Original Article

Does Wii Fit balance training improve balance and reduce fall risk in Diabetic patients as compared to balance training exercises?

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Objective: To determine the effects of Wii Fit gaming on balance deficits in diabetic subjects as compared to balance training exercises.

Methodology: This randomized control trial included 66 diabetic participants who were randomly divided into two groups; experimental (n=33) and control (n=33). After baseline assessment, experimental group received Wii fit balance training twice a week, while control group received balance exercises. Reassessment was done after 4 and 8 weeks of interventions. Five participants dropped out. Timed up and go (TUG), Berg balance scale (BBS) and Fukuda test were used as outcome measures. Statistical analysis was done by SPSS v. 21.

Results: There were 26 males and 5 females in experimental group while 19 males and 11 females in control group. Improvements throughout the 8 weeks of intervention in both groups were seen from baseline to 8 weeks; TUG: 13.6129±2.485 to 11.2258±1.874 in experimental group and 14.6000±1.792 to 11.5667±1.612 in control group, BBS: 31.484±5.772 to 39.968±8.604 in experimental group and 29.300±5.657 to 35.667±5.609 in control group, Fukuda: 39.0968±7.345 to 27.5806±6.815 in experimental group and 43.2667±5.601 to 34.9333±6.307 in control group.

Conclusion: There was no significant difference between Wii fit training and balance training exercises in improving balance among diabetic patients. (Rawal Med J 201;44:44-48).

Keywords: Diabetes, balance, Wii fit balance training, Berg balance scale.

INTRODUCTION

Diabetes causes several limitations for the subjects in physical and social activities.[1] Decreased insulin activity is consequence of lessened insulin secretion and/or decreased reaction to insulin at the receptor sites.[2] Diabetes has various complications including nephropathy, retinopathy, neuropathy, peripheral vascular disease, ischemic heart disease and cerebro-vascular disease.[3]

In diabetic neuropathy, some patients do not show any symptoms while others may have paresthesia, burning, itching or numbness in hands, arms, feet and legs.

Individuals who suffer from diabetes for more than 25 years are more prone to nerve damage.[4] Multiple factors result in neuropathy.[4,5] Damage to peripheral nerves ultimately turns out to be the main cause of balance impairments and instability in diabetic patients. The balance disturbance causes increase in postural sway even with the eye opened.[6] These patients have increased risk of falls along with balance problems such as increased body sway as compared to unaffected population.[7,8] Balance problems in the diabetic individuals may have a negative effect on an individual's mental, physical and social health.[9]

These can be rectified with successful rehabilitative treatment plan that includes motor retraining strategies, correct use of other sensory inputs, repositioning maneuvers in vestibular rehabilitation.[7] The aim of balance training is to develop balance by perturbations of musculoskeletal system that will aid neuromuscular potential of readiness and reaction. They improve proprioceptive control and balance.[10] Wii Fit is one of the latest technologies based on virtual reality that improves postural control and balance by means of various games. The games are designed to be fun

and are interactive and also provide activities for a variety of age groups. It also has built-in motivational features i.e. score keeping and video playbacks. It uses interactive video gaming that also improves the motor performance,[11] and Virtual reality has proved to be more effective in this regards.[12] The aim of this study was to assess the effects of Wii Fit training on level of balance in individuals with diabetes.

METHODOLOGY

This randomized control trial was conducted in physical therapy department of Kulsum International Hospital, Islamabad, Pakistan and included 66 patients. Inclusion criteria selected was vital stability, age 45 to 70 years, Berg Balance Score <40, absence of any systemic involvement and foot ulcers. Participants were randomly allocated into two groups by sealed envelope method; interventional group (n=33) and control group (n=33). All were blinded and prior to their enrollment in study. Demographic data and baseline measurements were done including Berg balance test, timed up and go test and Fukuda stepping test. Written Informed Consent was taken from all patients.

