ORIGINAL ARTICLE

Effects of Wii Fit exer-gaming on balance and gait in elderly population: A randomized control trial

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Abstract

Objective: To assess the effect of exer-gaming on balance and gait in the elderly.

Methods: The randomised controlled trial was conducted at Kulsum International Hospital, Islamabad, Pakistan, from July to October 2018, and comprised physically independent subjects aged 60 years and above who were randomised into experimental and control groups using concealed envelope method. The cases received exer-gaming for 30 minutes twice a week for 8 weeks, while the controls received balance training exercises twice a week for 8 weeks. Assessment was done at baseline and after 8 weeks of intervention. Outcome measures were assessed with Berg balance scale and the gait abnormality rating scale modified. Data was analysed using SPSS 21.

Results: Of the 90 subjects, there were 45(50%) in each of the two groups. The intervention group had better outcome in terms of gait ($p<0.05$) except for foot contact and shoulder extension ($p>0.05$), while the difference related to balance was not significant ($p>0.05$).

Conclusion: Exer-gaming was found to be effective in improving various components of gait in the elderly compared to exercises.

Keywords: Balance, Elderly population, Exer-gaming, Gait, Gait abnormality rating scale, Nintendo Wii Fit.

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Introduction

Gait is an integral part of one's personality and strongly affects a person's social and personal life. Gait pattern is influenced by certain factors including age, personality, mood and socio-cultural trends. As one may notice, there is high walking speed in urban population compared to those in the villages.[1]

Prevalence for gait and balance disorders increases with age as 10% for age 60-69, and more than 60% for >80 years.[2] About one-third of the elderly encounter a fall of whom >50% fall more than once, and 10-15% of these falls cause serious injuries that can even lead to death.[2]

Balance, postural reflexes, motor control, sensorimotor function, musculoskeletal and cardiopulmonary systems are the contributing factors for normal gait. The nervous system, providing afferent supply from eyes, vestibular system and proprioceptors, plays an essential role in maintaining the balance during walk.[3] Central integration of this information with cortex, basal ganglia, brainstem and cerebellum contributes to successful walking pattern.[3]

With advancement in age, various disturbances take place in these systems, leading to poor balance and increased falls. Impaired proprioception, polyneuropathy, visual losses, osteoarthritis and vascular diseases are some common causes behind gait disorders in the elderly. Adverse effects of drugs and psychiatric problems are other major contributors to balance and gait issues.[4] Muscle power reduces with age and proprioception becomes weak which causes increased body sway that aggravates with time. This leads to fear of falling and increased risk of fall in the elderly.[5] Another factor affecting the elderly is frailty which targets balance, mobility, muscle strength, physical activity and gait.[6]

It is believed that pre-existing problems in balance and gait system play a bigger role in causing falls compared to acute issues, like stroke, seizures or syncope.[7]

Poor balance and gait disorders leading to falls greatly affect the personal independence and quality of life.[2] It is crucial to search for plans and remedies that can reduce the risk of fall, and may improve balance and gait in the elderly. A lot of interventions are being done to counter these issues, among which the types of interventions that have emerged to be convenient to use over time are interactive video games (IVDs) which are believed to improve motor functions along with optimising neural plasticity.[8] IVGs provide an interactive environment for the person to perform various tasks that require combination of motor and cognitive efforts, and they also provide motivation by continuous feedback.[9] IVGs encourage complex movement patterns like the ones we require in daily life.[8] IVGs are also cost-effective and are also a source of motivation.[9]

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Literature shows that Nintendo Wii Fit is a cost-effective motor and cognitive tool among IVGs. It consists of a balance board to detect oscillations and perturbations by sensors that detect the centre of pressure of the player.[10] A systematic review also suggested that Nintendo Wii Fit was effective for balance improvements in the elderly. There is evidence for Nintendo Wii Fit to be effective for balance improvements and reducing fall risks.[11,12] It is observed that very little work has been done on its use for improvement of gait in the elderly worldwide and even lesser in Pakistan. The current study was planned to detect the changes in gait and balance after use of Wii Fit exer-gaming in the elderly.

