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Comparison of Postural Stability in Older Adults Aged Above 55 Years Practicing Yoga versus Non-Yoga Practitioners: A Cross-Sectional Comparative Study

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Abstract

Background: Ageing is accompanied by a progressive decline in balance, postural control, muscle strength, proprioception, and functional mobility, which increases the risk of falls among older adults. Falls are a major cause of morbidity, disability, and reduced quality of life in the elderly. Yoga is a mind-body intervention that combines physical postures, breathing exercises, and relaxation techniques and may improve balance and reduce fall risk. However, comparative studies evaluating postural stability among older adults who practice yoga and those who do not remain limited.

Objective: To compare postural stability and functional balance between older adults aged above 55 years who practice yoga and those who do not practice yoga.

Methods: A cross-sectional comparative study was conducted among 60 community-dwelling older adults aged above 55 years, divided into two groups: Yoga Practitioners (n = 30) and Non-Yoga Practitioners (n = 30). Postural stability was assessed using the Berg Balance Scale (BBS), Functional Reach Test (FRT), Timed Up and Go Test (TUG), and Single Leg Stance Test (SLS). Statistical analysis included descriptive statistics, paired t-test, independent t-test, Mann–Whitney U test, and effect size estimation using Cohen's d.

Results: Yoga practitioners demonstrated significantly higher baseline Berg Balance Scale scores (54.60 ± 2.90) than non-yoga practitioners (42.77 ± 9.41; $p < 0.001$). Post-assessment scores also remained significantly higher in the yoga group (55.57 ± 1.33) compared with the non-yoga group (50.73 ± 5.31; $p < 0.001$). Although both groups improved significantly, the non-yoga group demonstrated a greater absolute change owing to lower baseline values, whereas the yoga group showed a ceiling effect. Overall, long-term yoga practitioners maintained superior balance performance and lower fall risk.

Conclusion: Regular yoga practice is associated with significantly better postural stability, balance performance, and reduced fall risk among older adults aged above 55 years. Yoga may serve as a safe, low-cost, and effective intervention for promoting healthy ageing and preventing falls in the elderly population.

Keywords: Postural Stability, Yoga, Older Adults, Balance, Fall Prevention

1. Introduction

Postural stability is the ability to maintain the body's centre of mass within its base of support during static and dynamic activities. It is an essential component of functional independence and enables individuals to perform activities of daily living safely and efficiently. Maintenance of postural stability depends on the coordinated interaction of the musculoskeletal, visual, vestibular, and somatosensory systems. These systems continuously provide sensory information to the central nervous system, which processes the information and generates appropriate motor responses to maintain balance and prevent falls [1].

Ageing is accompanied by several physiological changes that adversely affect postural control. Older adults commonly experience reductions in muscle strength, joint flexibility, proprioception, reaction time, and neuromuscular coordination. In addition, age-related deterioration of the visual and vestibular systems further compromises balance control. These changes collectively increase postural sway, impair functional mobility, and substantially elevate the risk of falls. Falls are one of the leading causes of injury, hospitalization, disability, and loss of independence among older adults, making fall prevention a major public health priority [2].

Regular physical activity is widely recommended to maintain balance, mobility, and functional independence in the ageing population. Among various exercise interventions, yoga has gained increasing attention because of its holistic approach to physical and mental well-being. Yoga integrates physical postures (asanas), breathing exercises (pranayama), and relaxation or meditation techniques, promoting improvements in strength, flexibility, coordination, body awareness, and mental concentration. Unlike conventional exercise programs that primarily target physical fitness, yoga simultaneously enhances psychological well-being, making it particularly suitable for older adults [3].

Several mechanisms may explain the beneficial effects of yoga on postural stability. Many yoga postures require controlled weight shifting, activation of core and lower-limb muscles, and maintenance of body alignment, thereby improving neuromuscular coordination and muscular endurance. Regular yoga practice also enhances flexibility and joint mobility, enabling individuals to respond more effectively to postural perturbations. Furthermore, yoga improves proprioception and body awareness by encouraging conscious control of movement and posture. Breathing exercises and meditation reduce stress and improve concentration, which may further contribute to better balance performance and movement control [4].

