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Research Article

WII FIT BALANCE BOARD WITH BALANCE & STRENGTH TRAINING ON FALL RISK, BALANCE& MOBILITY IN ELDERLY FALLERS

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Fall, Wii Fit Balance Board, Balance & Strength Training, balance.

A B S T R A C T

Background: fall in older adults is associated with Diminished balance, increased fall risk. Evidence suggests that utilizing Nintendo Wii-Fit Balance Board, a virtual-reality game console, is effective in assessing balance and improving Balance in elderly.
Objectives: In this study, we tried to find out the effect of Wii-Fit Balance Board in combination with Balance & strength training in reducing fall risk (FRAT), improving static & Dynamic Balance (Wii fit & berg balance scale (BBS)& Mobility by Timed Up and Go Test (TUG)in old age adults (60 and above) fallers.
Methods: This was a double blinded randomized control trial, pre-test post-test design in which there was control group and multiple outcome measures. Participants were divided into Experimental Group (Group- A) and Control Group (Group- B). The participants in Group- A (n = 50) received Total 60 minutes of Wii Fit Gaming exercises combined with Balance & Strength Training (20+40) 5 Days in a week. Group- B (n = 50) participants performed 60 Minutes of Balance & Strength Training with Wooden board for 4 weeks. Four different position on Wii Fit Balance Board, BBS and (TUG) were the outcome measures used in pre-& post assessments.
Results: There were 100 participants in the study with a mean age of 63.96 ± 2.97 years. Following intervention, both groups showed a significant change in scores ($p<0.01$) on the Wii Fit Balance Board, BBS and TUG. It also suggests that exercises combined with Wii Fit Balance board may improve balance & mobility however, the improvements in balance were restricted to standing on one leg with open eyes and BBS Score and no difference were observed for the control groups in other component like standing on both legs with open eyes, eyes closed & Mobility at post intervention level.
Conclusion: The use of Wii Fit Balance Board can be a possible tool in assessing & improving the Balance& Mobility of elderly fallers when used in conjunction with Balance & Strength Training. Clinically, physiotherapist should also consider effectiveness not only for providing balance training but also for assessment of balance and provide functional activities.

INTRODUCTION

Over future many decades, the senior individuals can represent an outsized section of the population. [1] consistent with World Health Organization (WHO), the dimensions of the senior population in India raised from twenty million in 1951 to fifty-seven million in 1991 and is concerning eighty-four million in 2001, 107 million in 2010,is predicted that concerning 198 million in 2030 and 326 million in 2050. The fast increase within the range of senior individuals within the population conjointly raises numerous social, economic and health problems. [2]

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Elderly individuals have common geriatric issues like impaired mobility, falls, impaired cognitive function, incontinency, etc. [3] Out of this, falls are one of the key issues within the senior and are thought of one among the "Geriatric Giants". the danger for falls increases dramatically with age. [4] Falls are common events within the lives of older individuals and may lead to a variety of adverse outcomes, from minor bruises to fractures, disability, dependence and death. Repeated falls are a vital reason for morbidity and mortality within the older and are a marker of poor physical and cognitive functional status. [5]

A "fall" is outlined as an unexpected, unintentional loss of balance leaves the individual in touch with the ground or another surface like a step or chair. [5] around twenty fifth to thirty fifth of individuals over the age of sixty-five years'

experiences one or a lot of falls annually. [3,5,6] the results of falls among older adults are devastating. In individuals over the age of sixty-five years, falls are the leading reason behind death from injury. Falls additionally results in substantial morbidity among older adults. Nearly 70% of all emergency department visits by individuals over the age of seventy-five years are associated with falls. the quantity of fallers increases to over 40% for those seventy-five and older. A history of falling is additionally a strong predictor of morbidity among the older. [4,6]

Falls are manifold interaction between intrinsic and extrinsic risk factors. [7,8,9,10,11,12,13] Researchers have shown that among intrinsic factors, impaired stance balance and mobility greatly increase the likelihood for falls, fractures, and purposeful dependency among older adults. It has been predicted that between 10% and 25% of all falls are related to poor balance and gait abnormalities. [14]

Deficits within the postural system, controlling stance balance that have been reported encircle changes within the temporal and spatial sequencing of muscles responding to loss of balance, raised dependence on visual cues for postural control, and a reduced ability to prepare and choose sensory info for postural control. Studies shows that balance impairment could be a major contributor to falling in senior individuals. [11,13,14,15]

The ability to transfer weight from one leg to the opposite may be a basic form of human locomotion and everyday activities. [16] The transfer desires postural changes and is central to gait moreover regarding maintaining balance throughout reaching tasks. Older people with balance problem usually asymmetric; they place a lot of weight on the one leg and have diminished ability to transfer weight in the midst of their base of support without loss of balance. [17]Differences in sway with age are emphasized while testing single stance postures. Single-stance sway measures are threefold larger in older subjects than in younger subjects. Single-stance time declines with age, and in advanced age, few persons are able to stand on one leg for over many seconds. [18]

Older adults with balance impairment are often referred for physiotherapy to enhance balance control and reduce the danger of falling. To work in everyday life, a person should be ready to maintain and adopt varied postures, react to external disturbances, and use automatic postural responses that precede voluntary movements. It's wide accepted that exercise is a crucial factor in maintaining health and fitness. Despite the apparent relationship between impaired balance and raised chance for falls among senior people, studies examining the results of exercise on rising balance and reducing risk for falls over elderly population have had mixed result. [19,20,21]

In recent years, several researches have tried to form and take a look at training programs with the precise goal of improvement on useful test, as well as those of standing balance. These training programs could also be classified in to four categories: strengthening, aerobic, balance and combined. [22,23,24]Various studies done on balance & strength training have confirmed that resistance training combined with balance training seems to be more effective in reducing fall and improving balance function in frail adults. [25,26]
Biofeedback systems are designed to produce visual or auditory feedback relating to the locus of the center of pressure (CoP), and training protocols look to reinforce weight distribution, steadiness, and dynamic stability. [27,28,29,30] Manystudies have shown improved weight distribution, static and dynamic balance control in older adults with visual feedback training. [31,32,33] whereas visual feedback training or Balance & Strength training alone not train each static & dynamic aspects of purposeful Balance, a mixture of Wii fit Balance Board combined with balance & strength training could be desirable for reducing fall risk, increasing purposeful balance in senior fallers.