Subjects and Methods

This randomized control trial was conducted at Kulsum International Hospital during July to October 2018 after taking approval from ethical committee of the study setting. Trial was registered with Iranian registry of clinical trials with trial number IRCT20180417039344N1. The RCT followed the CONSORT Guidelines (Diagram). It began with screening the subjects initially which resulted in sample size of 90 individuals to participate in the study, who fulfilled the inclusion criteria of being stable vitally, physically independent with age 60 years and above, without any serious systemic, neurological or orthopaedic disorders. Sample size was decided according to evidence from previous literature.[13] After informed consent, the subjects were randomised into Wii Fit Group A and Exercise Group B using the concealed envelope method. The intervention-provider, the assessor and all the participants were blind to the group distribution. Both groups performed warm-up for 10 minutes before each session and 10 minutes of cool-down after the session. Group A received 30 minutes of exer-gaming twice a week for 8 weeks, while Group B was provided with a plan containing balance-training exercises twice a week for 8 weeks. These exercises included high stepping, walking sideways, tandem walk and walking with head-turns. All interventions were provided in the presence of qualified physiotherapists in a fully supported and safe environment.

The outcome was measured using the Berg Balance Scale (BBS) and the Gait Abnormality Rating Scale-Modified (GARS-M).[14,15] Participants were assessed at the baseline and post–intervention at the end of week 8. Data was analysed using SPSS 21. Parametric tests were used considering the approximate normal distribution of the means on BBS and GARS-M according to central limit theorem on having sufficiently large sample size (>30) in each group. Paired sample test was used to compare the pre- and post-intervention values. P<0.05 was considered statistically significant.

Results

Against the required sample of 100 subjects, with 50(50%) in each group, the study could enrol 90(90%) subjects, with 45(50%) in each of the two groups. Of them, 7(4.44%) dropped out, and the final sample stood at 83(92.2%), with 42(50.6%) in intervention Group A and 41(49.4%) in control Group B. The mean age in Group A was 65±3.0 and 66.5±4.6 years in Group B. There were 26(62%) males in Group A and 25(61%) Group B. The most common co-morbidity was hypertension (HTN) (Figure).

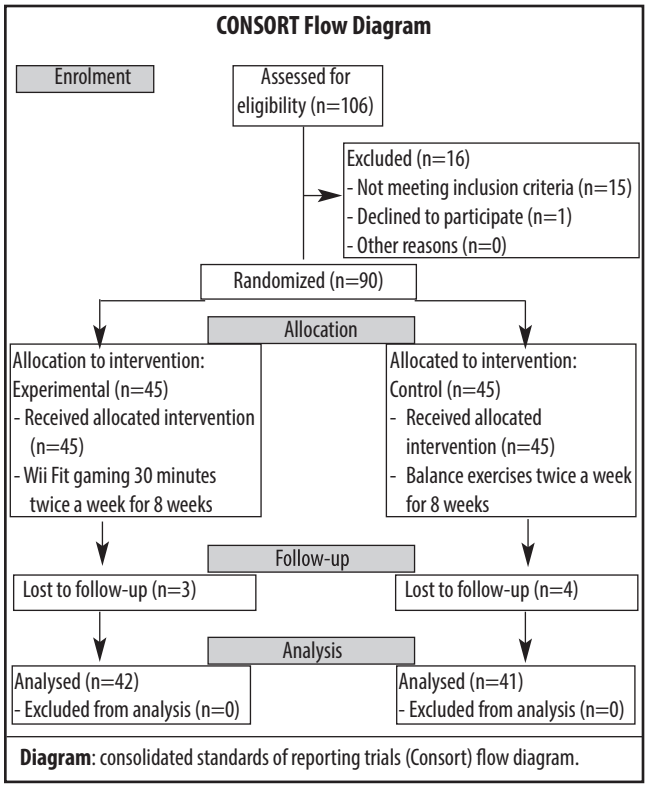

Diagram: consolidated standards of reporting trials (Consort) flow diagram.

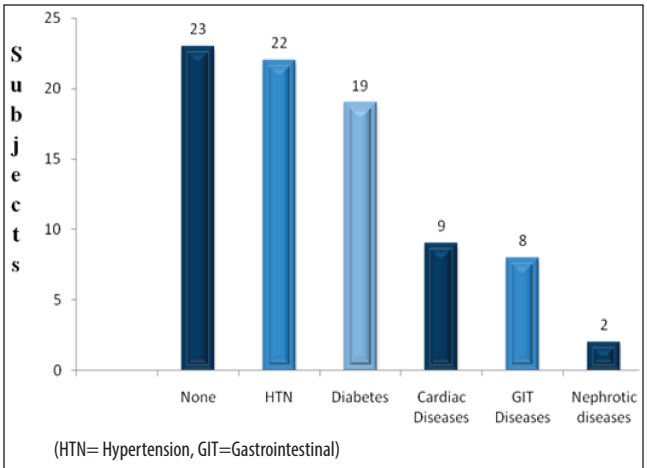

Figure: Co-morbidities.

