo*. Three parts of a modified Javanese traditional dance create a total of 16 movement motifs with a duration of 15 minutes are critical of the intervention. The dance therapy was performed after warming up and ended up with a cooling down (10 minutes each stretching and breathing exercise). The intervention duration requires 35 minutes of exercise. Dance movements are adapted to the needs of the elderly and start at a slow tempo and then go faster (Chakim, 2020). Elderly subjects who had met the inclusion criteria were explained the study objective and examination procedures. Subjects may accept or reject the examination offer. Subject characteristics data collection, subjective examination (anamnesis) and physical examination were needed to determine the inclusion and exclusion criteria. Assessment of balance function with One Leg Stance Test and Timed Up and Go Test will be carried out before giving the exercise.

The research subjects were asked to participate in a modified Javanese dance intervention with the following steps: (a) before the dance intervention, there were three preparatory classes in 3 days with an interval of 1 day for a week; (b) the dance intervention performed with a duration of 35 minutes (consisting of warm-up, dance core and cool-down) each session three times a week for 12 weeks according to the exercise protocol; (c) due to the patient safety and proper implementation of dance interventions, exercises will be taught by two dance instructors at each meeting session. One instructor leads the dance in front of the group, and the other supervises the movements and guides the participants to ensure they move correctly. Two doctors (researchers) and two nursing home staff were responsible for supervising participants safety during the intervention. During the program, the subjects will fill out an exercise monitoring card each time a dance intervention to assist in monitoring. The balance function final

assessment through the One Leg Stance Test and the Timed Up and Go Test will be examined a day after the subject has completed the last exercise.

The data analysis technique uses statistical tests through SPSS 26 software. The collected data will be processed with a data normality test using the Shapiro-Wilk test. If the data is normally distributed then a parametric analysis test is carried out, but if it is not, a nonparametric statistical analysis test will be used. To compare the balance function assessment results with the One Leg Stance Test and the Timed Up and Go Test before and after treatment, there several alternatives test to use. Paired t-test will be used if the data is normally distributed, but the Wilcoxon Signed Rank test will be used if the data is not normally distributed. The p-value is considered significant if  $p < 0.05$ .

## Results and Discussions

### *Hargo Dedali Nursing Home Elderly Characteristics*

This research is an experimental pre-post study. The study was conducted at Hargo Dedali Nursing Home Surabaya for 12 weeks from February to April 2022. The total subjects were 11 people who received Modified Javanese dance intervention three times per week for 12 weeks. Subjects received three preparatory sessions before the intervention. There were no dropouts during the final evaluation and no side effects were found during the administration of dance training or after the intervention.

Table 2  
Female Elderly Characteristic

Variable	n	%	Min	Max	Mean±SD	p
Education						
• Elementary School	8	72.7				0.000
• High School	2	18.2				
• Bachelor	1	9.1				
Ethnicity						
• Javanese	5	45.5				0.001
• Madura	1	9.1				
• Chinese	5	45.5				
Age			62	86	74.18 ± 8,49	0.403
BMI			15.10	27.34	21.02 ± 3,70	0.975
$p > 0,05$ ( <i>Normal</i> )						

Sources: SPSS 26 Analysis Result, 2022.

The results of the Shapiro-Wilk normality test on education and ethnicity variables have a p-value of  $<0.05$ , which means the data is not normally distributed. Meanwhile, the age and BMI variables have  $p > 0.05$ , which means that the data is normally distributed. The subject elderly age criteria was following Law Number 13 of 1998. Elderly is someone who has reached the age of 60 years and over ([Badan Pusat Statistik, 2019](#)). All subjects are female because

the incidence of falls in female elderly exceeds older men for all age groups (Maeda et al., 2011). Muscle fatigue is common in female elderly because motor control and endurance occur more slowly. The variables of age and BMI are normally distributed. Individuals with an increase in fat mass experience a gradual decrease in body strength relative to body size, so there is a risk of decreased neuromuscular control which makes them more prone to injury and falls. Motor strength and control are also affected by age (Duan et al., 2018). Then, ethnicity variable is important because it relates to the background of movements and music used in modified Javanese dances. Behavioural, physiological, cognitive and environmental factors will affect the efficacy and success of therapy (Whaley & Schrider, 2014). Then, the statistical test used to measure the normality of the data is the Shapiro-Wilk test using a significance level of 5%. If the p-value > 0.05, data is normally distributed. If the p-value < 0.05 is obtained, data is not normally distributed. The results of the normality test using SPSS can be seen in Table 3.