Previous studies have consistently demonstrated the positive effects of yoga on balance and functional mobility among older adults. Youkhana et al. reported that yoga-based exercise significantly improves balance, mobility, muscle endurance, and flexibility while reducing fall risk in elderly individuals. Similarly, Gaur et al., Patil et al., Tiedemann et al., Schmid et al., and Eyigor et al. observed significant improvements in balance, functional mobility, and postural control following yoga interventions. These findings suggest that yoga may be an effective non-pharmacological strategy for maintaining functional independence and promoting healthy ageing [5].

Despite the growing evidence supporting yoga, relatively few comparative studies have directly evaluated postural stability between long-term yoga practitioners and non-yoga practitioners among community-dwelling older adults in the Indian population. Most previous studies have focused on intervention programs rather than comparing individuals with established yoga practice to those who do not practice yoga. Further research is therefore required to strengthen the available evidence and determine whether regular yoga practice is associated with superior balance performance in older adults [6].

The present study was conducted to compare postural stability among adults aged above 55 years practicing yoga and those who do not practice yoga. Balance performance was evaluated using

standardized outcome measures, including the Berg Balance Scale (BBS), Functional Reach Test (FRT), Timed Up and Go Test (TUG), and Single Leg Stance Test (SLS). The findings of this study may provide valuable evidence supporting the incorporation of yoga into physiotherapy practice and community-based fall-prevention programs for older adults [7].

Aim: The aim of this study is to compare the postural stability of individuals above 55 years who practice yoga with those who do not practice yoga and to determine whether yoga can be recommended as a preventive and rehabilitative approach for reducing fall risk.

2. Materials and Methods

2.1 Design and Setting

This study employed a cross-sectional comparative design to compare postural stability between older adults practicing yoga and those who did not practice yoga. The study was conducted in community settings, including yoga centers (Yogshalas), group yoga classes, and residential areas in Kota, Rajasthan, India. All procedures were performed in accordance with ethical guidelines, and written informed consent was obtained from every participant before enrolment.

2.2 Participants

A total of 60 older adults aged 55 years and above participated in the study. Participants were recruited through purposive sampling and were divided into two equal groups:

Group A (Yoga Practitioners): 30 participants who had been practicing yoga regularly.

Group B (Non-Yoga Practitioners): 30 participants who did not practice yoga or participate in any structured balance-training program.

Inclusion Criteria: Participants were included if they were 55 years of age or older, able to walk independently, and willing to provide written informed consent. Participants in the yoga group had been practicing yoga regularly for at least three sessions per week for a minimum of three months, whereas those in the non-yoga group had no regular yoga practice.

Exclusion Criteria: Participants with neurological disorders, severe musculoskeletal or vestibular conditions, recent fractures or surgery, severe visual impairment, cognitive impairment, or any medical condition affecting balance assessment were excluded from the study.

2.3 Sample Size

The study included a total sample of 60 participants, with 30 participants in each group. This sample size was considered adequate for comparing postural stability between yoga practitioners and non-yoga practitioners using standardized clinical outcome measures.

2.4 Outcome Measures Postural stability was assessed using four standardized clinical balance assessment tools:

1. **Berg Balance Scale (BBS):** This scale consists of 14 functional tasks, each scored on a five-point scale ranging from 0 to 4, with a maximum score of 56. Higher scores indicate better balance performance and a lower risk of falls.
2. **Functional Reach Test (FRT):** This test measures the maximum distance an individual can reach forward while standing without losing balance or taking a step. A greater reach distance indicates better dynamic balance.
3. **Timed Up and Go Test (TUG):** Participants were instructed to stand up from a chair, walk 3 meters, turn around, return to the chair, and sit down. The total time required to complete the task was recorded; a lower completion time indicates better functional mobility and balance.

4. **Single Leg Stance Test (SLS):** Participants were asked to stand on one leg while keeping their hands on their hips. The duration for which balance could be maintained was recorded in seconds; a longer standing time reflects better static balance and postural control.