Aim & objectives of the study

The aim & objectives of the study is to look at the effects of Wii Balance Board combined with balance & strength training program & balance & strength training alone on falls risk, Mobility &balance, among senior fallers.

Significance of the Study

Balance training employing a Laboratory-based training program that assess center of pressure (COP) recorded from a force platform (FP) - thought of best for assessing and training of balance. [34] Assessing and grooming balance by using Force platform provides helpful information; although, they're terribly expensive, exhausting to setup and laborious to move and therefore this technique of balance training is usually not practicable during a clinical scenario.

The Significance of This Study is necessity to find out a movable, affordable balance assessment & intervention system that has intensive accessibility. The Wii fit Balance Board (WBB) (Nintendo, Kyoto, Japan), a part of the widespread game that fulfills all of those criteria. [34] that is little, portable, and cheap and if verified helpful can be utilized in clinical setting.

Methodology/Design (Methods and Procedures)

Research design: - Experimental Design (Comparative Study)

Sample size: Total Sample - 100

- Group A- 50 Patients (Balance & Strength Training Wii Balance Board)
- Group B- 50 patients (Balance & Strength training with Wooden Board)

Sampling technique: - Simple Random Sampling using lottery method

Selection criteria

Inclusion criteria

- Patients over the age of 60 years and of either sex.
- Self-reported history of two or extra falls in the previous last 6 Months screened by The Falls Risk Assessment Tool (FRAT). [18]
- With no known neurologic impairment.
- Able to walk without assisted and without walking aids.
- Able to follow spoken and visual instructions.
- Willing to take part in study.

Exclusion criteria

- Musculoskeletal condition involving the lower extremity.
- Associated psychological and cognitive disorder.
- Significant visual & auditory impairment.
- Participating in another balance training program.

Variables

Independent variables

- Balance& Strength exercise
- Wii fit Balance training

Dependent variables

- Falls Risk Assessment Tool (FRAT)
- Berg balance scale
- Timed up and Go Test (TUG)
- Wii fit balance board
- Double limb stance- eye open
- Double limb stance- eye Closed
- Single limb stance- eye open
- Double limb stance- eye Closed.

Procedure

- First the entire subject screened with The Falls Risk Assessment Tool (FRAT) and completed assessment. Subjects who accomplished the inclusion norms selected for the study. The entire selected subject evaluated by Wii fit Balance Board, berg balance scale and time up and go test. All subjects were divided in to two groups.
- **Group A** (experimental group): - Wii Balance board group received 20 Minutes of Wii fit games training combined with 40 minutes of balance & strength exercises while standing on Wii Balance board and getting visual feedback over monitor in front.
- **Group B** (Control group): - Balance & Strength Training group Received 60 minutes of balance & strength training exercises while standing on wooden board with equal size to Wii fit balance board. There was no visual feedback provided to them.
- Total duration of treatment is 4 weeks.

Exercises: -Balance & Strength training exercises[35,36]

1. Static balance control. The subjects stood barefooted on uniform surface. They have to stand as still as possible controlling their COP through visual feedback from a PC monitor for 30 s in 3 different standing positions. These were
   a. Normal bipedal stance,
   b. A modified tandem stance with the one leg in front (big toe of rear foot touching instep of foot in front), and
   c. A modified tandem stance with another leg in front.

   The subjects performed this sequence 3 times with 2 minutes' rest between each sequence.
2. Dynamic balance control. The subjects adopted a barefoot, quiet bipedal stance on the floor, with arms relaxed by their sides and looking straight forward. They then performed a sequence of moving the COP to 7 different positions (center, left side, right side, left forefoot, right forefoot, left heel, and right heel) within their base of support while keeping their trunk still. The whole sequence took 35 s, consisting of 5 s in each

Table 1 Balance & Strength Training Exercise protocol[35,36,37]

Balance training exercises	Strength/co-ordination exercises
Balance exercises in a standing, sitting position included hip flexion, side-leg raises, squats, and standing up from a chair and sitting down in the chair without using hands. Aim for a large number of repetitions (initially10, progressing to individual capacity). • Warm-up 1. High stepping on the spot for 5 min 2. Standing with a decreased base- ❖ for progression: ✓ Making it harder: • Feet together and level • Semi-tandem stance • Tandem stance • Stand on one leg • Maintain position for longer 10seconds • Close eyes10seconds ✓ Making it easier: • place a table beside the person for hand support 3. Graded reaching in standing- ❖ for progression: ✓ Making it harder: • Foot placement- narrower, step standing • Reaching further • Reaching in different directions • Reaching down to a stool or the floor • Reaching for heavier objects • Reaching for a full cup of water • Standing on a softer surface e.g. foam rubber mat • Stepping while reaching ✓ Making it easier: • place a table beside the person for hand support • give feedback to enable the task to be successfully completed (e.g. keep your hips forward) Structure the environment to enhance performance e.g. markers on floor to show foot position, an object to move hips towards. 4. Stepping in different directions- ❖ for progression: ✓ Making it harder: • Narrow foot position • Longer steps • Faster steps • Step over objects • Choice component e.g. step forward with left foot • Incorporate pivoting on the non-stepping foot • Use different colors, numbers of letters or a clock face or coins as targets for variety ✓ Making it easier: • place a table beside the person for hand support	1. Sit-to-stand- ❖ for progression and variety: ✓ Making it harder: • lowering the height • don't use hands to push off, cross arms across chest • changing the nature of the surface (e.g. softer chair) • ask the person to stand up with most weight on one leg- the other leg can be placed in front or on a stool to ensure this • adding weight (either vest or belt) ✓ Making it easier: • place a table in front of or beside the person for hand support • Give feedback to enable the task to be successfully completed (e.g. feet back behind your knees, move your shoulders forward) • structure the environment to assist performance e.g. markers on floor to show foot position. 2. Heel raises- ❖ for progression and variety: ✓ Making it harder: • decrease hand support • hold the raise for longer • One leg at a time • use a wedge to increase the range of motion ✓ Making it easier: • place a table on one or both sides of the person for hand support or use their walking aid. 3. Half- squats sliding down a wall- ❖ for progression and variety: ✓ Making it harder: • increasing step height • adding weight (either vest or belt) • decrease hand support • Step up and over block ✓ Making it easier: • place a table on one or both sides of the person for hand support or use their walking aid.

position. The sequence was performed 3 times with 2 minutes rest between each sequence.

