

# Examining the Effects of Senior Yoga on Balance and Fear of Falling in a Female Elderly Population

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## Abstract

**Purpose:** The fear of falling (FoF) has been identified as one of the greatest fears in elderly populations. It is a disabling feeling often linked to depression, isolation, and activity avoidance. Thus, exercise intervention programs can and should be used to prevent falls, which will then decrease FoF. Yoga has been established as a discipline which reduces the risk factors for falling by increasing muscle strength, flexibility, and proprioception. The aim of this study was to analyze the effect of a 5 week yoga program on balance and how physical improvements may translate to a reduced FoF.

**Methods:** Eleven functionally capable senior women (mean age  $87.6 \pm 4.4$  SD, age range 78-95; mean HT  $156.1 \text{ cm} \pm 6.2$  SD; mean WT  $145.5 \text{ lbs} \pm 25.1$  SD) were recruited as participants from an independent living community in Roseville, MN. Subjects attended 10 Ageless Yoga sessions, designed for seniors by the Harvard University Center for Wellness and Health Communication. These 10 yoga sessions were 45 minutes long, performed 2 days a week, for 5 weeks. Balance was measured with a BioDex three-condition Clinical Test for Sensory Integration of Balance (CTSIB) system assessment. FoF data was collected via the Illinois Fear of Falling Measure Questionnaire. Assessments were completed pre and post intervention with identical protocols.

**Results:** Paired sample t-tests using SPSS software showed significance in only one CTSIB condition, the unstable foam surface with eyes open (pre-test sway index mean  $1.1 \pm 0.2$  SD, post-test sway index mean  $0.9 \pm 0.2$  SD;  $p=0.027$ ). There was no significance between the pre and post intervention results for stable surface conditions (eyes open  $p=0.959$ ; eyes closed  $p=0.784$ ) and FoF questionnaire scores ( $p=0.808$ ).

**Conclusion:** The data indicated that the subjects' balance was significantly improved on an unstable foam surface with eyes open following the yoga intervention. This surface was specifically challenging to the musculoskeletal system and required input from both the visual and vestibular systems. Therefore, the observed improvements may be attributed to a positive increase in lower extremity strength and heightened proprioception resulting from the yoga intervention. Further research on balance and measurement of leg strength is necessary to determine changes in FoF in relation to a yoga program.

## Methods

Eleven functionally capable senior women (mean age  $87.6 \pm 4.4$  SD, age range 78-95, able to stand unassisted, no lower extremity injuries in the past 6 months) were recruited as participants from an independent living community in Roseville, MN. Prior to the intervention, height, weight, balance and FoF were measured. Balance was measured with a BioDex three-condition Clinical Test for Sensory Integration of Balance (CTSIB) system assessment. This specific test analyzed the individual's ability to maintain a steady vertical posture while situated on the Biosway platform under three conditions; eyes open on a firm surface, eyes closed on a firm surface, and eyes open on a dynamic foam surface. Test instructions were administered by the researchers and shown on the device's attached screen. FoF data was collected via the Illinois Fear of Falling Measure Questionnaire. This was a 16-question survey which quantitatively evaluated participants' FoF during specific occurrences of daily life. Assessments were completed pre and post intervention with identical protocols. Subjects attended 10 Ageless Yoga sessions, designed for seniors by the Harvard University Center for Wellness and Health Communication. Yoga instruction was delivered via video and simultaneously demonstrated by researchers to promote uniformity amongst sessions. The 10 yoga sessions were 45 minutes long, performed 2 days a week, for 5 weeks. A combination of seated and standing yoga poses were used, designed to increase strength, balance, and joint range of motion. Stress reduction and mental clarity were promoted through restorative breathing exercises and a final relaxation piece.

