



## COMPARISON OF HATHA YOGA AND ELDERLY EXERCISE IN FUNCTIONAL BALANCE OF THE ELDERLY

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### ABSTRACT

**Background:** Physical changes with age affect functional balance. Hatha Yoga, a common balance exercise for the elderly, is not widely known among them, despite its numerous benefits. This study aims to compare Hatha Yoga and elderly exercise to improve functional balance in the elderly. **Methods:** The study was a randomized controlled trial with 26 participants divided into two groups: the Hatha Yoga group (n=13) and the elderly exercise group (n=13). Both groups engaged in three-week exercises for six weeks, with balance measured before and after the intervention using the BBS. **Results:** There was an increase in BBS scores after treatment in the elderly exercise group ( $p < 0.001$ ) and the Hatha Yoga group ( $p = 0.001$ ). The BBS value of the Hatha Yoga group ( $42.00 \pm 0.58$ ) was higher than that of the elderly exercise group ( $41.92 \pm 0.86$ ) at the start of the study, but the difference was not significant ( $p = 0.953$ ). At the end of the study, the BBS score in the Hatha Yoga group ( $55.08 \pm 0.86$ ) was higher than that of the elderly exercise ( $50.54 \pm 1.76$ ) and the difference was significant ( $p < 0.001$ ). The difference in the score of Hatha Yoga ( $13.08 \pm 0.76$ ) compared to elderly exercise ( $8.62 \pm 1.61$ ) results in a significant  $p < 0.001$ . **Conclusion:** Hatha Yoga improves better balance than elderly exercises to improve the functional balance of elders

**Keywords:** Berg Balance Scale, elderly, functional balance, Hatha Yoga, elderly exercise

### INTRODUCTION

The structure of Indonesia's population is the aging population, which is marked by the percentage of the elderly population in 2020, which reaches more than 10%.<sup>1</sup> Physical changes that occur in the elderly include the musculoskeletal system, which includes decreased muscle mass, decreased Range of Motion (ROM), as well as decreased bone mass and density. Changes in body function in the elderly, which tend to decrease, will cause a decrease in functional balance and interfere with activities of daily life.<sup>1,2</sup> Muscular strength training can help the elderly improve balance and maintain body posture to remain stable and balanced, so that the risk of falling decreases. One of the balance exercises that are commonly done in Indonesia, such as in communities or at "posyandu" for the elderly, is elderly exercise. Elderly exercise has the benefits of increasing muscle and bone strength, increasing body flexibility, improving body balance and coordination, and improving heart function. Hatha Yoga is a practice to improve physical fitness that focuses on the physical aspects and breath control. Hatha Yoga is known to improve balance, muscle strength, endurance, flexibility, and coordination. Hatha Yoga has advantages compared to exercise for the elderly because of its low impact movements, variations in movements in several

body positions, breathing control in rhythm with the movements, relaxation and meditation exercises at the end of the exercise, as well as many modifications to achieve the movements. Therefore, it is hoped that Hatha Yoga can play a role in functional balance.<sup>2,3</sup> To the best of the author's knowledge, research on the comparison of Hatha Yoga practice with an elderly exercise on balance in the elderly population over 60 years has never been conducted in Indonesia; therefore, the researcher is interested in conducting this research.

### METHOD

#### 2.1 Participant

The research was conducted in January–February 2023 at the Elderly Social Service Center, Pucang Gading, Semarang, Indonesia. A total of 28 elderly people met the inclusion and exclusion criteria, received explanations and information regarding the research and procedures to be undertaken, and were willing to participate in the study by signing an informed consent. Subjects were randomized and divided into two groups, namely the Hatha Yoga group and the elderly exercise group, with 14 subjects in each group. The study inclusion criteria were age 60–75 years, Body Mass Index  $> 18.5$  and  $\leq 25$ , ability to understand commands, ability to