Berg balance Scale (BBS) consists of 14 components. The scoring is done by an ordinal scale, with scores ranging from 0 to 4 and the maximum possible score is 56. Individual with a score of 49 or below are at a high risk of falling, and each drop in one point will raise the risk of fall by 68% for scores ranging from 54 to 46.[13]

Timed Up and Go test (TUG) test is very simple balance test and is the timed adaptation of "Get-Up and Go" test. For balance assessment the individual stands up from a chair with arm rests, walks about a distance of 3 meters, turns, walks back, and sits down again in the same chair. The TUG test is reliable and valid tool for quantifying functional mobility.[13]

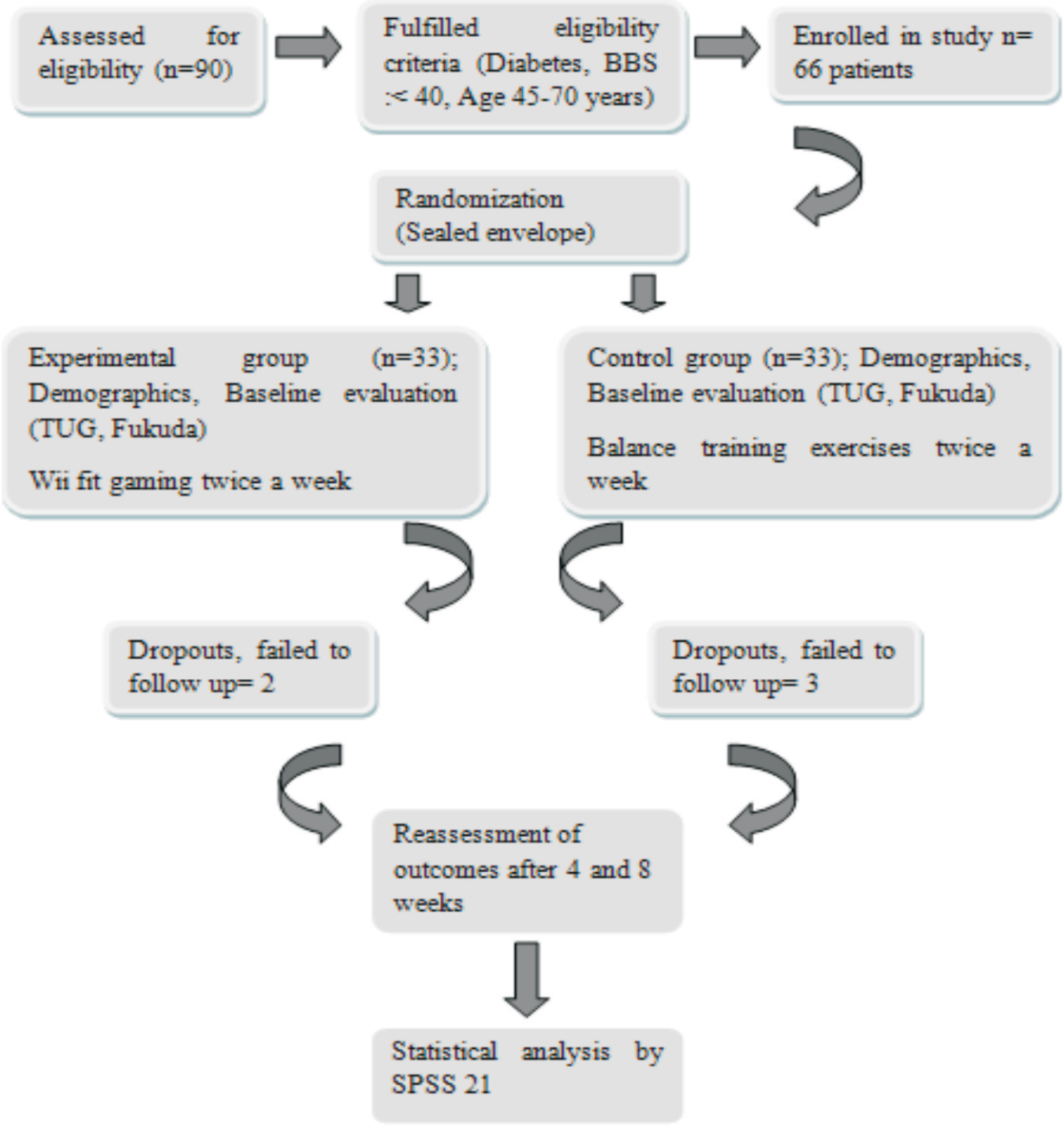
Fukuda stepping test is the ability to step in place without turning with eyes closed depends on normal vestibule-spinal and proprioceptive function. Subject is made to stand on a straight line then asked to close his eyes and start taking steps in place. After 50 steps subject is asked to stop and open eyes. Deviation from the centre is measured.[14]

