



## Comparison of Hatha Yoga and “Senam Lansia” on The Cardiorespiratory Fitness of The Elderly

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### Abstract

**Introduction:** Cardiorespiratory fitness declines with age. Regular exercise helps enhance an elderly person's physical capacity, fitness, and overall quality of life. Senam lansia is physical activity that is frequently performed by the elderly population. Though hatha yoga has slower movements than exercise for the elderly, it still incorporates various exercise component. This study was aimed to assess the difference between hatha yoga exercise and senam lansia on cardiorespiratory fitness of the elderly.

**Methods:** This study was a randomized controlled pre- and post-test. The hatha yoga group and the control group were randomly selected with a total of 26 participants. For six weeks, three times a week, participants in the intervention group and control group performed hatha yoga and senam lansia, respectively. The six-minute walk test is used to measure maximum oxygen consumption ( $VO_{2max}$ ), a measure of cardiorespiratory fitness.

**Result:** The mean  $VO_{2max}$  value was  $15.03 \pm 2.63$  ml/kg/minute in the hatha yoga group and  $13.82 \pm 2.05$  ml/kg/minute in the senam lansia group with significant differences between groups. The increase in  $VO_{2max}$  values before and after the intervention was  $1.83 \pm 1.15$  ml/kg/minute in the hatha yoga group and  $1.35 \pm 1.04$  ml/kg/minute in the senam lansia group with no significant difference between the two groups.

**Conclusion:** Hatha yoga exercises and senam lansia have the similar effect on increasing cardiorespiratory fitness as measured by the 6-minute walk test.

**Keywords:** Hatha Yoga Exercise, Senam Lansia, Elderly, Cardiorespiratory Fitness

## **Perbandingan Latihan Hatha Yoga dan Senam Lansia terhadap Kebugaran Kardiorespirasi Lansia**

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### **Abstrak**

**Pendahuluan:** Penambahan usia diiringi dengan penurunan kebugaran kardiorespirasi. Latihan fisik teratur dapat memperbaiki kebugaran, kapasitas fisik dan kualitas hidup lansia. Latihan fisik yang umum dilakukan oleh populasi lansia adalah senam lansia. Dibandingkan dengan senam lansia, hatha yoga memiliki gerakan yang lebih lambat tetapi tetap menggabungkan berbagai komponen latihan. Penelitian ini bertujuan untuk melihat perbedaan latihan hatha yoga dengan senam lansia terhadap kebugaran kardiorespirasi lansia.

**Metode:** Penelitian ini merupakan randomized controlled pre- and post-trial study. Sebanyak 26 orang diacak menjadi dua kelompok, kelompok hatha yoga ( $n = 13$  orang) dan kelompok kontrol ( $n = 13$  orang). Partisipan pada kelompok intervensi melakukan latihan hatha yoga dan kelompok kontrol mendapatkan senam lansia, 3 kali seminggu selama 6 minggu. Konsumsi oksigen maksimal ( $VO_{2max}$ ) yang merupakan indikator kebugaran kardiorespirasi diukur dengan menggunakan uji jalan 6 menit (6MWT).

**Hasil:** Pada akhir penelitian, nilai rata-rata  $VO_{2max}$  adalah  $15,03 \pm 2,63$  ml/kg/menit pada kelompok latihan hatha yoga dan  $13,82 \pm 2,05$  ml/kg/menit pada kelompok senam lansia dengan perbedaan yang signifikan intra kelompok. Peningkatan nilai  $VO_{2max}$  sebelum dan sesudah intervensi adalah  $1,83 \pm 1,15$  ml/kg/menit pada kelompok latihan hatha yoga dan  $1,35 \pm 1,04$  ml/kg/menit pada kelompok senam lansia dengan perbedaan yang tidak bermakna antara kedua kelompok.

**Kesimpulan:** Tidak terdapat perbedaan pengaruh antara latihan hatha yoga dan senam lansia terhadap kebugaran kardiorespirasi lansia yang diukur dengan uji jalan 6 menit. Latihan hatha yoga dan senam lansia memiliki pengaruh yang sama dalam meningkatkan kebugaran kardiorespirasi.