3. Standing on one leg and taking other leg in forward, sideways and backward for 20 repetitions to each side., 4. Marching

The participants of both groupswere performed balance and strength exercise, Group A for 40 Minutes &B for 60 Minutes. Group A First Completed 20 Minutes of individual Wii Fit balance Games in sitting and standing positions followed by 40 minutes of Balance and Strength Training Exercises. Group B completed 60 Minutes of Balance & Strength training in standing position over wooden board and floor of the clinic.
The balance games on Wii fit balance board had progression according to the level of difficulty from beginner to expert, the games which experimental group played was Basic step, Soccer heading, ski slalom and Table tilt. [38,39]

Table 2 Wii fit balance board protocol [40]

Wii fit balance board protocol		
Basic step- Time: 2.5 min per game 2 games Total minutes: 5 min with 1-min rest between each step game	Participants follow a step sequence on the television screen by stepping on and off the balance board (forward / backward and side to side) Scoring: number of synchronized steps	Warm up and low-moderate intensity aerobic exercise Dynamic balance Attention and coordination Visual and auditory feedback
Soccer heading Time: 1 min per game, 3 games Total minutes: 5 min with 1-min rest between 2 games	Participants move their center of gravity to strike virtual soccer balls coming at them from the television screen Scoring: number of soccer ball strikes and avoiding diversions	Static balance and quick motor response Attention and coordination Visual and auditory feedback
Ski slalom Time: 1 min per game 3 games Total minutes: 5 min with 1-min rest between 2 games	Participants ski downhill between poles while flexing their knees and shifting their weight Scoring: speed and accuracy with skiing between poles	Static balance and whole-body movement Attention and coordination Visual and auditory feedback
Table tilt Time: variable, depending on performance Total minutes: 5 min	Participants tilt their center of gravity to direct balls into a hole on a shifting platform Scoring: number of balls that enter the hole.	Static balance and motor Response Visual and auditory feedback

Level of difficulty first started from beginner level for all subject and later level increased according to achievement of patient.

All the subject did exercises under direct direction of same Physiotherapist. One therapist who was unaware to study &group division used all outcome measures.

Outcome Measures

Wii Balance Board (WBB): Wii Balance Board (WBB) (Nintendo, Kyoto, Japan), a part of the popular computer game Wii fit, satisfies all of those criteria. The WBB possesses similar characteristics to a laboratory-grade Force Plate therein it contains four transducers that are used to assess force distribution and also the resultant movements in COP. [26,27] Originally designed as a computer game controller, the WBB is preponderantly utilized in combination with a computer game console and its associated software system. Given the capability for providing instant feedback and also the potential for increased motivation levels, this technique has already been integrated into the rehabilitation programs of neurologic patients with balance defects [41,42,43].

Assessment of balance on Wii fit balance board was utilized in four completely different condition, Double limb standing with eye open (DLS-EO), double limb standing with eye closed (DLS-EC), Single limb standing with eye open (SLS-EO) and single leg standing with eye closed (SLS-EC) [29,44]. On every of the 2 test occasions, pre-& post intervention level assessment of balance performed by four completely different standing balance tasks on a WBB, that includes a useable surface of forty five cm " twenty six.5 cm. The WBB was interfaced with a laptop pc using custom-written software package (Lab view 8.5 National Instruments, Austin, TX, U.S.A.), and was calibrated by placing a range of identified loads at totally different positions on the WBB, a protocol mentioned very well by Bobbert mf *et al* in their study. [28]

The order of tasks and testing device was indiscriminately allotted for every participant, however remained consistent between testing sessions. throughout every trial the participants were educated to stay their hands placed on their hips and to stay as still as attainable for the period of the trial. Data were collected for 10 s throughout single limb trials and for 30 s throughout double limb trials. a complete of 3 successful trials (maximum of 3 unsuccessful attempts) were conducted for every task and device with 15 s of rest between trials and a minimum of 60 s between-device or task.

Falls Risk Assessment Tool (FRAT): - The Falls Risk Assessment Tool (FRAT) was developed by the peninsula Health Falls prevention Service for a DH funded project in 1999, and is a component of the frat Pack. The 4-item PH-FRAT could be a widespread, moderately predictive, reliable and transient technique of screening fall risk in sub-acute and residential aged care. [45]

Berg Balance Scale (BBS): - To assess functional performance, berg balance scale a performance-based measure designed to evaluate performance throughout balance activities, and to predict multiple falls in community-dwelling and institutionalized older adults. [46,47]

Timedup and Go test (TUG): -For assessing the mobility the timed up and Go test (TUG), a widely-used performance-based measure of functional mobility in community-dwelling older adults. [48,49]

Ethical approval

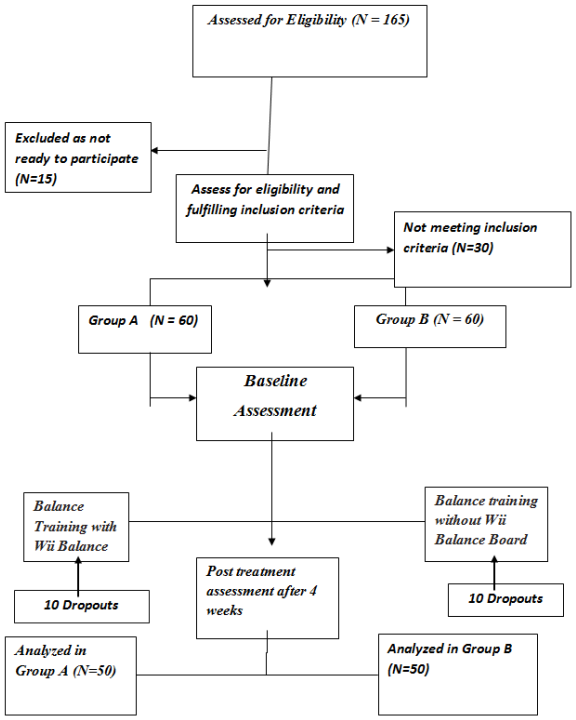
An approval from departmental research Committee of maharaja Vinayak global University & MGM's Institute of Health Sciences, was taken before beginning the study. The Protocol number of Approval was MGM-ECRHS/2015/221.

Data Collection, Analysis and Interpretation of Data

The entire subject included for the study would be evaluated by The Falls Risk Assessment Tool (FRAT), Wii fit balance board, berg balance scale and timed up and Go test (TUG) at the 0 day and finish of 4 weeks and data were collected. after data collection data analysis, was performed by using SPSS Package 22.

