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Exergaming Versus Conventional Balance Exercises on Balance Compromised Geriatric Population - A Single Blinded Randomized Clinical Trial

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ABSTRACT

Background: Balance impairment and fear of falling are common concerns in older adults. Exercise-based interventions can improve balance, while exergaming provides interactive visual feedback that may support participation.
Objective: To compare the effects of Nintendo Wii Fit exergaming and conventional balance exercises on balance and fear of falling in older adults with moderate balance impairment.
Methods: This single-blinded randomized clinical trial included 46 participants aged 60–80 years. Participants were allocated to an exergaming group (Group A, n=23) or a conventional balance exercise group (Group B, n=23). Both groups received supervised 45-minute sessions three times per week for 6 weeks. Balance and fear of falling were assessed before and after the intervention using the Berg Balance Scale (BBS) and Falls Efficacy Scale–International (FES-I).
Results: Within-group paired comparisons showed significant pre- to post-intervention improvement in BBS and FES-I in both groups ($p \leq 0.001$). At post-test, BBS scores were higher in Group A than Group B (28.91±2.70 vs 26.17±1.67; $t=4.14$, $p<0.001$; Cohen's $d=1.22$). Post-test FES-I scores were 28.61±4.80 and 30.04±5.11, respectively, with no statistically significant between-group difference ($t=-0.98$, $p=0.333$; Cohen's $d=-0.29$).
Conclusion: Both interventions improved balance and reduced fear of falling over 6 weeks. The between-group analysis demonstrated a statistically significant difference in post-intervention BBS scores, whereas no statistically significant between-group difference was observed in FES-I scores.
Keywords: Exergaming; Nintendo Wii Fit; conventional balance exercise; older adults; Berg Balance Scale; Falls Efficacy Scale–International.

INTRODUCTION

In India, older adults are generally defined as people aged 60 years and above. Older adults represented about 8.6% of the Indian population in 2011, with projections of approximately 11% by 2025 and 19% by 2050. Reduced balance and fear of falling are important functional concerns in this

population. [1] Exercise programmes that challenge balance can reduce fall risk and support functional independence. [2]

The World Health Organization recommends regular physical activity for older adults, including aerobic activity, muscle-strengthening activity and multicomponent activity emphasizing functional balance and strength on at least 3 days per week. [3] Despite these recommendations, adherence to conventional exercise programmes may be affected by motivation and the repetitive nature of unsupervised exercise. [4]

Exergaming combines physical exercise with interactive video-game tasks. Wii Fit-based training uses a balance board and visual feedback and has been studied as an accessible approach to balance training in older adults. [5-7] The Nintendo Wii Balance Board has also been evaluated as a tool for postural balance assessment, demonstrating its potential utility for measuring balance-related performance. [8] Previous randomized and feasibility studies have reported improvements in postural control, gait or functional outcomes after Wii-based training, although results have varied across populations and protocols. [6,7]

Systematic reviews and meta-analyses have reported beneficial effects of exergames on balance and mobility in older adults. [9,10] Comparisons between technology-assisted balance training and conventional training have also produced mixed findings; some studies reported improvements in both groups without a clear between-group difference. [11,12] Adherence is another potential advantage of interactive exercise, although it depends on the intervention and setting. [13] A controlled trial of Wii-based balance training in community-dwelling older adults did not demonstrate an effect on the primary balance outcome at long-term follow-up, highlighting the need for direct trials with clearly defined populations and protocols. [14]

Therefore, the present study was conducted to compare Nintendo Wii Fit exergaming with conventional balance exercises in older adults with moderate balance impairment. The primary outcomes were balance measured by the BBS and fear of falling measured by the FES-I. The null hypothesis was that there would be no significant difference between the two interventions.

MATERIALS & METHODS

Study design and ethics

A single-blinded, parallel-group randomized clinical trial was conducted. The study was approved by the Institutional Ethics Committee of Cauvery College of Physiotherapy, Mysuru (Approval No. CHMH/IEC/01/19/CY/2024-25, dated 25 May 2024) and was prospectively registered with the Clinical Trials Registry of India (CTRI/2025/08/092900). Written informed consent was obtained from all participants before participation.