2.5 Procedure

All participants underwent a standardized assessment procedure. Demographic information, including age, gender, height, weight, occupation, medical history, and history of yoga practice, was recorded, and participants were screened according to the predefined inclusion and exclusion criteria. Before testing, all participants received a detailed explanation of the study protocol and performed a brief warm-up consisting of gentle joint-mobility exercises and marching activities to minimize stiffness.

A baseline assessment of postural stability was carried out using the Berg Balance Scale, Functional Reach Test, Timed Up and Go Test, and Single Leg Stance Test under standardized testing conditions. Following assessment, participants were categorized into the yoga or non-yoga group according to their yoga practice history.

Participants in the yoga group continued their regular yoga program, which included balance-oriented postures such as Tadasana (Mountain Pose), Vrikshasana (Tree Pose), Ardha Utkatasana (Half Chair Pose), and Sukhasana/chair sitting with single-leg lift, along with balance training on a folded mat. Emphasis was placed on proper posture, controlled breathing, body awareness, and safe execution of movements. Participants in the non-yoga group continued their routine daily activities without participating in any structured yoga program.

After completion of the assessment period, postural stability was reassessed using the same outcome measures, and a follow-up assessment was conducted to evaluate the retention of balance performance using identical testing procedures. All assessments were performed under standardized environmental conditions to ensure participant safety and consistency.

2.6 Statistical Analysis

Collected data were entered into Microsoft Excel and analysed using appropriate statistical methods. Descriptive statistics were expressed as mean ± standard deviation (SD). Between-group comparisons were performed using the independent t-test and Mann–Whitney U test, whereas within-group comparisons were analysed using the paired t-test. The normality of data distribution was assessed using the Shapiro–Wilk test. Effect sizes were calculated using Cohen's d to determine the magnitude of differences between groups. A p-value of less than 0.05 was considered statistically significant.

3. Results

A total of 60 older adults (35 males and 25 females; age range 56–86 years; mean age 63.58 ± 8.21 years) were assessed. Participants were equally allocated to the yoga group (n = 30) and the non-yoga group (n = 30).

3.1 Demographic Characteristics and Baseline Comparison

Variable	Group A (Yoga), n = 30	Group B (Non-Yoga), n = 30	Statistic	p-value	Interpretation
Age – Mean ± SD (years)	62.1 ± 6.7	65.1 ± 9.4	t = -1.440	0.155 (ns)	Age comparable between groups; no

Variable	Group A (Yoga), n = 30	Group B (Non-Yoga), n = 30	Statistic	p-value	Interpretation
					significant difference
Gender (Male / Female)	20 M / 10 F	15 M / 15 F	—	—	Noted; not statistically tested
BBS Pre – Mean ± SD	54.60 ± 2.90	42.77 ± 9.41	t = 6.586	< 0.001***	Yoga group had significantly superior baseline balance
BBS Pre – Median (Min–Max)	56 (46–56)	44 (23–55)	U = 846	< 0.001***	Mann–Whitney confirms highly significant baseline difference
BBS Pre – Fall-Risk Category	100% Low Fall Risk (all ≥ 45)	50% Low, 6.7% Medium, 43.3% High	—	—	Yoga group near ceiling; Non-yoga group highly heterogeneous

Table 1. Demographic Characteristics and Baseline Comparison Between Groups

3.2 Descriptive Statistics: BBS Pre, Post, and Change Scores

Measure	Group A (Yoga)	Group B (Non-Yoga)	Difference (A − B)
BBS Pre – Mean ± SD	54.60 ± 2.90	42.77 ± 9.41	+11.83 (A higher)
BBS Pre – Median (IQR)	56 (55–56)	44 (36–52)	—
BBS Post – Mean ± SD	55.57 ± 1.33	50.73 ± 5.31	+4.83 (A higher)
BBS Post – Median (IQR)	56 (56–56)	52 (46–56)	—
BBS Change – Mean ± SD	0.97 ± 1.83	7.97 ± 4.74	-7.00 (B improved more)
BBS Change – 95% CI	[0.28, 1.65]	[6.20, 9.74]	—