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walk without assistance, ability to sit and stand from the floor with or without assistance, and activities of daily living independently. Exclusion criteria are comorbid diseases that prevent exercise (myocardial infarction, uncontrolled DM, lung disease, stroke, Parkinson's, knee/hip osteoarthritis, cerebellar disorders), acute injuries/acute musculoskeletal disorders, and the risk of major osteoporosis and femur fractures. History of uncontrolled HT, muscle strength with MMT  $\leq 4$ . The criteria for dropping out were not coming to the exercise schedule 3 times non-consecutive or 2 times in a row, not being able to complete the exercises 2 times, or not coming to the initial and final assessment of the study. This study received ethical approval from the Health and Medical Research Ethics Commission at Universitas Diponegoro, Semarang, Indonesia.

## 2.2 Intervention

In the Hatha Yoga group, participants received Hatha Yoga intervention 3 times/week for 6 weeks; in the elderly exercise group, participants received elderly exercise 3 times/week for 6 weeks. Elderly exercise is an elderly exercise that consists of warm-up, core, and cool-down movements developed by the State Minister for Youth and Sports to improve the health of the elderly. Elderly exercises are given 60 minutes per session, light-to-moderate intensity, three times a week for six weeks. Hatha Yoga consists of Pranayama (breathing exercises) for 10 minutes in the Sukhasana position (sitting cross-legged). The 40 minutes of asana (posture practice) consist of: Garudasana: seated eagle pose; Marjaryasana: cat-cow pose; Urdhva Hastasana: upright standing pose with hands up; Utthita Parshvakonasana: extended side angle pose; Ardha Uttasana: pose standing forward bend; Vrikshasana: tree pose; Virabhadrasana 1: knight pose; Bhujangasana: cobra pose; Relax for 10 minutes in the Shavasana position (supine sleeping position).

## 2.3 Outcome

Balance assessment with the Berg Balance Scale (BBS) was carried out before and at the end of the intervention. BBS has high reliability and validity in measuring functional balance. BBS is a standard for measuring functional balance because it is able to show simulations of activities of daily living and

work, assess disability, and assess the risk of falling in the elderly.

## 2.4 Statistic analysis

Data analysis includes descriptive analysis and hypothesis testing. Before testing the hypothesis, the normality of the data distribution was carried out using the Shapiro-Wilk test. To determine the difference in BBS values before and after the intervention, a hypothesis test was carried out using the paired t test. To find out the difference in BBS scores for the Hatha Yoga group and the elderly exercise group, a hypothesis test was carried out using the Mann-Whitney U test. All data is processed with the help of a computer using SPSS® software. Significance in this study was obtained if a p value  $<0.05$  was obtained with a 95% confidence interval.

## RESULTS

Total subjects analyzed as a whole were 26 subjects until the end of the study. There were 2 subjects who dropped out of this study; 1 subject had a fever, so he could not take part in the exercise, and 1 subject did not take part in the routine exercise twice in a row. In this study, the average age of the respondents was 67.46 years in the Hatha Yoga group and 68.92 years in the elderly exercise group. The characteristics of the research subjects were evenly distributed among the Hatha Yoga group and the elderly exercise group, with p value  $>0.05$ . Improvements have occurred significantly (p  $<0.001$ ) between pre-test scores ( $41.92 \pm 0.86$ ) and post-test scores ( $50.54 \pm 1.76$ ) in the functional balance of the elderly by providing elderly exercise. Improvements have occurred, which is significant (p = 0.001) between pre-test scores ( $42.00 \pm 0.58$ ) and post-test scores ( $55.08 \pm 0.86$ ) in the functional balance of the elderly by providing Hatha Yoga. The post-test BBS score in the elderly exercise group ( $50.54 \pm 1.76$ ) was lower than the Hatha Yoga group ( $55.08 \pm 0.86$ ); this difference was significant (p  $<0.001$ ).

## DISCUSSION

The characteristics of the research subjects in both groups were evenly distributed so that it did not affect the research results. Respondents with female gender were found more frequently than males in this study.