Table 3  
Normality Test Results Before Treatment

Variable	<i>p</i>	Description
<i>One Leg Stance Test</i>	0.461	Normal
<i>Timed Up and Go Test</i>	0.092	Normal

*p* > 0,05 (Normality)

Sources: SPSS 26 Analysis Result, 2022.

Table 3 is the result of the normality test of the One Leg Stance Test and the Timed Up and Go Test before 12 weeks of Modified Javanese dance therapy. It shows p-value > 0.05, thus the data normally distributed. Because the data has met the normality test, the analysis of differences between the One Leg Stance Test and the Timed Up and Go Test before giving the Modified Javanese dance will be analyzed using a paired data t-test (Paired Sample T-test).

#### *Static and Dynamic Balance Test*

The difference in the value of the one-leg stance test and the timed up-and-go test before and after giving Modified Javanese dances will be analyzed using paired data t-test. At the significance level of 5%, if the p-value < 0.05. Then there is a significant difference in test values before and after giving Modified Javanese dance.

Tabel 4  
One Leg Stance Test And The Timed Up And Go Test Average Value (Mean) Before And After Treatment

Variable	Before Therapy	After Therapy	p-value
Uji <i>One Leg Stance</i>	8.63 ± 1.44	11.15 ± 1.66	0.000*
Uji <i>Timed Up and Go</i>	18.14 ± 1.81	16.64 ± 2.33	0.001*

\* Significantly different at the 5% significance level

Source: SPSS 26 Analysis Result, 2022.



In the static balance test (OLS test, the average value of the One Leg Stance test before treatment was  $8.63 \pm 1.44$  and increased after treatment to  $11.15 \pm 1.66$ . The results of the t-test of paired data on the One Leg Stance test before and after giving modified Javanese dance to the elderly were significantly different ( $p = 0.000$ ). It indicates that the administration of modified Javanese dance significantly increases the One Leg Stance test score in the female elderly. The average score of the Timed Up and Go test before treatment was  $18.14 \pm 1.81$  and decreased after treatment to  $16.64 \pm 2.33$ . The paired data t-test results of the Timed Up and Go test before and after giving modified Javanese dance to the elderly were significantly different ( $p = 0.001$ ). The modified Javanese dance provision significantly reduces the value of the Timed Up and Go test scores in female elderly.

Modified Javanese dance exercises for 12 weeks improved the function of static balance in the elderly by using the OLS test with open eyes ( $p = 0.000$ ). The limit of the OLS reference value by opening the eyes according to the average age of the elderly was 6.2-15 seconds. OLS test values with a longer time duration indicate a better static balance function. At the time of the OLS test by standing on one leg simultaneously, there was activation of maximum motor control, especially for the extensor group, muscle spindles, proprioceptive receptors in joints, muscles, tendons, tactile receptors and pressure on the skin, visual and vestibular senses to achieve better postural control through COP (Ageberg et al., 2003). The average value of the OLS test before the modified Javanese dance intervention was  $8.63 \pm 1.44$  seconds.

Dancing is an activity that has various aspects, not only cardiorespiratory fitness aspects but also other components such as balance, flexibility, speed and coordination (Voelcker-Rehage et al., 2010). The expert dancers have structural differences in the sensorimotor network (Hänggi et al., 2010) and the hippocampus (Hüfner et al., 2011). These arguments support that dance can cause neuroplastic changes. Dance has also increase proprioception in the elderly. Proprioception is important for balance, stability, sitting-standing performance, and the ability to walk on stairs. Postural balance requires proper proprioceptive acuity and neuromuscular control (Marmeleira et al., 2009).