Measure	Group A (Yoga)	Group B (Non-Yoga)	Difference (A − B)
Percentage Improvement	1.77%	18.63%	B showed greater % gain

Table 2. Descriptive Statistics for BBS Pre, Post, and Change Scores (N = 60)

3.3 Normality Testing

Variable	Group	W Statistic	p-value	Distribution	Note
BBS Pre	Group A (Yoga)	0.543	< 0.001	Non-normal	Strong ceiling effect at score = 56
BBS Post	Group A (Yoga)	0.380	< 0.001	Non-normal	Extreme ceiling; most scores = 56
BBS Change	Group A (Yoga)	0.601	< 0.001	Non-normal	Most participants changed 0 points
BBS Pre	Group B (Non-Yoga)	0.919	0.025	Non-normal	Moderate ceiling/floor effects
BBS Post	Group B (Non-Yoga)	0.880	0.003	Non-normal	Post-treatment ceiling effect
BBS Change	Group B (Non-Yoga)	0.923	0.032	Non-normal	Borderline; t-test still valid, n = 30

Table 3. Shapiro–Wilk Normality Test

A p-value below 0.05 indicated a non-normal distribution; non-parametric tests were therefore used alongside parametric tests as the primary statistical analyses.

3.4 Within-Group Analysis: Paired t-Test (Pre vs. Post BBS)

Group	Mean Pre ± SD	Mean Post ± SD	Mean Change	t-value	p-value	Cohen's d	95% CI	% Change
Group A – Yoga	54.60 ± 2.90	55.57 ± 1.33	+0.97	-2.896	0.007**	0.529 (Medium)	[0.28, 1.65]	1.77%
Group B – Non-Yoga	42.77 ± 9.41	50.73 ± 5.31	+7.97	-9.210	< 0.001***	1.681 (Large)	[6.20, 9.74]	18.63%

Table 4. Within-Group Comparison of Pre- and Post-Assessment BBS Scores

Both groups improved significantly. Group A's modest gain reflects a ceiling effect, as most participants were already near the maximum score of 56. Group B's change (+7.97 points) exceeds the clinically meaningful difference of 2.5–4 points reported for the BBS.

3.5 Between-Group Analysis: Independent t-Test and Mann–Whitney U Test

Comparison	Mean/Median A	Mean/Median B	Difference (A − B)	t-value	p (t-test)	U	p (Mann-Whitney)	Cohen's d
BBS Pre-Score	54.60 / 56	42.77 / 44	+11.83	6.586	< 0.001***	846	< 0.001	1.701 (Very Large)
BBS Post-Score	55.57 / 56	50.73 / 52	+4.83	4.835	< 0.001***	728	< 0.001	1.249 (Very Large)
BBS Change Score	0.97 / 0	7.97 / 7	-7.00	-7.550	< 0.001***	44	< 0.001	1.949 (Very Large)

Table 5. Between-Group Comparison of BBS Pre-, Post-, and Change Scores

All between-group comparisons were highly significant ($p < 0.001$) by both parametric and non-parametric tests. The 95% confidence interval for the change-score difference was [-8.86, -5.14].

3.6 BBS Fall-Risk Category Distribution: Pre vs. Post

Fall-Risk Category	BBS Range	Group A Pre	Group A Post	Shift A	Group B Pre	Group B Post	Shift B
Low Fall Risk (≥ 45)	45–56	30 (100%)	30 (100%)	No change	15 (50.0%)	27 (90.0%)	+12 improved
Medium Fall Risk	41–44	0 (0%)	0 (0%)	—	2 (6.7%)	1 (3.3%)	-1
High Fall Risk (≤ 40)	0–40	0 (0%)	0 (0%)	—	13 (43.3%)	2 (6.7%)	-11 improved

Table 6. Fall-Risk Category Distribution Before and After Assessment

Ninety percent of non-yoga participants reached the 'Low Fall Risk' category at post-assessment, compared with 50% at baseline. All yoga participants maintained 'Low Fall Risk' status throughout the study.

