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Exer-gaming; An Effective Way to Improve Balance Confidence and Quality of Life of Subjects with Diabetes

Kiran Khushnood[1], Sidra Qureshi[2], Nasir Sultan[3], Shafaq Altaf[4], Malik Muhammad Ali Awan[5], Riafat Mehmood[6]

[1,5]Assistant Professor, Isra University Islamabad
[2]Demonstrator / Physical therapist, Foundation University Islamabad
[3]Senior Lecturer, Shifa Tameer e Millat University.
[4]Assistant Professor, Shifa Tameer e Millat University
[6]HOD Physical Therapy, Kulsoom International Hospital

Author`s Contribution

[1]Conception and design, [3 &6]Collection and assembly of data, [5]Analysis and interpretation of the data, [1 & 2]Critical revision of the article for important intellectual content, [6]Statistical expertise [2]Final approval and guarantor of the article.

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Address of Correspondence

Sidra Qureshi
dr.sidraqureshi92@gmail.com

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A B S T R A C T

Background: Recent evidence has suggested that mental health and cognitive functions improve as the individual involves himself in routine physical exercise thus enhancing self-motivation and confidence levels.

Objective: The objective of this study was to find out the effect of Wii-Fit Exer-gaming on the confidence levels and quality of life of diabetic patients.

Methodology: A randomized controlled trial was conducted on 66 diabetic patients who fulfilled the inclusion criteria of stable vitals, 45 to 70 years of age with no serious systemic illness and diabetic ulcers scoring <40 on berg balance scale. Sealed envelope method was used to randomize the patients into two groups in the physical therapy department of Kulsum International Hospital, Pakistan. Baseline measurements and demographic data were taken including activities-specific balance confidence scale (ABC) and European Quality of Life-5 Dimensions (EQ-5D-5L) respectively. Interventional group (group A) Wii Fit based games for 30 minutes twice a week, whereas control group was provided by balance training exercises twice a week for 8 weeks. The data was analyzed through SPSS version 21.

Results: There was a significant improvement in ABC, Euro 5Q 5L components ($p \leq 0.05$) except for pain/discomfort (group A, B) and anxiety/depression (group B) ($p \geq .05$) within the group. The independent sample T test showed a significant improvement in ABC and EURO 5Q-5D-5L ($p \leq 0.05$) in the experimental group as compared to control group.

Conclusions: All subjects who participated in training with Wii Fit exer-gaming showed statistically significant improvements in balance confidence and quality of life, although clinical presentation has improved in participants of both groups.

Keywords: *Balance Confidence and Quality of Life, Exer-Gaming.*

Introduction

Exer-gaming is the gaming technology that replaces the traditional consoles of sedentary gaming into the gamer's gross motor movements hence promoting physical activity levels.[1] As, inactive and sedentary lifestyle can lead to increased risk of developing several co-morbidities such as ischemic heart disease, diabetes, and various kinds of musculoskeletal complications, Exer-gaming has been found to influence confidence levels. Its effects on positive behavior change have been reported.[2] Mental health and cognitive functions improve as the individual involves himself into routine physical exercise thus enhancing self-motivation and confidence levels. [3] Quality of life is a complex and multidimensional concept that relates to the physical, psychological and social well-being of a person.[4]

Diabetes is a debilitating condition which affects every 1 in 11 adults and Asia is the Centre of this worldwide epidemic. This condition occurs when there is the imbalance between the action of insulin in insulin-sensitive tissues and the pancreatic secretion of insulin leading to abnormal levels of blood glucose.[5] Ultimately, macro-vascular and micro-vascular complications lead to diabetic neuropathy, nephropathy, and retinopathy. Diabetes has widely been associated with lowered self-confidence, physical loss of functions and social disturbances.[6] Foot problems, balance, falls and mobility has been a serious issue for diabetic populations and these frequent falls lead to lowered balance confidence and worsen the quality of life. It is the reality that diabetes affects quality of life which is the primary goal of treatment and diagnosis for diabetic patients.[7]

We definitely know that diabetes has a strong relation with the genetic component. ([8]) But it is also evident that people who exercise routinely do improve their physical and mental health. ([9]) An entertaining way to increase the activity levels of diabetic patients is to be more active physically and mentally through exer-gaming. It includes several motor retraining strategies that have been an enjoyable activity for all age groups thereby having a potential for sustained physical participation.[10]

The exer-gaming is also known as active video-gaming includes various platforms such as the Nintendo Wii Fit. The game includes up to 40 exercises that promote strength training, aerobics and balance training. [11] The interactive functions such as thorough supervision of exercise biomechanics by trained physical therapists, self-monitoring of behavior and participation encouragement may help increase balance confidence and quality of life.[12] The goal of this study were to examine the effect of Wii Fit Exer-gaming on the confidence levels and quality of life of diabetic patients. It was hypothesized that Wii Fit Exer-gaming will have statistically significant improvement on the confidence levels and quality of life of diabetic patients.