Levene's test was used for Equality of Variances to seek out out status at pre-intervention and post intervention level. independent sample t test has been used for between group analysis and paired sample t test for among group analysis.

Consort Flow Diagram



RESULT

Total 165 subjects were assessed for eligibility.Out of which 15 were excluded because they refused to participate in study,30 subjects unable to fulfill the inclusion criteria. Total 120 elderlies were randomized and divided in to two groups. Group A & Group B. There were 20 drop out from study, 10subjects from each group. total 100 participants,50 in each group completed the whole intervention and included for data analysis. Total 56 Males and 44 Females were participated in the study.

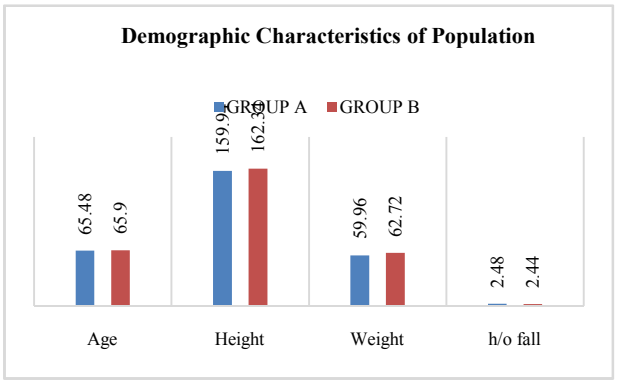
Table 3 Demographic characteristics of the population

		Group A	Group B	F-value	P value
AGE		65.48±3.86	65.90±3.73	.26	.581(NS*)
GENDER	MALE	26	30		
	FEMALE	24	20		
HEIGHT		159.94±7.88	162.34±8.02	.067	.135(NS*)
WEIGHT		59.96±7.49	62.72±7.94	.035	.077(NS*)
H/O FALL		2.48±61	2.44±.67	.167	.757(NS*)
RISK FACTOR	HT	27	22		
	DM	15	18		
	CHD	12	9		

*NS- Non-Significant

Above table shows demographic details of both the groups, age, height, weight & h/o previous fall

Score indicate that there was no significant difference between both the groups.



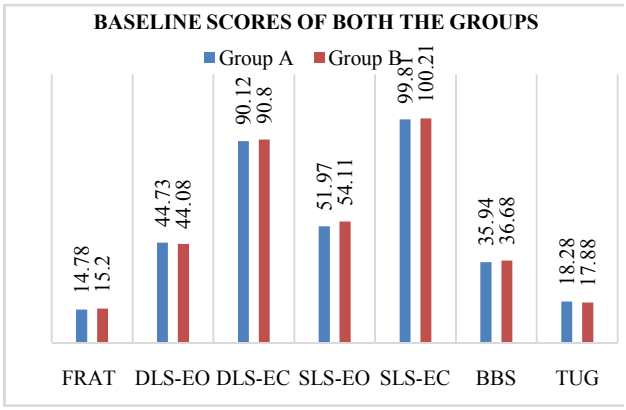
Graph 1 Demographic details of Both the groups

Above graph shows Age, Height, weight &h/o Fall of both the groups

Table 4 Baseline level scores of both the Groups

	GROUP A	GROUP B	F-value	P value
FRAT	14.78±2.16	15.20±2.14	.958	.333(NS*)
Double limb stance -eye open	44.73±1.77	44.08±1.79	.22	.072(NS*)
Double limb stance - eye closed	90.12±4.89	90.80±5.83	1.11	.527(NS*)
Single limb stance- eye open	51.97±6.36	54.11±5.97	.785	.086(NS*)
Single limb stance - Eye Closed	99.81±6.86	100.21±7.77	.747	.786(NS*)
Berg balance scale	35.94±3.93	36.68±4.72	2.15	.396(NS*)
TUG Test	18.28±2.87	17.88±2.76	.161	.480(NS*)

NS- Non-Significant

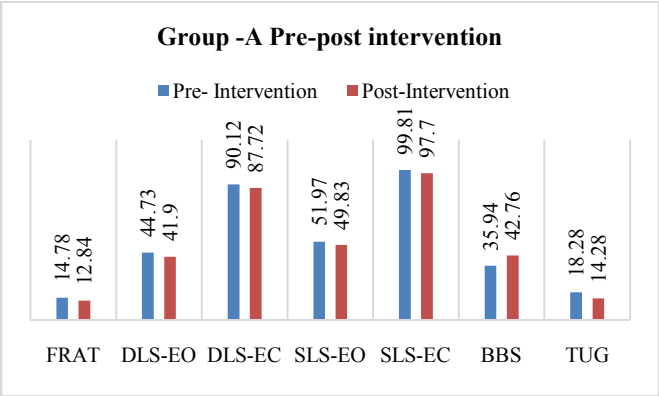


Graph 2 Baseline scores of FRAT, DLS-EO,DLS-EC, SLS-EO, SLS-EC,BBS & TUG

Table 5 Pre -Post Intervention level scores of Group A

	Pre-intervention	Post-intervention	t-value	P value
FRAT	14.78±2.16	12.84±1.56	13.21	.001(S**)
Double limb stance - eye open	44.73±1.77	41.90±1.85	28.68	.001(S**)
Double limb stance - eye closed	90.12 ±4.89	87.72± 4.85	28.94	.001(S**)
Single limb stance- eye open	51.97±6.36	49.83±6.22	27.19	.001(S**)
Single limb stance - Eye Closed	99.81±6.86	97.70±6.93	30.98	.001(S**)
Berg balance scale	35.94±3.93	42.76± 2.66	-20.12	.001(S**)
TUG Test	18.28±2.87	14.26±1.78	18.24	.001(S**)

*(S**- Statistically Significant)*

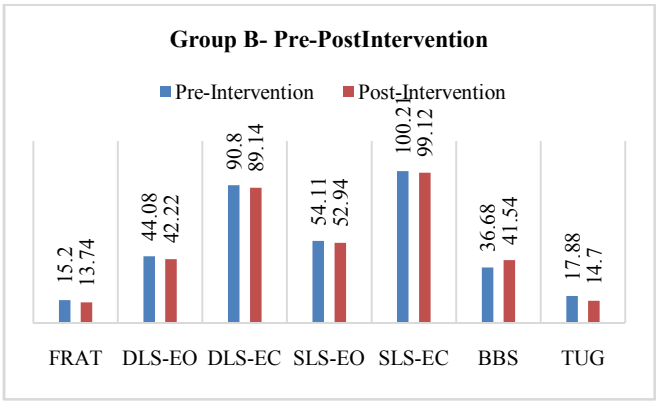


Graph 3 Pre -Post Intervention level scores of FRAT, DLS-EO,DLS-EC, SLS-EO, SLS-EC,BBS & TUG