Interventional group labeled as Group A; was provided with balance training through Wii Fit gaming system for 30 minutes twice a week for 8 weeks along with education regarding balance and stability. The control group was given a balance training exercise program and balance education. Fall risk according to BBS was slightly greater in experimental group (3.48±5.7) than control group (29.30±5.6). Figure 1 shows the step by step procedure of the study.

Before training, participants performed 15 minutes of warm up and stretching session, which consisted of head and neck rotations, upper and lower limb stretching exercises and walking. Environment was made sure to be safe for the participants with less interruption and fall risk prevention was also ensured. Experimental group did training via Wii fit gaming system. Control group performed activities in static and dynamic positions for 30 minutes including one leg standing, tandem standing, tandem walking, tip toe walking, walking on heels, sideway walking, one leg raise while walking, walking with raising leg and contra lateral arm.

All these activities were under supervision and guidance of physiotherapist. Reassessment was done after 4 and the 8 weeks of intervention. Data were analyzed by SPSS version 21. Repeated measures ANOVA were applied to assess longitudinal comparison for both groups at three time intervals: baseline, after 4 weeks and then after 8 weeks. Post Hoc analysis was then done to compare the post interventional results.

Figure 1. Consort Flow Diagram.



RESULTS

The study included 66 participants divided into two groups with 33 participants in each group. 5 subjects dropped out leaving 31 participants in interventional and 30 in control group. There were 26 males and 5 females in Wii fit training group (Group A) while 19 males and 11 females in balance exercise training group (Group B) (Table 1).

Table 1. Demographics.

Variable		Group A (n=31)	Group B (n=30)	Total (n=61)
Gender	Male	26 (84%)	19 (63%)	45 (74%)
	Female	05 (16%)	11 (37%)	16 (26%)
Congenital Conditions		1 (3%)	0	1 (1%)
Medical Conditions	Hypertension	8 (26%)	10 (33%)	18 (30%)
	GIT	2 (6%)	0	2 (3%)
	Nephrotic	1 (3%)	0	1 (1%)
	Cardiac	2 (6%)	1 (3%)	3 (5%)
Past Surgeries	Orthopedic	1 (3%)	2 (6%)	3 (5%)
	GIT	2 (6%)	1 (3%)	3 (5%)
	Others	4 (13%)	2 (6%)	6 (10%)
Addictions	Smoking	4 (13%)	4 (13%)	8 (13%)
	Alcohol	0	1 (3%)	1 (1%)
Allergies	Pollen	2 (6%)	1 (3%)	3 (5%)
	Chemical	0	1 (3%)	1 (1%)
Paresthesia		9 (29%)	5 (16%)	14 (22%)
Proprioception Deficits		4 (13%)	3 (10%)	7 (11%)
Traumatic Injuries		1 (3%)	2 (6%)	3 (5%)

n: number of participants, GIT: Gastrointestinal tract

Table 2. Comparison within groups from baseline to 4 and 8 weeks.