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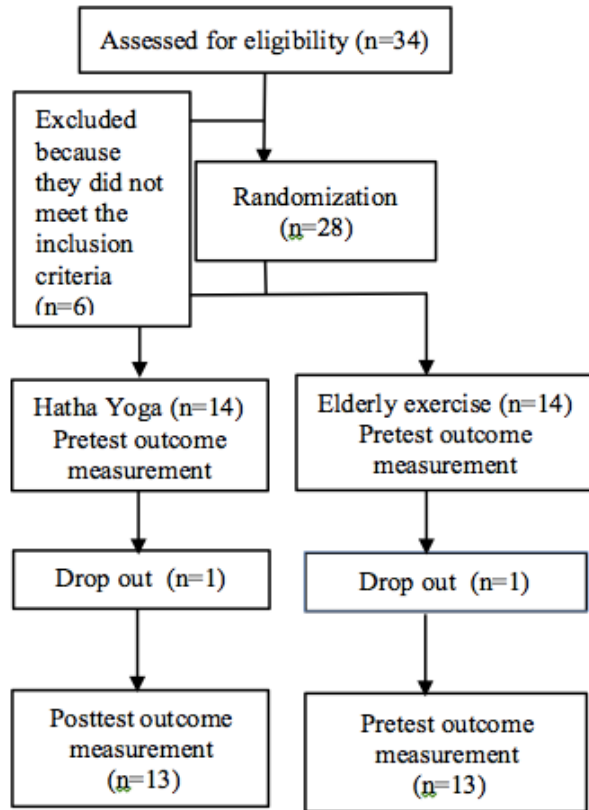


Figure 1. Flow diagram of the study

The mean age of the elderly in this study in the Hatha Yoga group was 67.46 years and elderly exercisers were 68.92 years based on the WHO elderly division included in the young elderly category.

Table 1. Baseline Characteristic

Variable	Group		P
	Hatha Yoga (13)	Elderly exercise (13)	
Sex			
Male	6 (60%)	4 (40%)	0,687¥
Female	7 (43,8%)	9 (56,3%)	
Age (years)	67,46 ± 4,65	68,92 ± 7,63	0,501¥
Body weight	56,38 ± 7,74	50,62 ± 6,97	0,067‡
Body height	157,54 ± 6,49	154,38 ± 9,54	0,334§
Body Mass Index	22,66 ± 2,32	21,26 ± 2,34	0,124‡
International Physical Activity Questionnaire IPAQ (MET-minutes/week)	397,58 ± 98,33	393,25 ± 86,72	0,840‡
BBS	42,00 ± 0,58	41,92 ± 0,86	0,953‡

Note : \* Signifikan (p < 0,05); ¥ Chi Square; § Independent t; ‡ Mann Whitney

BMI for Hatha Yoga was 22.66 ± 2.32 and for elderly exercise was 21.26 ± 2.34, so both of them were included in the normal weight category.

Tabel 2. Berg Balance Test

BBS	Group		P
	Hatha Yoga (13)	Elderly exercise (13)	
Pre test	42,00 ± 0,58	41,92 ± 0,86	0,953‡
Post test	55,08 ± 0,86	50,54 ± 1,76	<0,001‡*
P	0,001†*	<0,001¶*	
Delta	13,08 ± 0,76	8,62 ± 1,61	<0,001‡*

Note : \* Signifikan (p < 0,05); ‡ Mann Whitney; ¶ Paired t; † Wilcoxon

#### 4.1 Effects of Hatha Yoga on functional balance

The Hatha Yoga movements used in this study, such as Urdhva Hastasana, Utthita Parshvakonasana, Ardha Uttasana, Vrikshasana, and Virabhadrasana I, are movements that focus on contracting the lower extremity muscles, which are beneficial for balance. The Hatha Yoga movements used in the research are mostly dominated by stretching and isometric strengthening exercises while holding the body in a static position. Yoga movements performed in a static position and held for 5–20 breaths are known to be able to increase muscle mass so as to improve balance. This is in accordance with Syahputra's research, which compared isometric exercise with an isotonic exercise on the quadriceps femoris for 3 times a week to 4 weeks and stated that isometric exercise can increase strength (28.60) higher than isotonic exercise (27.67).<sup>4</sup> Increased strength can occur within 4 weeks of training, so it is hoped that yoga training carried out longer, namely for 6 weeks in this study, will be able to increase the strength of the quadriceps femoris muscle, which functions for knee extension, so that it plays a role in balance.<sup>5</sup>