**Kata Kunci:** Latihan Hatha Yoga, Senam Lansia, Lansia, Kebugaran Kardiorespirasi

## **Introduction**

Health is a fundamental need for the elderly. Declining health among the elderly can reduce the level of independence of the elderly population and increase the dependency ratio of the elderly. According to Survey Sosial Ekonomi Negara (Susenas) data from 2021, 43.22% of senior individuals report having health issues. Health issues impede daily activities for at least half of the older population.<sup>1</sup> Age-related structural and physiological alterations in the cardiovascular system will lead to a decline in lung func-

tion and cardiovascular capacity, ultimately affecting cardiovascular function. A person's capacity for functional activities is primarily determined by their level of cardiorespiratory fitness, the health of their cardiovascular system, and their ability to regulate tissue oxygenation and oxygen transport.<sup>2,3</sup>

Regular physical activity enhances the health, physical capabilities, and overall quality of life for the elderly and individuals with chronic conditions.<sup>4</sup> Despite these advantages, it is estimated that 50-60% of the elderly do not meet the recommended level of physical activity, which is 150 minutes of moder-

ate-intensity aerobic exercise or 75 minutes of high-intensity aerobic exercise per week.<sup>5</sup> Most senior persons report difficulty performing aerobic exercise (Senam Lansia) due to musculoskeletal injuries or other health issues, lowering the amount of elderly involvement.<sup>6</sup>

Yoga, a physical exercise practice that has been shown to have numerous benefits for the elderly population, is another exercise that can be given to them.<sup>7</sup> Yoga has been shown to improve cardiovascular health, mood, reduce stress, and enhance overall quality of life. Yoga can also enhance endurance, strength, flexibility, and balance, all of which are essential factors that promote participation and safety in physical activities.<sup>8</sup> Hatha Yoga is a type of yoga practice that is widely practiced. It is a branch of yoga that emphasizes health and fitness aspects rather than spiritual aspects. Hatha Yoga exercises utilize the principles of cardiorespiratory resistance training and relaxation exercises to enhance an individual's overall cardiorespiratory fitness, thereby improving their ability to perform functional activities.<sup>8,9</sup> The purpose of this study is to compare the effect of Hatha Yoga exercises and Senam Lansia on cardiorespiratory fitness in the elderly.

## Methods

This was a randomized controlled pre- and post-trial study. Participants in the study ranged in age from 60 to 75 years old and lived in senior housing facilities. Participants were admitted if they met the following requirements: (1) BMI norm weight, (2) Can comprehend and understand commands, (3) Can walk without assistive devices, (4) Can sit and stand from the floor with or without assistance, (5) Independent ADL, (6) METs score 3, (7) Cooperative and willing to participate in research, and excluded if any of the following criteria are met: (1) having a comorbid disease or acute musculoskeletal injury/disorder that prevents exercise, (2) having a risk of major osteoporotic fracture and femoral neck as measured by FRAX criteria, (3) having a history of surgery or planned surgery on the spine and limbs, (4) having a history of uncontrolled malignant HT, (5) having cognitive impairment, (6) experiencing mild-moderate depression, (7) having vision function that cannot be corrected, (8) hearing function that cannot be corrected or fails the whisper test.

Participants who met the inclusion and exclusion criteria were randomly assigned

to two groups. The Hatha Yoga (HY) group practiced Hatha Yoga three times per week, while the Senam Lansia (SL) group received elderly exercise three times per week. The Hatha Yoga training provided lasts 40 minutes per session and consists of Pranayama (breathing exercises), Asana (posture exercises) consisting of 10 movements, namely Sukhaasana (sitting cross-legged position), Garudasana (eagle pose in a sitting position), Utthita Parshvakonasana (extended side angle pose), Marjaryasana (cat-cow pose), Urdhva Hastasana (upward salute), Ardha Uttasana (Standing Half Forward Bend), Vrikshasana (tree pose), Virabhadrasana 1 (warrior 1 pose), Bhujangasana (cobra pose), Balasana (child pose), and relaxation exercises conclude the practice. The elderly exercise used is Senam Bugar Lansia MENPORA 2013™, with a training time of 40 minutes per session that includes a warm-up, core training, and cool-down stages.

Data was collected at the start of the study (baseline) and again after both groups had exercised for 6 weeks. Maximal oxygen consumption ( $\text{VO}_2\text{max}$ ) is a commonly used criterion for assessing cardiovascular and respiratory health.  $\text{VO}_2\text{max}$  is obtained from the conversion of the distance traveled by the 6-minute walk test (6MWT) using the Nury formula.<sup>10</sup> The 6MWT test can be used to estimate  $\text{VO}_2\text{max}$ . This test has several advantages over other walking tests, including the fact that it is easier to perform, more tolerable, and more accurately reflects daily activities. Furthermore, this test assesses the overall and integrated response of all exercise-related systems, such as the cardiovascular system, respiratory system, systemic circulation, blood, neuromuscular units, and muscle metabolism.<sup>3</sup>