Modified Javanese dance is a multimodal physical activity. This dance trains balance, muscle strength and joint flexibility from the head, trunk, upper and lower limbs and moderate intensity endurance (40-60% HRR). The ability to perform activities better and longer, including in terms of performing balance functions is influenced by cardiorespiratory endurance (Arshintina et al., 2018). These multimodal aspects of modified Javanese dance can improve the balance function of the elderly because they affect the components of balance including the musculoskeletal system, sensory/perceptual system, neuromuscular synergy, adaptive and anticipatory mechanisms and high-level neural processes related to cognitive to carry out these adaptive and anticipatory mechanisms (Shumway-Cook & Woollacott, 2001). In addition, besides combining cognitive and physical activities, modified Javanese dance also has an emotional aspect. Walking with others activate a widely distributed brain network compared to walking alone. The music used in this modified Javanese dance is music that is recognized by the elderly. Music in dance stimulates broad activity in brain areas associated with

sensorimotor, higher-order cognitive, and emotional processes (Koelsch, 2009; Herholz & Zatorre, 2012). Music used in dance is a strong multimodal stimulus in humans (Sacks, 2006).

Modified Javanese dance has the same elements as well as other dances used in other therapy studies. It has a significant impact on the static balance function. Even though, there are differences in movement types and intensity of the dance. Modified Javanese dance trains static and dynamic balance with almost the same proportions where the first part trains static balance, followed by the second part trains static and dynamic balance. Then, the third part trains static balance. The frequency of dance interventions varied but did not differ much. The therapy lasts 35 minutes per session and contains three parts: warm-up, dance as the core and cool-down. The shorter duration is expected to prevent boredom and fatigue in elderly women. Light-medium intensity is the intensity used in all dances, including modified Javanese dances.

Giving modified Javanese dance training for 12 weeks improves dynamic balance function in the elderly who were examined using the TUG test ( $p = 0.001$ ). The Timed Up and Go (TUG) test assesses the dynamic balance function (Frank & Patla, 2003). The TUG test assesses the ability to walk, and balance and the risk of falls in the elderly. In the TUG test, the subject sits in a standard chair (height 44-47 cm) with his back leaning on the chair. On cue, the patient stands (without using an armrest), walks three meters at a normal pace, turns around, walks back to the chair, and sits down. Longer test completion times indicate poorer static balance function. A duration of more than 13.5 seconds indicates an increased risk of falling (Roedl et al., 2016). Performance above 20 seconds indicates a deficit in physical mobility and the falling risk in the elderly (Karuka et al., 2011). The TUG normal value is determined based on age with the average age of the subjects. TUG value of all subjects is still in the normal range according to age. TUG improves values in the elderly by providing multimodal exercise (Toraman & Ayceyan, 2005).

Modified Javanese dance is multimodal and consists of aspects of balance, muscle strength and flexibility as well as endurance. These aspects of dance affect the nervous system, and musculoskeletal and contextual effects are needed to control balance (Kloos & Heiss, 2007). Dynamic balance is the ability to maintain stability and postural orientation with the centre of mass in the base of support when body parts move (O'Sullivan & Portnry, 2014). Modified Javanese dances train endurance, muscle strength and joint flexibility to maintain movement and stability. In addition, dance movements also train the somatosensory system consisting of tactile, pressure, and proprioceptive which are needed for good dynamic balance. Cognitive aspects of dance as a multimodal training also affect cognition related to coordination mechanisms and maintenance of movement and stability (Shumway-Cook & Woollacott, 2001).

The second part of the modified Javanese dance is performed in two positions, sitting and standing, practising static balance followed by dynamic balance. Dynamic balance control is induced by the body moving and the torso rotating. The body must adjust the position continuously so that the centre of mass (COM) is at the base of support (BOS) to control balance. Motor response to maintain

dynamic balance in the second and third parts of this dance is a suspension strategy where the movement is flexing the knee followed by hip and ankle flexion to maintain stability and a hip strategy where there is a movement response in the hip by flexing or extending the hip to move the COM on the BOS. The response of muscle contractions that occur in a pattern from proximal to distal (Chandler, 2003).

## Conclusion

In this study, it can conclude that the improvement of static balance function in elderly female subjects after being given modified Javanese dance 3x/week with a duration of 35 minutes for 12 weeks. There was also an increase in dynamic balance function in elderly female subjects after being given modified Javanese dance 3x/week with a duration of 35 minutes for 12 weeks. Modified Javanese traditional dances that have a variety of movements with a blend of accompaniment can stimulate the balance function of elderly. An applicative low-budget balance therapy for the elderly at the Hargo Dedali Nursing Home, Surabaya.

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