Table 6 Pre -Post Intervention level scores of Group B

	Pre-intervention	Post - intervention	t-value	P value
FRAT	15.20±2.14	13.74±1.41	11.09	.001(S**)
Double limb stance -eye open	44.08±1.79	42.22±1.94	17.27	.001(S**)
Double limb stance - eye closed	90.80±5.83	89.14±5.66	9.75	.001(S**)
Single limb stance- eye open	54.11±5.97	52.94±5.88	17.58	.001(S**)
Single limb stance - Eye Closed	100.21±7.77	99.12±7.90	17.20	.001(S**)
Berg balance scale	36.68±4.72	41.54±3.44	-17.45	.001(S**)
TUG Test	17.88±2.76	14.70±1.69	15.33	.001(S**)

(S**- Statistically Significant)

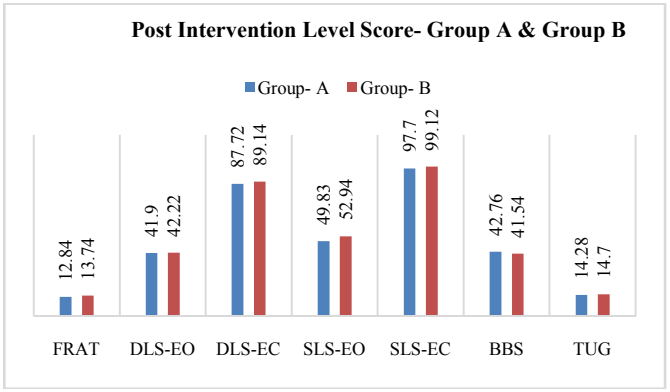


Graph 4 Pre -Post Intervention level scores of FRAT, DLS-EO,DLS-EC, SLS-EO, SLS-EC,BBS & TUG

Table 7 Post Intervention level scores of both the Groups

	Group A	Group B	F-value	P value
FRAT	12.84±1.56	13.74±1.41	.696	.003(S**)
Double limb stance -eye open	41.90±1.85	42.22±1.94	.345	.40(NS*)
Double limb stance - eye closed	87.72± 4.85	89.14±5.66	.762	.18(NS*)
Single limb stance- eye open	49.83±6.22	52.94±5.88	.637	.01(S**)
Single limb stance - Eye Closed	97.70±6.93	99.12±7.90	.905	.34(NS*)
Berg balance scale	42.76± 2.66	41.54±3.44	4.81	.05(S**)
TUG Test	14.26±1.78	14.70±1.69	.015	.20(NS*)

*NS- Non-Significant, S**- Statistically Significant



Graph 5 Pre -Post Intervention level scores of FRAT, DLS-EO,DLS-EC, SLS-EO, SLS-EC,BBS & TUG

DISCUSSION

The study pursued to determine the effectiveness of Wii-Fit Balance board exercise combined with balance & Strength exercises for improving balance in older adults with history of minimum two falls in last six months. As in previous studies, participants participated in this study intimate no adverse events, indicating that older adults with comorbidities can safely complete the program.

The finding of this study additionally shown that Wii-Fit Balance board is feasible to use for training in addition as assessment of balance since the participation rate was high and subjects were ready to exercise independently.

Demographic info of subjects, for groups demonstrate that subjects were matched for start line characteristics as it seen in Table 3 & graph 1. Age, height, weight, Gender distribution, history of previous falls among subjects within the groups is shown in Table 3.

When analysis was done at pre-intervention level between both the groups, it had been found that there was statically no distinction between Fall risk factors assessed by fall risk assessment tools (FRAT), Balance (Double limb standing with eyes open and Eyes Closed & Single leg standing with eyes open and eyes closed) assessed by Wii Fit balance board, BBS & TUG scores between both the groups, as it is shown in table 4 and graph 2, that suggest that both the group were matched for baseline.

When comparison was done at pre-and post-intervention level for group A, it had been found that there was statistically significant distinction for Fall Risk, Balance (Assessed by Wii fit Balance board), BBS & TUG score at post intervention level as it is evident in table 5 and graph 3 respectively. This shows that Wii fit Balance board training combined with balance & Strength training exercises are effective in reducing fall risk balance (Static & Dynamic) in aged fallers.

Finding of this study is supported by study done by Kalpana P. Padala to seek out effectiveness of Wii-Fit on Static and dynamic balance in Community lodging Older Veterans: A randomised Controlled Pilot Trial during which they suggested that the Wii-Fit exercise program is efficacious in improving balance in community lodging older Veterans. [50]Another study conducted by A. A. Rendon *et al* The impact of virtual reality recreation on dynamic balance in older adults during which they summarized that e Wii fit video game gaming system improves balance stability. Improved confidence with functional activities was additionally reported. [51]

When comparison was done at pre-and post-intervention level in group B, statistically significant distinction was found for fall risk, Balance, BBS & TUG scores at post intervention level [Table 6 and Graph 3], that shows that balance-strength training is additionally effective in reducing fall risk, improving static balance after four weeks of intervention.

Finding of this study is analogous to review done by Melina Galleti Prata *et al* on "Effects of strength and balance training on the mobility, fear of falling and grip strength of senior feminine fallers" who find out that Balance training consisting of video game and strengthening exercises evidenced to be an efficient tool to decrease the fear of falling and to enhance the mobility of aged feminine fallers, and should be a suitable treatment for the prevention of falls and balance recovery .[52]

Another study done by lindy Clemson (2010) conducted study "Integration of balance and strength training into everyday life activity to decrease rate of falls in older individuals (the LiFE study): randomized parallel trial and suggested that The LiFE programme provides an alternate to ancient exercise to consider for fall interference, function primarily on ADL shouldbe considered for interventions to protect older, high risk individuals from falling and to enhance and preserve functional capability.[53]

In the present study, important improvement in reducing fall risk and improving balance was discovered within the control group after the Balance -strength training program. These results may be explained by the fact that an intervention comprising balance & strength training liable for maintaining postural stability, increases the recruitment of motor neurons, muscle fatigue resistance and hypertrophy (mainly sort II fibers), therefore increasing muscle strength, muscle response time, coordination, balance and mobility factors are necessary for the prevention of falls.[54,55,35] Muscle strengthening (performed in a very typical manner or incorporated into ADL) seems to be essential to fall prevention; all of the high-quality studies showed decrease in falls . [53,35,37]

When comparison was done at post intervention level between the group A and group B, it has been found that there was statistically important distinction in reducing fall risk, Single leg standing with eyes open, & BBS however there was no significant distinction found in Double leg standing with eyes open and eyes closed, single leg standing with eyes closed & TUG as it is shown in Table 7 and Graph 5. that shows that Wii fit Balance Board combined with balance- strength training is effective in reducing fall risk, improving single leg standing and balance as compared to balance- strength trainingalone.