Participants and sampling

Participants were recruited from the outpatient department of the Cauvery Group of Institutions and nearby old age homes in Mysuru. Purposive sampling was used for recruitment, followed by simple random allocation to Group A or Group B using the chit method. The study population comprised older adults with balance impairment. The planned sample size was 23 participants per group, giving a total sample of 46.

Sample size calculation

The minimum sample size was calculated a priori using G*Power version 3.1.9.7 for a two-group comparison of independent means, with a two-tailed significance level of 0.05 and statistical power of 0.85. [15] The calculated sample size was 23 participants per group.

Inclusion criteria

- Age 60–80 years.
- Moderate balance impairment, defined as a BBS score of 21–40.
- Ability to walk independently or with minimal assistance.

- Male or female participants.
- FES-I score >23.

Exclusion criteria

- Musculoskeletal impairments.
- Vestibular or visual deficits.
- Inability to walk.
- Postural hypotension.
- Presence of a pacemaker or history of seizures.

Randomization and blinding

Eligible participants were randomly allocated to Group A or Group B using the chit method. The outcome assessor was independent and blinded to group allocation. Participants received supervised intervention according to their assigned group.

Intervention: Group A – Exergaming

Participants in Group A received Nintendo Wii Fit-based balance training. The system included the Wii console, Wii Remote, Wii Balance Board and Wii Fit Plus software. A 42-inch television was positioned approximately 152.4 cm from the participant. Participants performed balance-oriented games including Penguin Slide, Ski Jump, Tightrope Walk, Ski Slalom, Balance Bubble/River Bubble, Table Tilt, Soccer Heading and Snowboarding. A trained research assistant supervised the sessions for safety and guidance. Participants completed 18 sessions over 6 weeks, three sessions per week. Each session lasted approximately 45 minutes, with at least 30 minutes of active game time. On the first treatment day, 5 minutes were used for verbal instructions followed by a 5-minute familiarization trial.

Intervention: Group B – Conventional balance exercises

Participants in Group B received conventional balance training for approximately 45 minutes per session, three sessions per week for 6 weeks. The session included a 5-minute warm-up, balance training and a 5-minute cool-down. Balance activities included marching in place, two-leg standing, forward walking with 180° pivoting, alternate single-leg standing, sit-to-stand with arms crossed, heel raises while holding a stable support, back and side leg raises, forward/sideways/backward walking, marching with high leg lifting and tandem walking. Exercises were initially repeated five times and were progressed to 10 repetitions according to participant tolerance.

Outcome measures

The BBS was used to assess functional balance. It consists of 14 balance tasks scored from 0 to 4, giving a maximum score of 56.

The FES-I was used to assess concern about falling. It contains 16 items scored from 1 to 4, with total scores ranging from 16 to 64. Higher FES-I scores indicate greater concern about falling. Both outcomes were assessed at baseline and after the 6-week intervention by the blinded evaluator.

Statistical Analysis

Data were analyzed using IBM SPSS Statistics version 29.0. Continuous variables were summarized using mean and standard deviation, and categorical variables using frequency and percentage. The Shapiro–Wilk test was used to assess normality. Paired-samples t-tests were used to compare pre- and post-intervention BBS and FES-I scores within each group. Independent-samples t-tests were used to compare baseline and post-intervention scores between groups. Cohen's d was calculated for between-group standardized mean differences. Statistical significance was set at $p<0.05$.

RESULT

A total of 60 individuals were assessed for eligibility. Fourteen were excluded before randomization: 10 declined participation and 4 were excluded for other documented reasons. Forty-six participants were randomized, with 23 allocated to each group. No participant was lost to follow-up,

and all 46 participants were included in the analysis. Figure 1 shows the participant flow through enrolment, allocation, follow-up and analysis.