3.7 Effect Size Summary (Cohen's d): All Comparisons

Comparison	Cohen's d	Magnitude	Clinical Significance
Within Group A (Yoga) – BBS Change	0.529	Medium	Moderate; ceiling effect limits measurable improvement

Comparison	Cohen's d	Magnitude	Clinical Significance
Within Group B (Non-Yoga) – BBS Change	1.681	Large	Substantial, clinically meaningful improvement
Between Groups – BBS Pre-Score	1.701	Large	Very large; long-term yoga benefit reflected at baseline
Between Groups – BBS Post-Score	1.249	Large	Very large; yoga group maintains superior balance post-assessment
Between Groups – BBS Change Score	1.949	Large	Very large; non-yoga group improved significantly more in absolute points

Table 7. Summary of Effect Sizes (Cohen's d) for All Comparisons

Cohen's d benchmarks: < 0.2 = Negligible, 0.2–0.49 = Small, 0.5–0.79 = Medium, 0.8–1.99 = Large, ≥ 2.0 = Very Large (Sawilowsky, 2009).

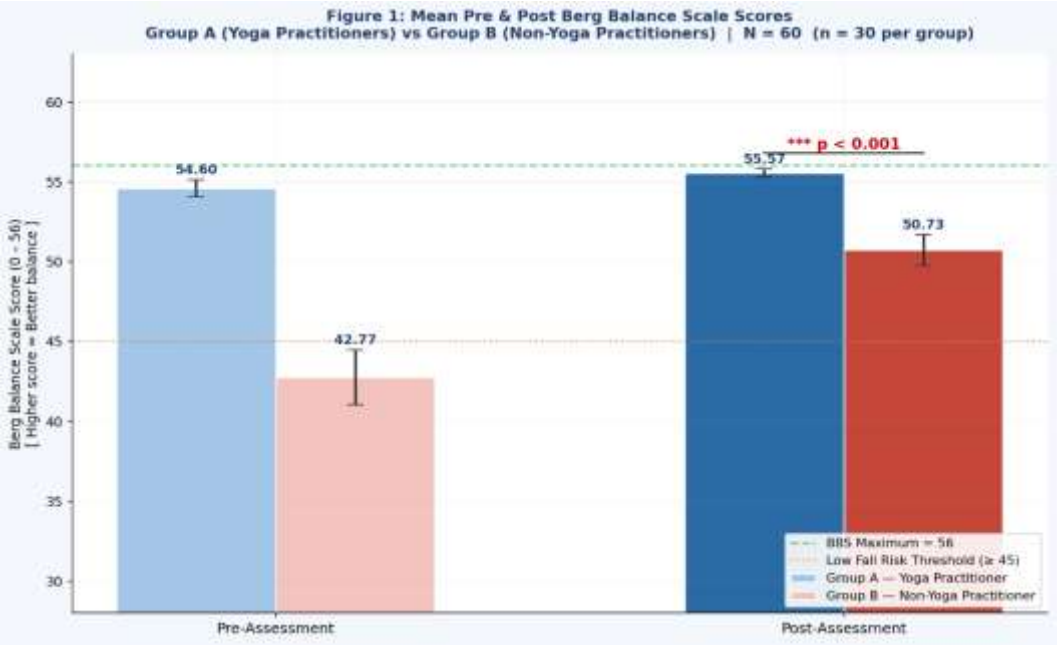

Figure 1. Mean Pre- and Post-Assessment Berg Balance Scale Scores (Group A vs. Group B)