Result of this study is matched with finding of previous study performed by Toulotte C1, Toursel C, Olivier N. titled "Wii fit training vs. adapted Physical Activities: which one is the most applicable to enhance the balance of independent senior subjects? A randomised controlled study." during which they find out that after 20 training sessions, adapted Physical Activities, Wii fit and adapted Physical Activities Combined with Wii fit improve balance. additionally, adapted Physical Activities and adapted Physical Activities with Wii fit increase dynamic balance. [56]

The previous studies on Wii fit interventions have largely been shown to be effective. No study has reported a negative impact of Wii fit training for any measure of balance ability, and most have specified a minimum of some measurable or indirect evidence of improvement like finding of this study. [57]

In this study Basic step, football heading, ski slalom & table tilt games were used. These games were in all probability chosen since they need adequate core muscle control and upper and lower limb muscle strength for fast and precise movements. The games challenged the subjects' balance by requiring them to lean in various directions and to take sharp turns, therefore shifting their centre of mass to the boundaries of their base of support. [58]

Jack *et al* urged that participating in fun and difficult Visual Reality games could powerfully have an effect on an individual's motivation to use peak effort and therefore increase overall compliance with treatment. [59] Wii-based interventions are reported as pleasurable for balance training in nonimpaired older adults. [59,60,61,62] additionally to their impact on compliance, Wii-based games are well matched for home-based exercise programs, as they're comparatively cheap, and don't need massive areas or further peripheral instrumentation.

In this study Wii fit balance board haven't used just for training purpose however additionally on assessment of static balance whereas single leg standing and double leg standing with eyes open and closed position, we tend to discovered that from pre to post level there's change in all four parts however at post intervention level solely important change was observed only one position (single leg standing with eyes open). After utilising Wii fit balance board for assessment purpose, we consider conclusion created by Ross A. Clark *et al* the WBB has the potential to 'bridge the gap' between laboratory testing and clinical assessment of standing balance. rather than replacement subjective-based balance protocols, the WBB might offer practitioners from a variety of medical specialties and disciplines with supplementary balance info that's not discernible using visual assessment alone however several future researches required to look at the accuracy. [63] At post intervention level three Balance element (Double leg Standing-eyes open and eyes closed, single leg standing -eyes closed) and TUG score were statically non-significant this might result to solely 4 weeks of intervention, these could have modified if longer length of intervention have been used.

Clinical Implication

This study confirms that Wii fit Balance Board, an inexpensive device, have positive effects in reducing fall risk single leg standing with eyes open & balance as compared to Balance-Strength coaching, which may be used for assessment and intervention purpose in clinical settings.

Limitations

Small sample size, intervention effects were examined solely 4 weeks after treatment. No follow up was taken, to seek out out whether or not enhancements in motor functions was maintained or not once halt of treatment.

Due to low-priced nature of the device there are variety of restraints inherent in exploitation the WBB as a force platform to measure COP coordinates for assessment purpose. These embody the eight-byte signal and sampling frequency limitations and here were taken from bioengineer.

Future analysis

Future study may be carried out on a bigger sample size with future follow up, with some objective measure to seek out out changes in strength, response time, static elements and gait parameters.

To investigate the long-run effects of Strength - Balance training in older population in comparison with Wii fit Balance board utilising as intervention furthermore as assessment tool is additionally needed.

CONCLUSION

The main results of this study is that the Wii fit Balance board is an efficient tool which might be utilized as assessment of Balance in clinical & Home setting. Wii fit Balance board combined with balance & Strength exercise program evidenced to be effective & practicable in improving balance in older fallers. The results additionally recommend that exercises with the Wii fit Balance board could improve balance and mobility but, the improvements in balance were restricted to single leg standing with eyes open and BBS Score and not considerably greater than that observed for the control groups in alternative component Double leg standing with eyes open & eyes closed and mobility.