CONSORT flowchart

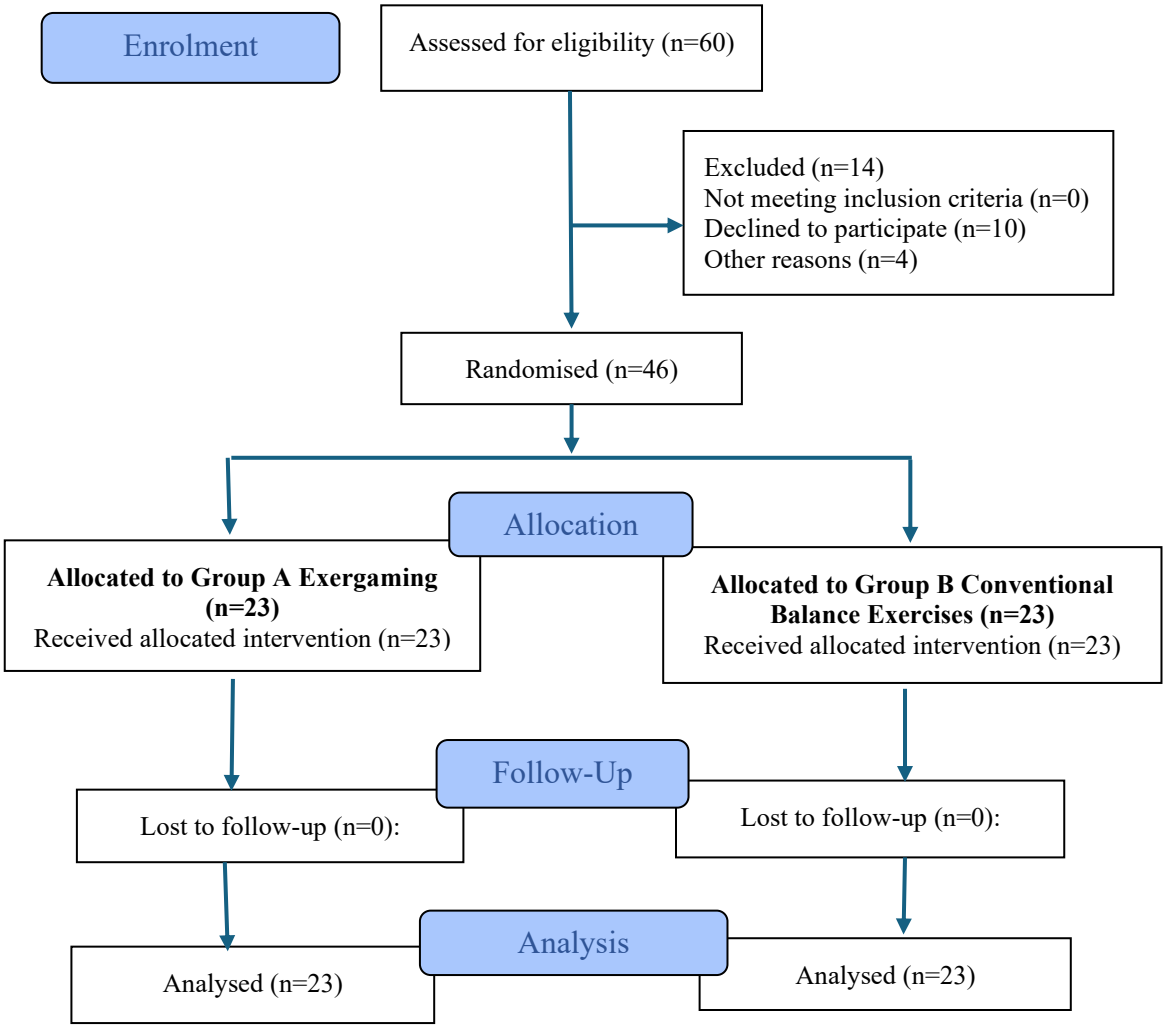

Figure 1. CONSORT flow diagram showing participant enrolment, allocation, follow-up and analysis.

A total of 60 participants were assessed for eligibility. Fourteen participants were excluded, including 10 who declined to participate and 4 excluded for other reasons. Forty-six participants were randomized equally into the exergaming group (n=23) and conventional balance exercise group (n=23). All randomized participants received their allocated intervention, completed the study, and were included in the final analysis.