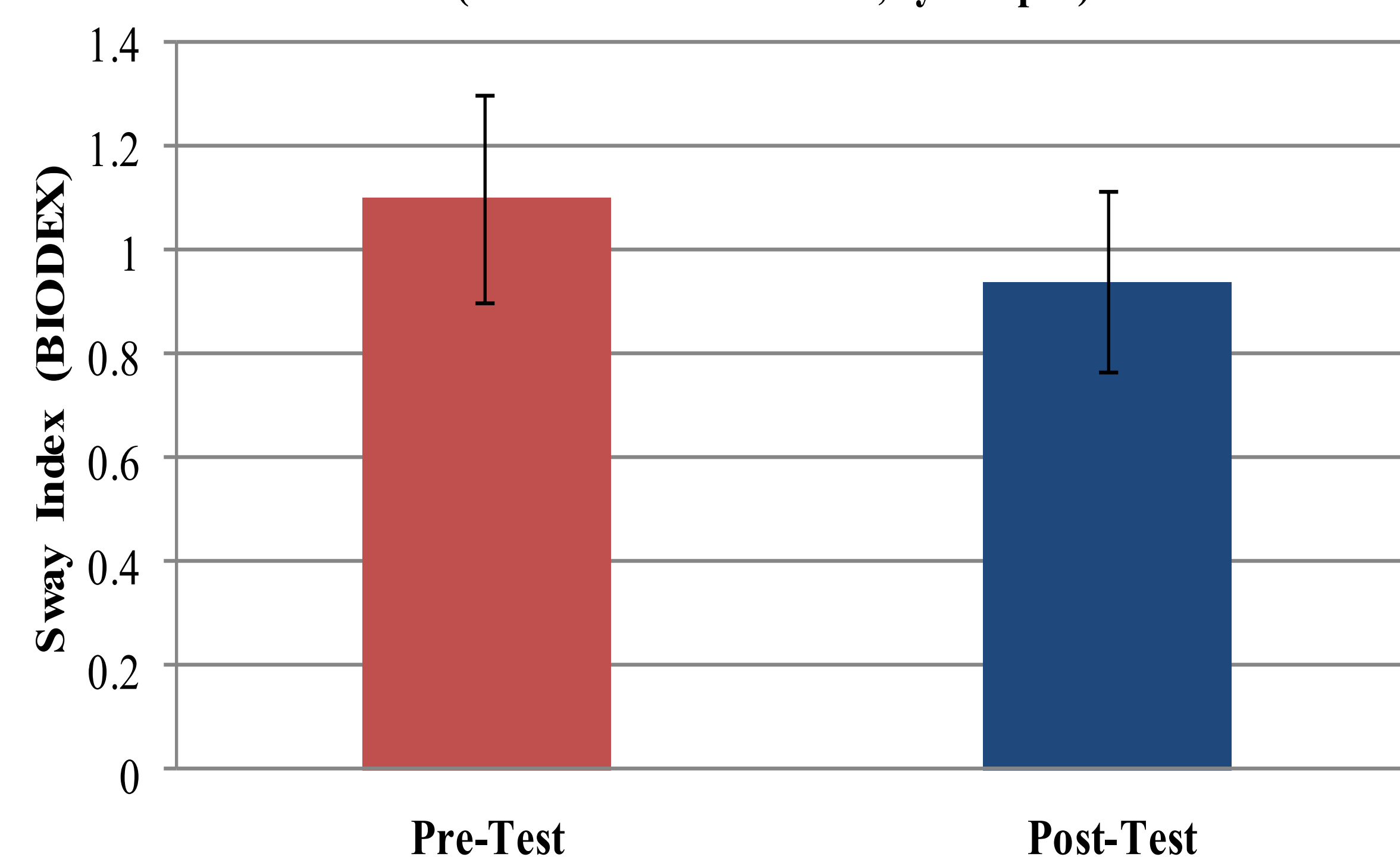
## Introduction

Each year, one in three adults over the age of 65 experiences a fall.<sup>1</sup> In these populations, falls have been identified as the leading cause of both fatal and nonfatal injuries.<sup>2</sup> It is justifiable that the fear of falling (FoF) is greatly prevalent among elderly individuals. FoF is a disabling feeling, often associated with depression, isolation, activity avoidance, and an overall decrease in one's quality of life.<sup>3,4</sup> The physical and emotional implications of FoF can become a risk factor for sustaining a fall. This phenomenon is often understood as the "vicious cycle" of FoF; individuals with FoF often employ inactive lifestyles, causing decreases in strength and balance, which may predispose them towards future falls.<sup>5</sup>