Variable		Baseline values (Mean ±SD)	4 weeks post intervention (Mean ±SD)	8 weeks post intervention (Mean ±SD)	F value	P value
TUG	**Group A (n=31)**	13.61±2.4	12.38±2.1	11.22±1.8	40.55	<0.001***
	Group B (n=30)	14.60±1.7	13.16±1.6	11.56±1.6	58.42	<0.001***
BBS	**Group A (n=31)**	31.48±5.7	36.12±5.7	39.96±8.6	763.53	<0.001***
	Group B(n=30)	29.30 ±5.6	32.43±5.5	35.66±5.6	551.67	<0.001***
Fukuda	**Group A (n=31)**	39.09±7.3	33.22±8.4	27.58±6.8	87.72	<0.001***
	Group B (n=30)	43.26±5.6	39.20±6.01	34.93±6.3	55.01	<0.001***

(***= 0.000, n= Number of participants, SD= Standard Deviation, TUG= Timed up and Go test, BBS= Berg Balance Scale, Group A= Experimental group, Group B= Control group)

Table 3. Comparison of mobility within group analysis (Paired Sample T Test).

Variable	Group	Baseline (Mean±SD)	Post 8 weeks (Mean±SD)	Mean Difference	P value
TUG	A (n=31)	13.61±2.4	11.22±1.8	2.38	<0.001***
	B (n=30)	14.60±1.7	11.56±1.6	3.03	<0.001***
BBS	A (n=31)	31.48±5.7	39.96±8.6	8.48	<0.001***
	B (n=30)	29.30±5.6	35.66±5.6	6.36	<0.001***
Fukuda	A (n=31)	39.09±7.3	27.58±6.8	11.51	<0.001***
	B (n=30)	43.26±5.6	34.93±6.3	8.33	<0.001***

SD= Standard Deviation, TUG= Timed Up & Go, BBS= Berg Balance Scale, n= Number of participants, ***= 0.000

Table 4. Comparison of mobility between group analysis (Independent Sample Test).

Variable	Group A (n=31) (Mean±SD)	Group B (n=30) (Mean±SD)	P Value
TUG	11.22±1.8	11.56±1.6	.188
BBS	39.96±8.6	35.66±5.6	.220
Fukuda	27.58±6.8	34.93±6.3	.528

SD= Standard Deviation, TUG= Timed Up & Go, BBS= Berg Balance Scale, n= Number of participants

Table 2 shows the longitudinal comparison between both groups at baseline, post 4 and 8 weeks of intervention. Timed up and go, BBS and Fukuda have improved after 8 weeks of intervention in both experimental and control group ($p<0.001$). Improvements were observed from baseline to post 8 weeks of interventions in both groups (Table 3). Independent sample test was applied for between group analysis. Table 4 shows the between group analysis post 8 weeks of Intervention.

DISCUSSION

Balance training is an important part of treatment for diabetic subjects for better quality of life, mobility status and fall prevention. We observed that balance training had positive effects on balance status of persons suffering from diabetes. Improvements were obvious in all outcome measures used for fall risk and balance. Training involving Wii Fit seemed to be more interactive and interesting for the subjects as compared to exercises.

Morrison et al found that with Wii fit gaming at home improved the balance and reduced fall risks among diabetics by improving reaction time and proprioception.[15] Our study has also shown that Wii fit can improve balance among diabetics who have medium fall risk and reduced reaction time. The type of balance training that was used in present study was supervised for both Wii fit and exercise group. Hakim et al used Wii Fit for training standing balance in community dwelling older adults and observed improvements in balance and reduction in falls.[16]

A systematic review concluded that Wii fit gaming was more effective in improving the balance status as compared to exercises.[17] Wii Fit gaming has shown improvements in balance and reduction in

fall risk in present study as well, but there has not been any significant difference observed among Wii fit and exercise training group.

There are still had gaps in research for the topic in context with long term effects of the interventions with modern tools. The study can be conducted on larger scale involving large number of subjects from variety of population. There is need to modify the games according to the condition and needs of patients, which can create a new of way to training and assessment of balance and treatment.

CONCLUSION

There was no significant difference between Wii Fit training and balance training exercises in improving balance and reducing fall risk in diabetic subjects. Subjects with Wii Fit training felt more motivated and target oriented as compared to exercise group.

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