Table 1. Test of normality

Outcome	Time	Group A: Shapiro-Wilk	p	Group B: Shapiro-Wilk	p
BBS	Pre	0.920	0.066	0.940	0.182
BBS	Post	0.938	0.159	0.942	0.199
FES-I	Pre	0.938	0.160	0.963	0.528
FES-I	Post	0.940	0.183	0.962	0.497

The Shapiro–Wilk test showed p-values >0.05 for all BBS and FES-I pre- and post-intervention scores in both groups, indicating that the data were approximately

normally distributed and supporting the use of parametric tests.

Table 2. Participant characteristics

Variable	Range	Mean	SD
Age (years)	62–79	70.30	5.01
Height (cm)	149–176	162.02	7.60
Weight (kg)	50–80	65.09	8.60
BMI (kg/m²)	19.0–34.7	24.85	3.35
Sex	Male 23 (50%); Female 23 (50%)	—	—
Allocation	Group A 23 (50%); Group B 23 (50%)	—	—

Table 2 presents the demographic characteristics of the participants. A total of 46 participants were included in the study, with 23 participants allocated to each group. The participants had a mean age of 70.30 ± 5.01 years, mean height of 162.02 ± 7.60 cm, mean weight of 65.09 ± 8.60 kg, and mean BMI of 24.85 ± 3.35 kg/m². The sample consisted of 23 male and 23 female participants.

Table 3. Baseline comparison between groups

Variable	Group A Mean±SD	Group B Mean±SD	t	p
Age (years)	70.30±5.07	70.30±5.07	0.00	1.000
Height (cm)	162.17±6.79	161.87±8.49	0.13	0.894
Weight (kg)	65.17±8.18	65.00±9.19	0.07	0.946
BMI (kg/m²)	24.79±2.81	24.91±3.88	-0.12	0.904
BBS (pre)	24.09±2.59	23.43±1.44	1.06	0.297
FES-I (pre)	31.87±4.49	33.13±3.95	-1.01	0.317

Table 3 presents the baseline comparison between the exergaming group and conventional balance exercise group. There were no statistically significant differences between the groups in age, height, weight, BMI, BBS, or FES-I scores at baseline, as all p-values were greater than 0.05. This indicates that the two groups were comparable before the intervention.

Table 4. Within-group pre- to post-intervention comparison

Outcome	Group	Pre Mean±SD	Post Mean±SD	Mean difference (Pre–Post)	t (df)	p	Partial η²
BBS	A	24.09±2.59	28.91±2.70	-4.83	-16.89 (22)	<0.001	0.928
FES-I	A	31.87±4.49	28.61±4.80	3.26	11.83 (22)	<0.001	0.864
BBS	B	23.43±1.44	26.17±1.67	-2.74	-15.20 (22)	<0.001	0.913
FES-I	B	33.13±3.95	30.04±5.11	3.09	4.01 (22)	0.001	0.422

Table 4: Within-group analysis showed statistically significant improvements in BBS and FES-I scores in both groups. In Group A, BBS scores increased significantly from pre-test to post-test (24.09 ± 2.59 to 28.91 ± 2.70; $t = -16.89$, $p < 0.001$), while FES-I scores decreased significantly (31.87 ± 4.49 to 28.61 ± 4.80; $t = 11.83$, $p < 0.001$). Similarly, in Group B, BBS scores increased significantly from pre-test to post-test (23.43 ± 1.44 to 26.17 ± 1.67; $t = -15.20$, $p < 0.001$), while FES-I scores decreased significantly (33.13 ± 3.95 to 30.04 ± 5.11; $t = 4.01$, $p = 0.001$). These findings indicate significant improvements in balance and reduction in fear of falling within both groups.

Table 5. Between-group comparison of baseline and post-intervention outcomes

Outcome	Time	Group A Mean±SD	Group B Mean±SD	t (df)	p	Cohen's d
BBS	Pre	24.09±2.59	23.43±1.44	1.06 (44)	0.297	0.31
BBS	Post	28.91±2.70	26.17±1.67	4.14 (44)	<0.001	1.22
FES-I	Pre	31.87±4.49	33.13±3.95	-1.01 (44)	0.317	-0.30
FES-I	Post	28.61±4.80	30.04±5.11	-0.98 (44)	0.333	-0.29

Table 5 presents the between-group comparison of BBS and FES-I scores. There was no statistically significant difference between the groups in pre-intervention BBS or FES-I scores ($p>0.05$). At post-intervention, the BBS score was significantly higher in the exergaming group compared with the conventional balance exercise group ($p<0.001$), with a large between-group effect size (Cohen's $d=1.22$). In contrast, the post-intervention FES-I scores did not differ significantly between the groups ($p=0.333$).