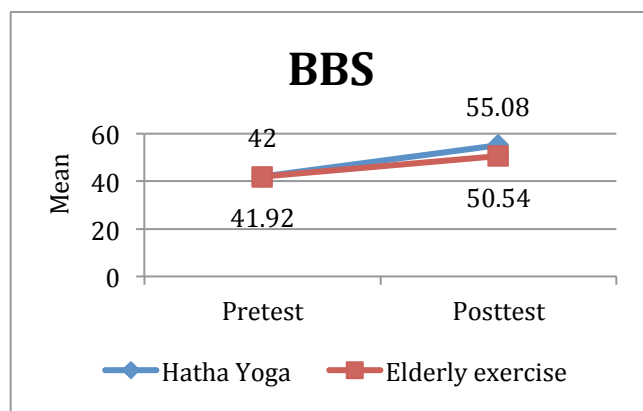
Hatha Yoga movements Marjaryarsana, Utthita Parshvakonasana, Virabhadrasana I, and Bhujangasana can increase the strength of the abdominal and back muscles.<sup>6,7</sup> A yoga and breathing session consisting of twenty breaths can be considered the equivalent of making one hundred conventional crunches. This is because the rectus abdominis and external oblique muscles are strongly mobilized during yoga practice. In addition, research-comparing yoga breathing exercises with sit-ups found more involvement of the abdominal



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muscles in yoga breathing exercises (41% muscle activity) than during sit-ups.<sup>8</sup>

Hatha Yoga exercises are also expected to improve respiratory muscle strength better than elderly exercise during this study. Movements Sukhasana, Garudasana, Ardha Uttasana, Utthita Parshvakonasana, Vrikshasana, and Virabhadrasana I are movements that can increase ROM of the lower extremity.<sup>9</sup> Iftekher's research said that significant changes occurred in the yoga group compared to the non-yoga group in the group of athletes who underwent yoga practice 2x/week for 6 weeks in flexibility ( $p = 0.018$ ) and balance ( $p = 0.021$ ).<sup>10</sup> Hatha Yoga movements are slow, and there is a change in position from sitting, lying, or standing, so the body tries to change positions to maintain the center of gravity at the base of support. This mechanism is obtained from the Garudasana movement, Utthita Parshvakonasana, Marjaryasana, Urdhva Hastasana, Vrikshasana, and Virabhadrasana.<sup>11,12</sup>



**Figure 2.** Timed up and go test

#### **4.2 Effects of elderly exercise on functional balance**

In this study, the elderly exercise group exercised three times a week for six weeks, resulting in an increase in functional balance as measured by BBS. The increase in BBS scores found was not as high as the scores found in the Hatha Yoga group. In this study, participants had good balance as seen from the average BBS test scores, and it was found that there was an improvement in BBS scores when compared from the start of the study to the end of week 6. Albert's study, which compared the elderly

and non-exercise groups, found differences in BBS test scores with differences in the mean rank of the exercise group (29.30) and the non-exercise group (15.70) with a  $p$  value  $<0.001$ .<sup>13</sup> Functional balance in the elderly exercise group also increased in this study. Elderly, who do not take part in elderly exercise, will experience a decline in the function of the body's cells, which will affect the balance organ system and increase the risk of falling. Standing exercises, walking in place, walking tandem, lifting one leg, and tiptoeing can reduce surface contact with the body and improve coordination of all lower extremity muscles and body movements in controlling balance.