Therefore, exercise intervention programs can and should be utilized to reduce falls and counteract inactivity, which will in turn decrease FoF. Yoga has been established as a discipline which reduces the risk factors for falling by increasing muscle strength, flexibility, and proprioception.<sup>3</sup> Balance can specifically be impacted by improving lower extremity muscle strength and heightening one's proprioception, making yoga ideal for combatting FoF in senior populations.<sup>3,6</sup> In order to meet the needs of an elderly population, a modified version of yoga called "senior yoga" is utilized. This includes movements with lower impact and intensity levels when compared to regular yoga sessions.

Previous studies have been limited by subjective balance measures.<sup>3,6,7</sup> Specifically, the objectivity of the scoring within the Berg Balance Scale, in combination with the limited transferability between true balance and measured balance, has severely limited the validity of certain studies.<sup>3,7</sup> The aim of this study is to correct these limitations by using more advanced assessment techniques. The use of the Biosway provided a non-objective, qualitative balance measure.<sup>8</sup>

Comparison of Pre and Post Intervention Sway Index Scores (Unstable Foam Surface, Eyes Open)



## Results

Paired sample t-tests were performed using SPSS statistical analysis software in order to determine statistical significance between the pre and post-intervention data in regards to each variable tested.

### CTSIB Conditions:

**Eyes open, firm surface:** showed no statistical significance ( $p=0.959$ ). 4 of 11 participants had decreased sway indexes; 2 of 11 participants had scores that were unchanged. (Pre-test sway index mean  $0.52 \pm 0.12$  SD, post-test sway index mean  $0.52 \pm 0.16$  SD).

**Eyes closed, firm surface:** showed no statistical significance ( $p=0.784$ ). 4 of 11 participants had decreased sway indexes. (Pre-test sway index mean  $0.97 \pm 0.35$  SD, post-test sway index mean  $0.95 \pm 0.27$  SD).

**Eyes open, dynamic foam surface:** showed statistical significance ( $p=0.027$ ). 9 of 11 participants had decreased sway indexes. (Pre-test sway index mean  $1.10 \pm 0.20$  SD, post-test sway index mean  $0.94 \pm 0.17$  SD).

### Illinois Fear of Falling Measure Questionnaire:

**Fear of Falling:** showed no statistical significance ( $p=0.808$ ). 4 of 11 participants had decreased Fear of Falling; 1 participant had scores that were unchanged. (Pre-test FoF mean  $23.82 \pm 8.61$  SD, post-test FoF mean  $23.45 \pm 5.35$  SD).



## Conclusion

The data indicated that FoF was prevalent amongst female seniors in an independent living community. While FoF was not significantly reduced following the five week yoga intervention, unforeseen winter weather during post-intervention testing may have directly attributed to the recorded increase in fear related to balance. Weather conditions during pre-testing and the five week intervention were mild and stable but drastically changed prior to the post-testing. Further research should be completed in more stable weather conditions to remove this limiting factor.

However, the subjects' balance was significantly improved on an unstable foam surface with eyes open, following the yoga intervention. This surface was specifically challenging to the musculoskeletal system and required input from both the visual and vestibular systems.<sup>8</sup> Therefore, the observed improvements may be attributed to a positive increase in lower extremity strength and heightened proprioception resulting from the yoga intervention. Further research on balance and measurement of leg strength is necessary to determine changes in FoF in relation to a yoga program.

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