DISCUSSION

This randomized clinical trial evaluated 6 weeks of Nintendo Wii Fit exergaming and conventional balance exercises in older adults with moderate balance impairment. Both groups demonstrated statistically significant pre- to post-intervention improvement in BBS and FES-I scores. The between-group analysis based on the reported summary statistics showed a statistically significant difference in post-test BBS, whereas the post-test FES-I difference was not statistically significant.

The improvement in balance observed in both groups is consistent with evidence that exercise programmes incorporating balance challenges can improve functional balance and reduce fall risk in older adults. **[2]** Previous studies of Wii-based training have also reported improvements in postural control and functional outcomes, supporting the use of interactive balance tasks as a rehabilitation approach. **[5–7]** Meta-analytic evidence has reported beneficial effects of exergaming on balance and mobility in older adults, although the size and consistency of effects vary according to intervention and outcome. **[9,10]**

The larger post-test BBS difference observed in the present study is compatible with previous work comparing exergaming with conventional training, but the evidence is not uniform. Studies comparing virtual reality or video-game-based balance training with conventional exercises have reported improvement in both intervention groups without necessarily demonstrating a between-group difference. **[11,12]** A community-based controlled trial of Wii balance training also reported no significant effect on its primary balance outcome at long-term follow-up. **[14]** These findings indicate that outcomes may depend on participant characteristics, intervention dose, technology, supervision and the specific balance measure used.

The FES-I findings showed a significant reduction in fear of falling within both groups after the 6-week intervention. However, the between-group comparison at post-test did not demonstrate a statistically significant difference ($p=0.333$; Cohen's $d=-0.29$). This indicates that although both interventions were associated with reduced fear of falling, the present data do not demonstrate a significant difference between exergaming and conventional balance exercises for FES-I. Interactive exercise may support engagement and adherence, and previous research has examined adherence to exergaming during geriatric rehabilitation. **[4,13]** However, improved engagement should not be interpreted as evidence of a superior effect on every clinical outcome.

The study has several limitations. The intervention lasted only 6 weeks, so the durability of the observed changes was not established. The sample size was modest and participants were recruited from selected outpatient and residential settings in Mysuru, which may limit generalizability. The study used a Nintendo Wii Fit system and therefore the findings

may not apply directly to newer immersive virtual-reality systems.

Future studies should use larger samples, longer follow-up periods and standardized exergaming protocols. Outcomes such as gait speed, falls, adherence and quality of life could also be included to provide a broader assessment of clinical effectiveness.

CONCLUSION

The findings of this study indicated that 6 weeks of exergaming exercise improved balance performance and reduced fear of falling in older adults with moderate balance impairment. Conventional balance exercises also demonstrated significant improvement in balance and reduction in fear of falling. The between-group analysis showed a statistically significant difference in post-intervention BBS scores, with greater improvement observed in the exergaming group. However, the post-intervention difference in FES-I scores between the groups was not statistically significant. These findings suggest that exergaming may be a useful approach for improving balance performance in older adults with balance impairment.

Declaration

Ethical Approval: This single-blinded, multi-centre randomized clinical trial was approved by the Institutional Ethics Committee of Cauvery College of Physiotherapy, Mysuru (Approval No: CHMH/IEC/01/19/CY/2024-25, dated 25 May 2024).

Trial Registration: The study was prospectively registered with the Clinical Trials Registry of India (CTRI/2025/08/092900).

Source of Funding: This research received no external funding.

Conflict of Interest: The authors declare no conflict of interest related to this study.