#### **4.3 Comparison between Hatha Yoga and elderly exercise on functional balance**

The BBS test delta value before and after the study in the Hatha Yoga group was higher than the elderly exercise group. This shows that Hatha Yoga can improve functional balance, as measured by BBS, compared to the elderly exercise group. Previous research comparing Hatha Yoga with an elderly exercise on functional balance in an elderly individual population as measured by BBS has never been done. In a previous study comparing Hatha Yoga practice with conventional exercise in the elderly population, an increase in static and dynamic balance was found in the yoga group compared to the conventional exercise group, and this difference was significant.<sup>14,15</sup> Previous research that compared yoga and conventional exercises in the elderly showed that the addition of yoga practice could significantly improve balance in the elderly and reduce the incidence of falls compared to conventional exercises.<sup>16</sup>

In this study, there were no elderly who experienced depression, so the elderly had good motivation to take part in the exercise. Hatha Yoga and elderly exercise are carried out together so as to increase the motivation of the elderly to practice. Hatha Yoga is the first type of exercise carried out at the research site so that the elderly have the enthusiasm to take part in Hatha Yoga exercises. Hatha Yoga practice is multiplanar and has a greater impact on balance, flexibility, endurance, and cardiovascular fitness. Elderly exercise is also multiplanar by further improving cardiovascular fitness, coordination, balance, flexibility, and



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endurance.<sup>17,18</sup> Elderly exercise has more and more varied movements compared to Hatha Yoga. Hatha Yoga movements are slow, and the transition from one movement to another takes longer and is a low-impact type. Hatha Yoga movements as many sitting, standing, and lying positions, while elderly exercise only uses standing positions. Hatha Yoga movement begins with breathing exercises; the core movements are rhythmic and improve breathing control. In Hatha Yoga, breathing and core muscle exercises are better than abdominal breathing exercises and voluntary breathing. Hatha Yoga will increase the activation of the parasympathetic system, which is associated with increased baroreflex sensitivity and affects the strength and endurance of the respiratory muscles. Both Hatha Yoga and exercise for the elderly are known to increase muscle strength and flexibility, which is beneficial for balance. Strength training in Hatha Yoga uses a combination of stretching, isometric, and isotonic contractions, while exercise for the elderly uses more isotonic contractions.<sup>19,20</sup> In Hatha Yoga, there is control of breathing and relaxation techniques (shavasana) at the end of the exercise, which has an effect on regulating the hormone cortisol and stress hormones, whereas in elderly exercise, there is no relaxation at the end of the practice. In Hatha Yoga, there are various alternative movements to achieve the desired movement goals, such as using chairs or cushions to make it easier for the elderly to achieve the movements, whereas in elderly exercise, there are not many modifications to the movements that can be made.<sup>19,20</sup>

This study did not use blinding techniques for researchers so that measurement bias could occur. Experimental research and clinical trials with randomization techniques will be of greater quality if the measurements are blinded.

## CONCLUSION

From the results of this study, it can be concluded that both Hatha Yoga and elderly exercise can improve the functional balance of the elderly. Hatha Yoga provides greater improvement compared to elderly exercise, so balance exercises with Hatha Yoga can be applied to communities in nursing homes with certain criteria.

## ETHICAL APPROVAL

This research ethical clearance was issued by Medical Health and Research Ethics Commission (KEPK), Faculty of Medicine, Universitas Diponegoro Number 422/EC/KEPK/FK-UNDIP/XII/2022.

## CONFLICTS OF INTEREST

The authors declare no conflict of interest.

## FUNDING

No specific funding was provided for this article.

## AUTHOR CONTRIBUTIONS

Conceptualization, IA, LI, HPJ; methodology, HPJ; software, IA; validation, IA; formal analysis, IA and HPJ; investigation, IA and LI; resources, IA; data curation, HPJ; writing—original draft preparation, IA; writing—review and editing, LI and HPJ; visualization, IA; supervision, LI and HPJ; project administration, IA; funding acquisition, IA

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