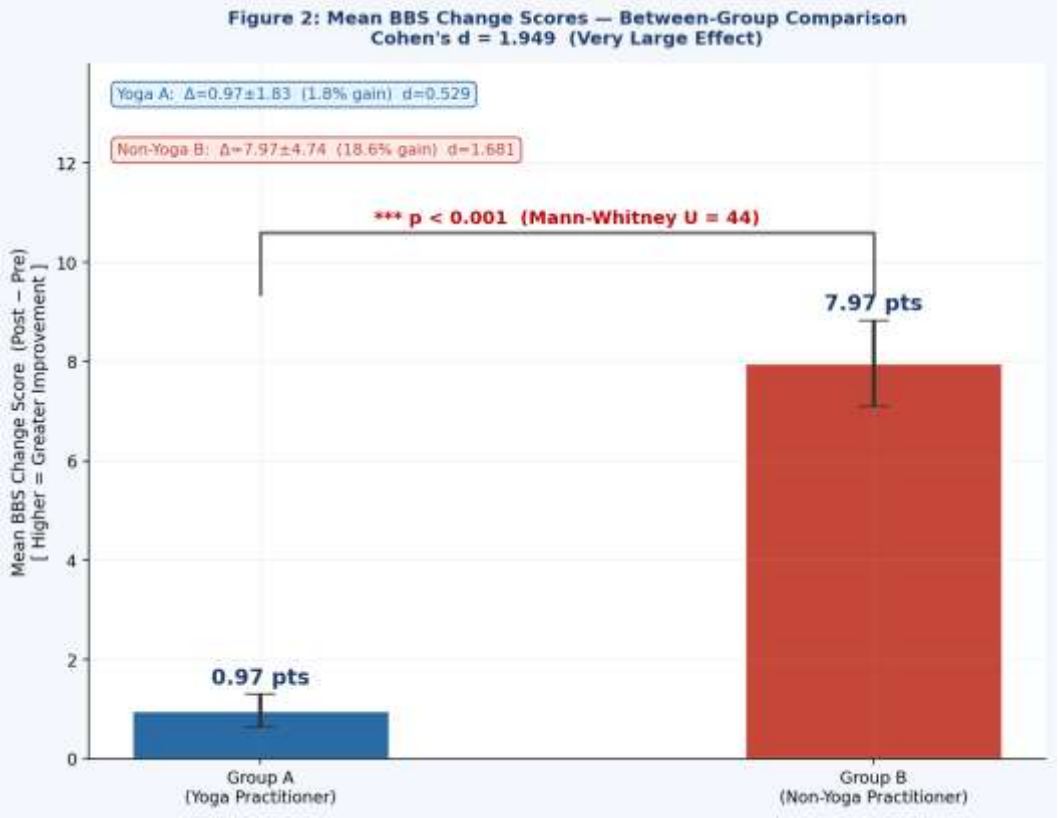

Figure 2. Mean BBS Change Scores: Between-Group Comparison

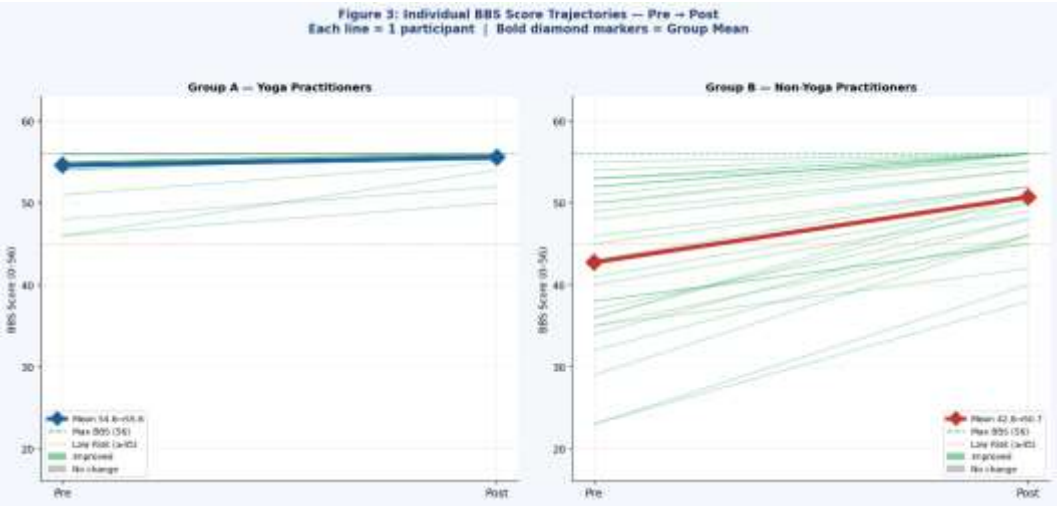

Figure 3. Individual BBS Score Trajectories from Pre- to Post-Assessment

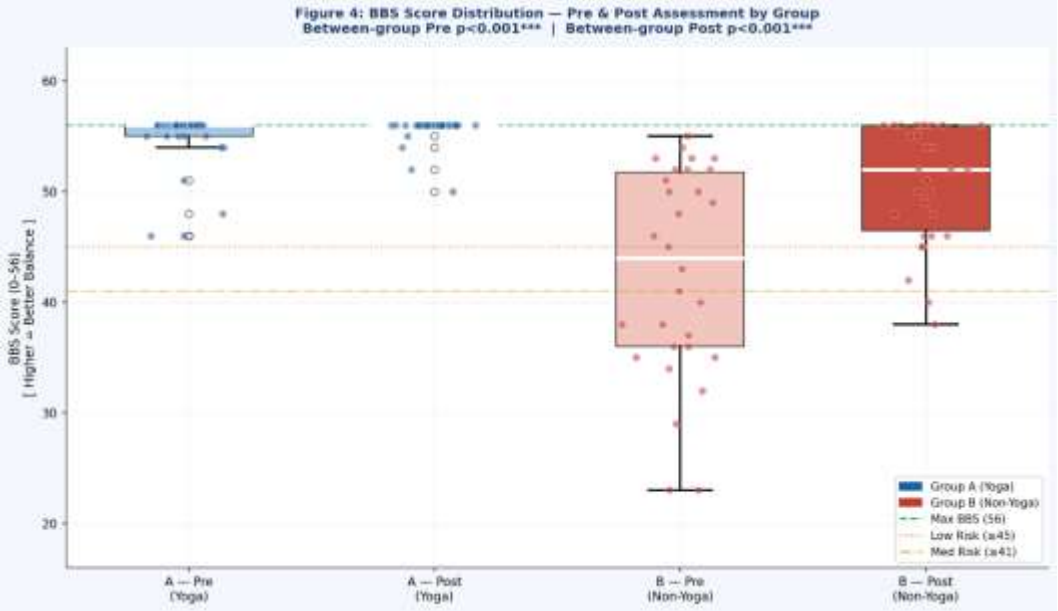

Figure 4. BBS Score Distribution at Pre- and Post-Assessment by Group

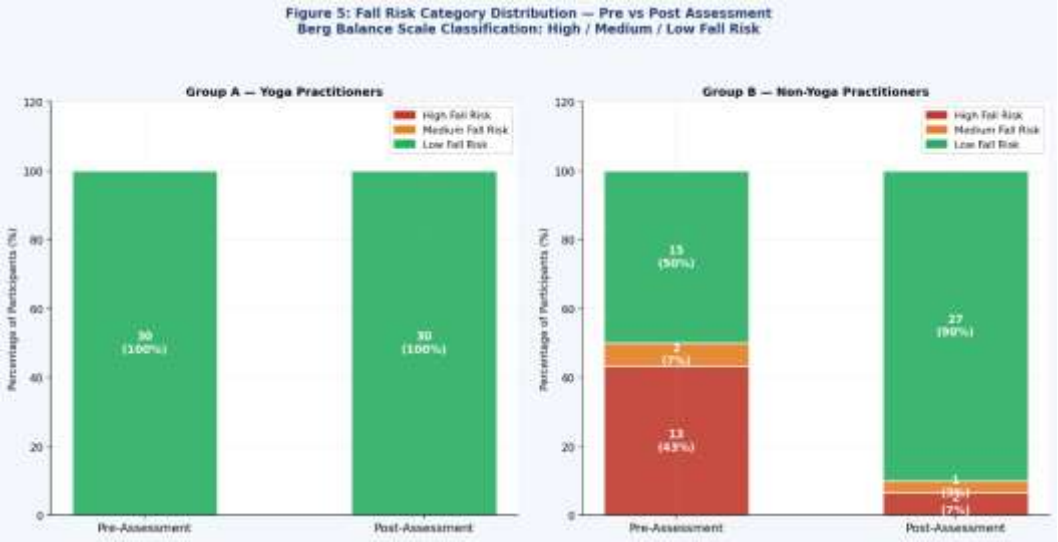

Figure 5. Fall-Risk Category Distribution: Pre- vs. Post-Assessment

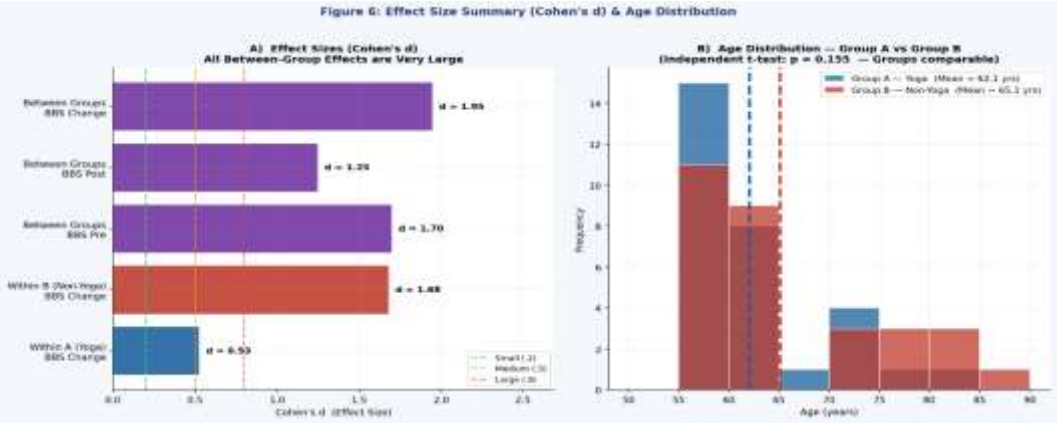

Figure 6. Effect-Size Summary (Cohen's d) and Age Distribution Between Yoga and Non-Yoga Groups

4. Discussion

The present study compared postural stability between older adults practicing yoga and those who did not practice yoga. The findings demonstrated that yoga practitioners had significantly better balance and lower fall risk than non-yoga practitioners. Higher baseline and post-assessment Berg Balance Scale (BBS) scores in the yoga group indicate that regular yoga practice is associated with superior postural stability [1].