This study was conducted at the Social Services Home for the Elderly, Pucang Gading, Semarang, from December 2022 to February 2023, with ethical approval from the Ethics Commission of the Faculty of Medicine, Diponegoro University, under the number 423/EC/KEPK/FK UNDIP/XII/ 2022. Data analysis includes descriptive analysis for general data and hypothesis testing. The Shapiro-Wilk test was used to ensure that the data distribution was normal before testing the hypothesis. An intragroup hypothesis test was performed using the paired t-test for normally distributed data and the Wilcoxon test for non-normally distributed data to determine the difference in 6MWT distance and  $\text{VO}_2\text{Max}$  values before and after treatment. The Mann-Whitney test was used to compare differences in 6MWT

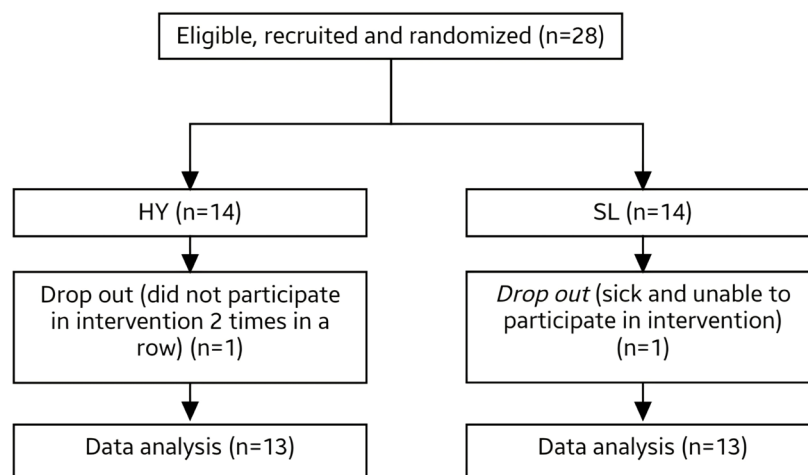
and  $VO_{2max}$  values between groups before and after treatment. SPSS® software was used to process all of the data. In this study, significance was defined as a p-value of 0.05 with a 95% confidence interval.

## Result

The sample that met the inclusion and exclusion criteria was 28 people, divided randomly into two groups (HY vs SL), with 14 subjects in each group (HY vs SL). Two subjects (1 in HY and 1 in SL) dropped out for various reasons, bringing the total number of subjects analyzed at the end of the study to 26

(Figure 1). Gender, age, weight, height, body mass index, blood pressure, and level of physical activity were similar across study groups (Table 1).

Both groups demonstrated improved 6MWT and  $VO_{2Max}$  after 6 weeks of intervention with  $p < 0.05$  (Figure 2). Although the HY group exhibited better progress than the SL group, there was no evidence of a between-group difference in 6MWT (HY, 34,62 21,68 vs SL, 25,46 19,54;  $p = 0,317$ ) or  $VO_{2Max}$  (HY, 1,83 1,15 vs SL, 1,35 1,04;  $p = 0,317$ ) (Tables 2 and 3).



**Figure 1. CONSORT flowchart.** HY, Hatha Yoga; SL, Senam Lansia. Twenty-eight people were randomly divided into two groups. At the end of the study, twenty-six patients were analyzed, 13 in the HY group and 13 in the SL group, while two patients (one in the HY group and one in the SL group) dropped out for various reasons.

**Table 1. Baseline Characteristic of the Patients**

Variable	Groups		p
	Hatha Yoga (13)	Senam Lansia (13)	
Gender			
Male	6 (60%)	4 (40%)	0,687 <sup>‡</sup>
Female	7 (43,8%)	9 (56,3%)	
Age	67,46 ± 4,65	68,92 ± 7,63	0,501 <sup>‡</sup>
Weight	56,38 ± 7,74	50,62 ± 6,97	0,067 <sup>‡</sup>
Height	157,54 ± 6,49	154,38 ± 9,54	0,334 <sup>§</sup>
BMI	22,66 ± 2,32	21,26 ± 2,34	0,124 <sup>‡</sup>
SBP	136,15 ± 12,61	136,92 ± 16,53	0,632 <sup>‡</sup>
DBP	82,31 ± 11,66	81,92 ± 11,46	0,979 <sup>‡</sup>
IPAQ	397,58 ± 98,33	393,25 ± 86,72	0,840 <sup>‡</sup>

Abbreviations: BMI, Body Mass Index; SBP, Systolic Blood Pressure; DBP, Diastolic Blood Pressure; IPAQ, International Physical Activity Questionnaire Score (in MET-minute/week). <sup>‡</sup> Chi Square, <sup>§</sup> Independent t, <sup>‡</sup> Mann Whitney.