References

1. Suraj Kumar, G Venu Vendhan, Dr Sachin Awasthi, Madhusudan Tiwari, Prof VP Sharma, Relationship Between Fear of Falling, Balance Impairment and Functional Mobility in Community Dwelling Elderly IJPMR 2008 October; 19 (2): 48-52
2. World Health Organization (2002). Active Ageing: A Policy Framework. Geneva.
3. Prudham D, Evans JG. Factors associated with falls in the elderly: a community study. Age Ageing 1981; 10:141-6.
4. Koski K, Luukinen H, Laippala P, and Kivela SL. Risk factors for major injurious falls among the home-dwelling elderly by functional abilities. Gerontol 1998; 44(4): 232-8.
5. Blake AJ, Morgan K, Bendall MJ, Dalloso H, Ebrahim S, Arie T, *et al*. Falls by elderly people at home: prevalence and associated factors. Age Ageing 1988; 17:365-372.
6. Rao SS, Prevention of falls in older patients. Am Fam Physician 2005; 72: 81-8, 93-4.
7. Nevitt MC, Cummings SR. Risk factors for recurrent non-syncopoal falls: a prospective study. J A M. 1989; 261:2663-2668.
8. Campbell AJ, Borrie MJ, Spears GF. Risk factors for falls in acommunity-based prospective study of people 70 years and older. J h n l o l. 1989; 44:M112-M117.
9. Nickens H. Intrinsic factors in falling among the elderly. Arch Intern Med. 1985;145: 1089-1093.
10. Ashley MJ, Gryfe CI, Amies A. A longitudinal study of falls in an elderly population, II: some circumstances of falling. Age Ageing. 1977; 6:211-220.
11. Tinetti ME, Ginter SF. Identifymg mobility dysfunctions in elderly patients: standard neuromuscular examination or direct assessment? J A M. 1988; 259:1190-1193.
12. Nelson RC, Amin MA. Falls in the elderly. Emerg Med Clin North Am. 1990; 8:309 -324.
13. Campbell AJ, Borrie MJ, Spears GF, *et al*. Circumstances and consequences of falls experienced by a community population 70 years and over during a prospective study. Age Ageing. 1990; 19:136 -141.
14. Overstall PW, Exton-Smith AN, Imms FJ, Johnson AL. Falls in the elderly related to postural imbalance. Br Med J. 1977; 1:261-264.
15. Haas BM, Burden AM. Validity of weight distribution and sway measurements of the Balance Performance Monitor. Physiotherapy Res Int. 2000; 5(1):19-32.
16. Panagiotis V. Tsaklis, PT, PhD,1,2,3 Wilhelmus J.A. Grooten, PT, PhD,2,3 and Erika Franzén, PT, PhD2,4 Effects of Weight-Shift Training on Balance Control and Weight Distribution in Chronic Stroke: A Pilot Study, Top Stroke Rehabil 2012;19(1):23-31, doi: 10.1310/tsr1901-23
17. Jonsson E, Henriksson M, Hirschfeld H. Age-related differences in postural adjustments in connection with different tasks involving weight transfer while standing. Gait Posture. 2007;26(4):508-515.
18. Tinetti ME, Baker DI, McAvay G, *et al*. A multifactorial intervention to reduce the risk of falling among elderly people living in the community. N Engl J Med. 1994; 331:821- 827.
19. Chandler JM, Hadly EC. Exercise to improve physiological and functional performance in old age. In: studenski S. Clinics in geriatric medicine: gait and balance disorders, 1996 vol13, pp. 761-784.philadelphia: Saunders.
20. Frontera W, MeredithC, O' Reilly KP, *et al* strength conditioning in older men: skeletal muscles hypertrophy and improved function. J Applied physiology 1988; 64:1038-1044.
21. Campbell AJ, Robertson MC. Comprehensive Approach to Fall Prevention on a National Level: New Zealand. Clin Geriatr Med. 2010;26(4):719-31.
22. Hornbrook MC, Stevens J, Wingfield DJ, *et al*. Preventing falls among community dwelling older persons: results from a randomized trial. Gerontologist. 1994; 34: 16-23.
23. Kellogg International Work Group on the Prevention of fall by the Elderly. The prevention of falls in later life. Dan Med Bull. 1987; 34:1-24.
24. Carter ND, Khan KM, Petit MA, Heinonen A, Waterman C, Donaldson MG, *et al*. Results of a 10-week community-based strength and balance training programme to reduce fall risk factors: a randomised controlled trial in 65-75-year-old women with osteoporosis. Br J Sports Med. 2001;35(5):348-51.
25. Clemson L, Singh MF, Bundy A, Cumming RG, Weissel E, Munro J, *et al*. LiFE Pilot Study: A randomised trial of balance and strength training embedded in daily life activity to reduce falls in older adults. Aust Occup Ther J. 2010;57(1):42-50.
26. Clark, R.A., Bryant, A. L., Pua, Y., McCrory, P., Bennel, K & Hunt, M. (2010). Validity and reliability of the Nintendo Wii Balance Board for assessment of standing balance. Gait & Posture, 31, 3, 307-310.
27. Koslucher F, Wade MG, Nelson B, Lim K, Chen FC, Stoffregen TA. Nintendo WiiBalanceBoard is sensitive to effects of visual tasks on standing sway in healthy elderly adults. Gait Posture. 2012 Jul; 36(3):605-8. Epub 2012 Jun 28.