Although both groups showed significant improvement, the yoga group demonstrated only a small increase in BBS scores because most participants had near-maximum baseline scores, indicating a ceiling effect. In contrast, the non-yoga group showed greater improvement owing to lower baseline balance levels.

These findings are consistent with previous studies by Youkhana et al., Gaur et al., Patil et al., and Tiedemann et al., which reported that regular yoga practice improves balance, mobility, and flexibility and reduces fall risk in older adults. The improvements may be attributed to enhanced muscle strength, proprioception, flexibility, and neuromuscular coordination achieved through yoga practice.

The results suggest that yoga is an effective, safe, and low-cost intervention for improving postural stability in older adults. Incorporating yoga into physiotherapy and community-based fall-prevention programs may help enhance functional independence and quality of life.

Limitations and Future Directions

The study was limited by a relatively small sample size and recruitment from a single geographical area. Variations in the duration and type of yoga practice among participants may also have influenced the results. Future studies with larger samples, standardized yoga protocols, and longer follow-up periods are recommended.

5. Conclusion

Regular yoga practice was associated with significantly better postural stability and balance among older adults aged above 55 years compared with non-yoga practitioners. Although both groups showed improvement, yoga practitioners maintained superior balance performance and a lower risk of falls. These findings suggest that yoga is a safe, cost-effective, and beneficial intervention for improving balance and promoting healthy ageing in older adults.

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