REFERENCES

1. Moiz JA, Bansal V, Noohu MM, Gaur SN, Hussain ME, Anwer S, et al. Activities-specific balance confidence scale for predicting future falls in Indian older adults. Clin Interv Aging. 2017; 12:645-651. doi:10.2147/CIA.S133523.
2. Sherrington C, Tiedemann A, Fairhall N, Close JCT, Lord SR. Exercise to prevent falls in older adults: an updated meta-analysis and best practice recommendations. N S W Public Health Bull. 2011;22(3-4):78-83. doi:10.1071/NB10056.
3. World Health Organization. WHO guidelines on physical activity and sedentary behaviour. Geneva: World Health Organization; 2020. ISBN:978-92-4-001512-8.
4. Hasselmann V, Oesch P, Fernandez-Luque L, Bachmann S. Are exergames promoting mobility an attractive alternative to conventional self-regulated exercises for elderly people in a rehabilitation setting? Study protocol of a randomized controlled trial. BMC Geriatr. 2015; 15:108. doi:10.1186/s12877-015-0106-0.
5. Liu H, Xing Y, Wu Y. Effect of Wii Fit exercise with balance and lower limb muscle strength in older adults: a meta-analysis. Front Med (Lausanne). 2022; 9:812570. doi:10.3389/fmed.2022.812570.
6. Jorgensen MG, Laessoe U, Hendriksen C, Nielsen OBF, Aagaard P. Efficacy of Nintendo Wii training on mechanical leg muscle function and postural balance in community-dwelling older adults: a randomized controlled trial. J Gerontol A Biol Sci Med Sci. 2013;68(7):845-852. doi:10.1093/gerona/gls222.
7. Gomes GCV, Simões MS, Lin SM, Bacha JMR, Viveiro LAP, Varise EM, et al. Feasibility, safety, acceptability, and functional outcomes of playing Nintendo Wii Fit Plus for frail older adults: a randomized feasibility clinical trial. Maturitas. 2018; 118:20-28. doi: 10.1016/j.maturitas.2018.10.002.
8. Park DS, Lee G. Validity and reliability of balance assessment software using the Nintendo Wii balance board: usability and validation. J Neuroeng Rehabil. 2014; 11:99. doi:10.1186/1743-0003-11-99.
9. Pacheco TBF, de Medeiros CSP, de Oliveira VHB, Vieira ER, de Cavalcanti FAC. Effectiveness of exergames for improving

mobility and balance in older adults: a systematic review and meta-analysis. Syst Rev. 2020; 9(1):163. doi: 10.1186/s13643-020-01421-7.
10. Chen Y, Zhang Y, Guo Z, Bao D, Zhou J. Comparison between the effects of exergame intervention and traditional physical training on improving balance and fall prevention in healthy older adults: a systematic review and meta-analysis. J Neuroeng Rehabil. 2021; 18(1):164. doi: 10.1186/s12984-021-00917-0.
11. Yousefi Babadi S, Daneshmandi H. Effects of virtual reality versus conventional balance training on balance of the elderly. Exp Gerontol. 2021; 153:111498. doi: 10.1016/j.exger.2021.111498.
12. Yeşilyaprak SS, Yıldırım MŞ, Tomruk M, Ertekin Ö, Algun ZC. Comparison of the effects of virtual reality-based balance exercises and conventional exercises on balance and fall risk in older adults living in nursing homes in Turkey. Physiother Theory Pract. 2016;32(3):191-201. doi:10.3109/09593985.2015.1138009.
13. Oesch P, Kool J, Fernandez-Luque L, Brox E, Evertsen G, Civit A, et al. Exergames versus self-regulated exercises with instruction leaflets to improve adherence during geriatric rehabilitation: a randomized controlled trial. BMC Geriatr. 2017; 17(1):77. doi: 10.1186/s12877-017-0467-7.
14. Montero-Alía P, Miralles-Basseda R, López-Jiménez T, Muñoz-Ortiz L, Jiménez-González M, Prat-Rovira J, et al. Controlled trial of balance training using a video game console in community-dwelling older adults. Age Ageing. 2019;48(4):506-512. doi:10.1093/ageing/afz047.
15. Faul F, Erdfelder E, Buchner A, Lang AG. Statistical power analyses using G*Power 3.1: tests for correlation and regression analyses. Behav Res Methods. 2009;41(4):1149-1160. doi:10.3758/BRM.41.4.1149.

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