28. Bobbert MF, Schamhardt HC. Accuracy of determining the point of force application with piezoelectric force plates. Journal of Biomechanics 1990; 23(7):705-710.
29. Bauer C, Gro¨ ger I, Rupprecht R, Gabmann KG. Intrasession reliability of force platform parameters in community-dwelling older adults. Arch Phys Med Rehabil 2008; 89 (10): 1977-82.
30. Gil-Gomez JA, Llorens R, Alcaniz M, Colomer C: Effectiveness of a Wii balance board-based system (eBaViR) for balance rehabilitation: a pilot randomized clinical trial in patients with acquired brain injury. J Neuroeng Rehabil 2011, 8:30.
31. Kennedy MW, Schmiedeler JP, Striegel AD, Crowell CR, Villano M, Kuitse J: Enhanced Feedback in Balance Rehabilitation using the Nintendo Wii Balance Board. In e-Health Networking Applications and Services (Healthcom), 2011 13th IEEE International Conference Columbia, MO. 2011:162-168.
32. Dougherty J, Kancel A, Ramar C, Meacham C, Derrington S: The effects of a multi-axis balance board intervention program in an elderly population. Mo Med 2011, 108:128-132.
33. Shaw JM, Snow. Weighted vest exercise improves indices of fall risk in older women. Pubmed (accessed 1998;).
34. Ross A. Clark a, Adam L. Bryant a, YonghaoPua b, Paul McCrory a, Kim Bennell a, Michael Hunt a Validity and reliability of the Nintendo Wii Balance Board for assessment of standing balance Gait & Posture 31 (2010) 307-310.
35. Kumar C (2017) Comparison between Tai Chi and Balance-Strength Training Exercise to Decrease Fear of Fall and Improving Balance and Functional Mobility in Elderly. J Nov Physiotherapy 7: 350. doi:10.4172/2165-7025.1000350.
36. Schmitz KH, Courneya KS, Matthews C. *et al*. American college of sports medicine roundtable on exercise guidelines for cancer survivors. Med Sci Sports Exerc. pubmed (accessed 2010;42(7):1409â€“1426.).
37. Clemson L, Singh MF, Bundy A, Cumming RG, Weissel E, Munro J, *et al*. LiFE Pilot Study: A randomized trial of balance and strength training embedded in daily life activity to reduce falls in older adults. Aust Occup Ther J. 2010;57(1):42-50.PMid:20854564. http://dx.doi. org/10.1111/j.1440-1630.2009.00848.
38. Emily Bainbridge, *et al*, The Effects of the Nintendo Wii Fit on Community-Dwelling Older Adults with Perceived Balance Deficits: A Pilot Study. Physical & Occupational Therapy in Geriatrics, 2011, 29(2):126-135, 2.
39. Bateni H *et al*. Changes in balance in older adults based on use of physical therapy vs the Wii Fit gaming system: a preliminary study. Physiotherapy. 2012 Sep; 98(3):211-216.
40. MaayanAgmon, Cynthia K. Perry, Elizabeth Phelan; George Demiris, Huong Q. Nguyen, A Pilot Study of Wii Fit Exergames to Improve Balance in Older Adults J Geriatr Phys Ther 2011;34:161-167. DOI: 10.1519/JPT.0b013e3182191d98
41. Nilsagard YE, Forsberg AS, von Koch L: Balance exercise for persons with multiple sclerosis using Wii games: a randomised, controlled multi-centre study. MultScler 2013, 19:209-216.
42. Esculier JF, Vaudrin J, Beriault P, Gagnon K, Tremblay LE: Home-based balance training programme using Wii Fit with balance board for Parkinsons's disease: a pilot study. *J Rehabil Med* 2012, 44:144-150.
43. Gil-Gomez JA, Llorens R, Alcaniz M, Colomer C: Effectiveness of a Wii balance board-based system (eBaViR) for balance rehabilitation: a pilot randomized clinical trial in patients with acquired brain injury. J Neuroeng Rehabil 2011, 8:30.
44. Winter DA, Patla AE, Frank JS. Assessment of balance control in humans. Med Prog Technol 1990;16(1-2):31-51.
45. Stapleton C, Hough P, Oldmeadow L, Bull K, Hill K, Greenwood K. Four-item fall risk screening tool for subacute and residential aged care: The first step in fall prevention. Australas J Ageing 2009 Sep; 28(3):139-43.
46. Berg K, Wood-Dauphinee S, Williams JI. The Balance Scale: reliability assessment with elderly residents and patients with an acute stroke. Scand J Rehabil Med. 1995; 27(1):27-36.
47. Berg KO, Maki BE, Williams JI, Holliday PJ, Wood-Dauphinee SL. Clinical and laboratory measures of postural balance in an elderly population. Arch Phys Med Rehabil. 1992; 73(11):1073-1080.
48. Podsiadlo D, Richardson S. The Time “Up & Go”: A Test of Basic Functional Mobility for Frail Elderly Persons. Journal of the American Geriatrics Society 1991; 39(2): 142148.
49. Shumway Cook A, Brauer S, Woollacott M. Predicting the Probability for Falls in Community Dwelling Older Adults Using the Timed Up & Go Test. Physical Therapy 2000 Vol 80(9): 896903.
50. Kalpana P. Padala,Prasad R. Padala, Shelly Y. Lensing, Richard A. Dennis, Melinda M. Bopp,1 Christopher M. Parkes,1 Mark K. Garrison, Patricia M. Dubbert,1 Paula K. Roberson, and Dennis H. Sullivan Efficacy of Wii-Fit on Static and Dynamic Balance in Community Dwelling Older Veterans: A Randomized Controlled Pilot Trial Journal of Aging Research Volume 2017, Article ID 4653635, 9 pages http://dx.doi.org/10.1155/2017/4653635.
51. A. A. Rendon, E. B. Lohman, D. Thorpe, E. G. Johnson, E. Medina, and B. Bradley, “The effect of virtual reality gaming on dynamic balance in older adults,” Age and Ageing, vol. 41, no. 4, pp. 549-552, 2012.
52. Melina Galleti Prata, Marcos Eduardo Schleicher - Effects of strength and balance training on the mobility, fear of falling and grip strength of elderly female fallers journal of bodywork & Movement Therapy: October 2015Volume 19, Issue 4, Pages 646-650.
53. Clemson L1, Fiatarone Singh MA, Bundy A, Cumming RG, Manollaras K, O'Loughlin P, Black D. Integration of balance and strength training into daily life activity to reduce rate of falls in older people (the LiFE study): randomised parallel trial. BMJ. 2012 Aug 7;345: e4547. doi: 10.1136/ bmj. e4547.
54. Casale, R., Rainold, A., Nilsson, J., Bellotti, P., 2003. Can continuous physical training counteract aging effect on myoelectric fatigue? A surface electromyography

study application. Arch. Phys. Med. Rehabil. 84, 513e517. http: //dx.doi.org/10.1053 /apmr. 2003.50083.
55. Karinkanta, S., Nupponen, R., Heinonen, A., Pasanen, M., Sievanen, H., Uusi-Rasi, K., Fogelholm, M., Kannus, P., 2012. Effects of exercise on health-related quality of life and fear of falling in home-dwelling older women. *J. Aging Phys. Activity* 20, 198e214.
56. Toulotte C1, Toursel C, Olivier N. Wii Fit® training vs. Adapted Physical Activities: which one is the most appropriate to improve the balance of independent senior subjects? A randomized controlled study. Clin Rehabil. 2012 Sep;26(9): 827-35.doi: 10.1177/026921 5511434996.
57. Daniel J Goble1*, Brian L Cone1 and Brett W Fling2Using the Wii Fit as a tool for balance assessment and neurorehabilitation: the first half decade of "Wii-search" *Journal of Neuro Engineering and Rehabilitation* 2014, 11:12.
58. Yocheved Laufer Gali Dar EinatKodesh; Does a Wii-based exercise program enhance balance control of independently functioning older adults? A systematic review; Clinical Interventions in Aging 2014:9 1803-1813
59. Jack D, Boian R, Merians AS, *et al*. Virtual reality-enhanced stroke rehabilitation. IEEE Trans Neural Syst Rehabil Eng. 2001;9(3):308-318.
60. Nicholson VP, McKean M, Lowe J, Fawcett C, Burkett B. Six weeks of unsupervised Nintendo Wii Fit gaming is effective at improving balance in independent older adults. J Aging Phys Act. February 28, 2014. [Epub ahead of print].
61. Meldrum D, Glennon A, Herdman S, Murray D, McConn-Walsh R. Virtual reality rehabilitation of balance: assessment of the usability of the Nintendo Wii® Fit Plus. Disabil Rehabil Assist Technol. 2012;7(3):205-210.
62. Williams BDNL, Bender A, Mattox H, Tibbs JR: The effect of Nintendo Wii on Balance: A Pilot Study Supporting the Use of the Wii in Occupational Therapy for the Well Elderly. Occup Ther Health Care 2011, 25:131-139.
63. Clark RA, McGough R, Paterson K: Reliability of an inexpensive and portable dynamic weight bearing asymmetry assessment system incorporating dual Nintendo Wii Balance Boards. Gait Posture 2011, 34:288-291.

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