Table-1: Trends in Berg Balance Scale (BBS) between the groups.

Group	Baseline Mean±SD	Post 8 weeks Mean±SD	*p*-value
Wii Fit	39.30±3.11	47.09±3.19[a]	0.000***
Exercise	41.65±2.18	45.65±2.35[a]	0.000***

SD: standard deviation; ***=<0.001, a: $p = 0.22$.

Table-2: Trends in Gait abnormality rating scale modified (GARS-M) between the groups.

Variable	Group	Baseline Mean±SD	Post 8 weeks Mean±SD	*p*-value
Variability	Wii Fit	1.83±0.90	0.73±0.76[a]	0.000***
	Exercise	2.02±0.72	1.50±0.63[a]	0.66
*SD: standard deviation; ***=<0.001, a: p = <0.001*				
Guardedness	Wii Fit	1.54±0.94	0.61±0.49[a]	0.000***
	Exercise	2.21±0.85	1.41±0.66[a]	0.55
*SD: standard deviation; ***=<0.001, a: p= <0.001*				
Staggering	Wii Fit	1.90±0.93	0.61±0.62[a]	0.000***
	Exercise	2.09±0.76	1.29±.74[a]	0.004
*SD: standard deviation, ***=<0.001, a: p= <0.001*				
Foot Contact	Wii Fit	2.04±.69	1.16±.90[a]	0.000***
	Exercise	1.92±0.86	1.12±.78[a]	0.000***
*SD: standard deviation; ***=<0.001, a: p= 0.81*				
Hip Range of Motion	Wii Fit	2.09±0.72	0.73±0.70[a]	0.000***
(ROM)	Exercise	2.14±0.69	1.20±0.57[a]	0.000***
*SD: standard deviation; ***=<0.001, a: p= 0.001*				
Shoulder Extension	Wii Fit	2.11±0.70	0.90±0.69[a]	0.000***
	Exercise	2.00±0.80	1.21±0.68[a]	0.000***
*SD: standard deviation; ***=<0.001, a: p= 0.41*				
Arm Heel Strike	Wii Fit	1.85±0.75	0.73±0.70[a]	0.000***
Synchrony	Exercise	2.07±0.75	1.82±0.86[a]	0.000***
*SD: standard deviation; ***=<0.001, a: p= <0.001*				

Intra-group differences from the baseline were significant ($p<0.05$) for both groups related to balance ($p<0.05$). Inter-group difference in this regard was not significant (Table 1).

In terms of gait, Group A had significant improvement in all variables ($p<0.05$), while Group B showed significant improvement except for variability and guardedness ($p>0.05$). In inter-group comparisons, Group A had significantly better outcome compared to Group B across the board except for foot contact and shoulder extension (Table 2).

Discussion

The current study showed that Wii Fit was a helpful tool to facilitate balance in the elderly, which is in line with earlier studies.[13] As significant improvement was not observed in inter-group comparison between Wii Fit and exercise groups in the current study, the possible reason could be similarity in the subjects of the two groups, same selection and recruitment and the process of managing the interventions, assessment and blinding which could have brought improvements in both groups. Interventions were given 5 times a week in earlier studies[13,16] while the current study provided interventions twice a week, as recommended in literature for the used intervention.[17] A study also signified that Wii Fit improved gait in the elderly.[13] Another study inferred that there was improvement in gait of the elderly as exer-gaming challenged the centre of mass displacement more than the exercises.[16] In the current study also, exer-gaming showed to have significant improvement in terms of gait in the elderly.

During the period of intervention in the current study, the subjects of both groups felt motivated and were continuously encouraged to perform the activities. Feedback was also given to subjects from time to time. It was observed that subjects taking Wii Fit training were more motivated than the other group. Feedback from Wii Fit games after every session also gave confidence to the participants.

The current study has limitation owing to a small sample size which was due to resource and time constraints. Also, it used BBS as a primary outcome measure which has chances of ceiling effect, especially in subjects with higher scores.

Further studies are recommended that may monitor the perceived level of exertion, and may include more sophisticated measures to assess balance and biomechanical factors to limit ceiling effects.

Conclusion

Wii fit was found to improve all components of gait except foot contact and shoulder extension in the elderly, while balance could be equally improved from Wii fit and balance training exercises.

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