**Table 2. Comparison Between Groups for 6-minute Walking Test**

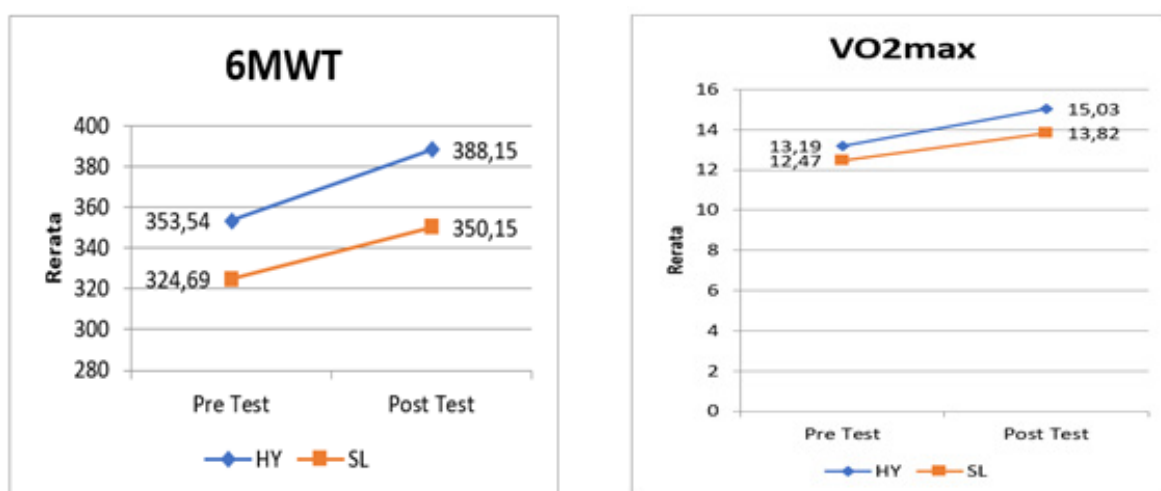
6MWT	Groups		p
	Hatha Yoga (13)	Senam Lansia (13)	
Pre test	353,54 ± 51,55	324,69 ± 25,21	0,077 <sup>‡</sup>
Post test	388,15 ± 55,45	350,15 ± 32,65	0,020 <sup>*‡</sup>
p	<0,001 <sup>*¶</sup>	0,001 <sup>†*</sup>	
Difference	34,62 ± 21,68	25,46 ± 19,54	0,317 <sup>‡</sup>

Abbreviations: 6MWT, 6 minute walking test; HY, Hatha Yoga; SL, Senam Lansia, \* Signifikan ( $p < 0,05$ ), <sup>†</sup> Wilcoxon, <sup>‡</sup> Mann whitney.

**Table 3. Comparison between group for VO<sub>2</sub>Max**

VO <sub>2</sub> max	Groups		p
	Hatha Yoga (13)	Senam Lansia (13)	
Pre test	13,19 ± 2,48	12,47 ± 1,75	0,427 <sup>‡</sup>
Post test	15,03 ± 2,63	13,82 ± 2,05	0,086 <sup>‡</sup>
p	<0,001 <sup>*¶</sup>	0,001 <sup>†*</sup>	
Difference	1,83 ± 1,15	1,35 ± 1,04	0,317 <sup>‡</sup>

Abbreviations: 6MWT, 6 minute walking test; HY, Hatha Yoga; SL, Senam Lansia \*Signifikan ( $p < 0,05$ ), <sup>¶</sup> Paired t, <sup>†</sup> Wilcoxon, <sup>‡</sup> Mann whitney.



**Figure 2. Overall Group Average of Scores from Baseline to 6 Weeks for Both Groups for 6MWT and VO<sub>2</sub>Max. 6MWT, 6 Minute Walking Test; HY, Hatha Yoga; SL, Senam Lansia.**

## Discussion

The cardiorespiratory fitness of a person determines their physical capacity. Cardiorespiratory fitness is related to the cardiovascular system, specifically the blood vessels, heart, and lungs.<sup>3</sup> Someone with cardiovascular disease, as well as someone with lung function problems, will have a decrease in fitness. Cardiorespiratory fitness tends to decline in the elderly population, who also often experience decreased function in their blood vessels, heart, and lungs.<sup>11,12</sup>

Several previous studies investigated the effects of SL and HY on cardiorespiratory fitness in elderly populations. Nuraeni et

al (2019) included a sample of 80 people and compared elderly people who exercised regularly to those who did not. It has been shown that elderly people who exercise regularly have a higher VO<sub>2</sub>max value than those who do not exercise regularly.<sup>13</sup> Barrows and Fleury (2015) identified nine articles of literature that discussed the beneficial effects of yoga on cardiovascular health in the elderly population in a systematic review. Yoga has been shown to improve blood pressure, body composition, glucose levels, and fat levels in the elderly.<sup>8</sup> Several other studies have also found that practicing yoga for a set period of time improves the cardiorespiratory endurance of elderly people.<sup>14–16</sup>



The purpose of this study is to compare the effects of senior exercise and Hatha Yoga training on cardiorespiratory fitness. It was found that following a 6-week intervention, both HY and SL showed significant increases in  $\text{VO}_2\text{max}$ . In the SL group, the mean improvement in the 6MWT value was  $25.46 \pm 19.54$  meters, while in the HY group, it was  $34.62 \pm 21.68$  meters. The results of this study indicate that the changes attained reached a clinically significant value. Previous research in a population of elderly Asian individuals indicated that a change in testing of 17.8 meters was considered a minimally clinically significant change.<sup>17,18</sup>

The practice of Hatha Yoga incorporates exercises that focus on breathing, balance, proprioception, cardiovascular endurance, strengthening, and relaxation. The increase in muscle oxygen consumption during exercise provides an explanation for the improvements in cardiorespiratory fitness observed following HY intervention. Relaxation combined with an exercise regimen causes an overall decrease in smooth muscle contractile activity in blood vessel walls, which is triggered by stimulation of parasympathetic activity during Hatha Yoga practice, resulting in increased blood flow to the muscles. Isometric contractions, a component of yoga poses, can help strengthen skeletal muscles. Some fast-twitch muscle fibers (type II) can be changed into slow-twitch nerve fibers (type I), which have greater aerobic strength and endurance, through yoga practice.<sup>19</sup> Yoga practice also increases the involvement of active muscle mass from various parts of the body, which can increase muscle endurance and delay the onset of fatigue.<sup>9,20</sup> Furthermore, because the Hatha Yoga training regimen includes breathing control and relaxation exercises, it leads to improved lung function and better oxygen utilization at the cellular level. Improved lung function and muscle strength contribute to the increase in  $\text{VO}_2\text{max}$ , as measured by the 6-minute walk test.

Increased blood flow to muscles due to increased oxygen demand, increased heart rate, increased arterial pressure with exercise, increased oxygen demand and consumption, increased respiratory frequency, decreased insulin secretion with increased glucagon secretion to maintain blood levels all contributed to the SL group's improved cardiorespiratory fitness. When regular exercise is performed at the appropriate intensity, blood sugar levels rise, as does the secretion of catecholamines and other hormones. Increased blood flow to

the muscles causes an increase in lactic acid metabolism, which leads to capillary and arteriole dilation. Consequently, regular exercise influences the amount of oxygen transported through the blood that is absorbed by the lungs.<sup>21</sup>

In this study, the difference in values between the baseline and post-intervention periods was greater in the HY group than in the SL group; however, this difference was not statistically significant ( $p = 0.317$ ). This demonstrates that there is no difference in the effect of Hatha Yoga training and Senam Lansia on improving cardiorespiratory fitness as measured by the 6MWT. In healthy elderly people, HY and SL interventions improve cardiorespiratory fitness. The mechanisms by which hatha yoga and Senam Lansia improve cardiorespiratory fitness are different. Hatha yoga practice movements are performed at a slow rhythm to stimulate parasympathetic activity, resulting in a decrease in smooth muscle contractile activity throughout the blood vessels, which leads to vasodilation and increased blood flow to muscles, ultimately enhancing maximum oxygen consumption. Senam Lansia movements have a faster rhythm, stimulate sympathetic activity, raise heart rate and arterial blood pressure, and thus increase oxygen demand and consumption.

This study has several limitations, including the lack of blinding, which could lead to measurement bias. Because lung function and lower limb muscle strength were not assessed using spirometry and a dynamometer at the beginning and end of the study, the possibility of improving fitness from these two factors could not be explained.

## Conclusion

The findings of this study suggest that Senam Lansia and Hatha Yoga both enhance cardiorespiratory fitness ( $\text{VO}_2\text{Max}$ ), as indicated by the average score on the 6-minute walk test. Hatha Yoga and elderly exercise have no effect on elderly cardiorespiratory fitness as measured by the 6-minute walk test.

## Conflicts of Interest

The authors declare no conflicts of interest. All co-authors have seen and agree with the contents of the manuscript and there is no financial interest to report. We certify that the submission is original work and is not under review at any other publication.

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