Methodology

A randomized controlled trial was conducted on diabetic patients who fulfilled the inclusion criteria of stable vitals, 45 to 70 years of age with no serious systemic illness and diabetic ulcers scoring <40 on berg balance scale. Diabetic individuals with cardiac complications, foot ulcers and orthopedic or surgical problems were excluded from the study. The study duration was 6 months (July to December 2018). The sample size was calculated using an online calculator (clincalc.com). A total of 90 participants were screened, where, 66 were eligible and agreed to participate. 33 were randomly assigned to each group. Out of 66 participants, 5 dropped out, so 31 participants remained in interventional and 30 in controlled group. Group A (Wii fit) had 26 males and 5 females whereas group B (exercise) had 19 males and 11 females. Randomization was achieved by dividing the patients into two groups by using sealed envelope method in the physical therapy department of Kulsum International Hospital, Pakistan. (Figure 1)

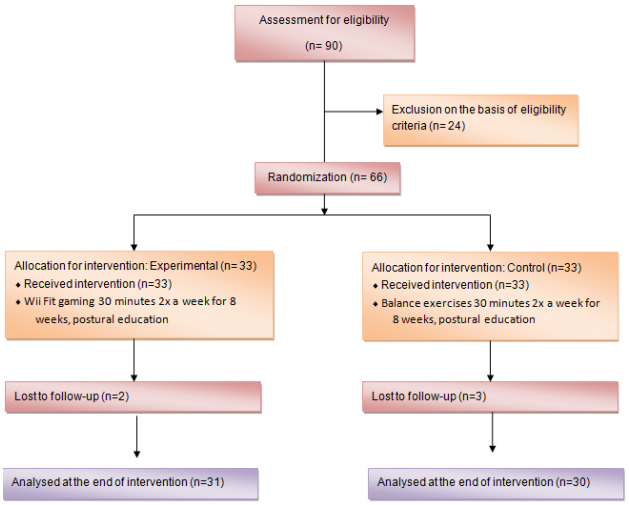

Figure 1. Consort flow diagram

Baseline measurements and demographic data were taken including tool for assessing balance confidence and quality of life i.e. activity balance confidence scale (ABC) and European Quality of Life-5 Dimensions (EQ-5D-5L) respectively. ABC is 11 point scale to measure the balance confidence of individuals while performing different activities and daily living tasks with score range from 0 (no confidence) to 100 (completely confident). The total average score is cacilated at the end from scores of all components. EQ-5D-5L has five dimensions each having five response levels: no problems (Level 1); slight; moderate; severe; and extreme problems (Level 5), and a visual analogue scale (EQ-VAS) 0 to 100 mm scale that represents the worst and the best health you can imagine, respectively.[13]

Interventional group (group A) played Wii Fit based games for 8 weeks twice a week for 30 minutes comprising of several balance games which included hula hoop, soccer heading, skiing, balance bubble and penguin slide. Control group (group B) was given balance education and balance training exercise program of 30 minutes session including static and dynamic positions (tip toe walk, walking on heels, one leg raise while walking one leg, tandem walking and standing, sideway and walking with raising leg and contra lateral arm). The patients were re-evaluated after 8 weeks of intervention. Figure 1 shows the consort diagram of the study.

The data was analyzed through SPSS version 21. Based on Shapiro-wilk test of normality, data was normally distributed (p=0.184 for ABC and p=0.10 for EQ-5D-5L), the longitudinal within group analysis was performed using paired sample test and the between-group analysis was done through independent sample test.

Results

The mean age of the participants was 55.83±1.36 in group A where mean age of males was 56.69±1.56 and mean age of female was 51.40±1.46. In group B, mean age of males was 61.89±1.48 and mean age of females was 55.72±1.85 with a combined mean age of 59.63±1.26. The descriptive of both the groups were similar at the baseline. (Table I and figure 2)

The within-group analysis of variables was performed through paired sample T test. There was a significant improvement in ABC, Euro 5Q 5L components (p= <0.05) except for pain/discomfort (group A, B) and anxiety/depression (group B) (p= >0.05). (Table II)

The independent sample T test was used for post 8 weeks' analyses between the groups which showed a significant difference. Statistical improvement was observed in balance confidence and quality of life in the group A. (Table III)

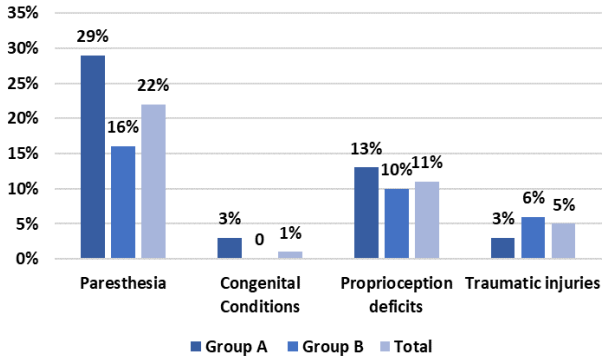

Figure 2. Descriptive of participants

Discussion

The study aimed to find the effects of Wii Fit Exer-gaming on balance confidence and quality of life of diabetic patients. After the following 8 weeks of said intervention, the balance confidence improved through Wii fit exer-gaming as compared to simple exercise regimen. It was also interpreted that Wii Fit exer-gaming significantly improved the quality of life in diabetic patients.

Renee Marie Hakim et al. conducted a case study on older adult with peripheral neuropathy using Nintendo Wii Fit training. They interpreted that exer-gaming is an effective tool to ameliorate balance confidence.[13] study also showed that Wii fit exer-gaming improves the balance confidence.

A study was conducted using Wii Fit Exer-gaming to determine its effect on fatigue and anxiety. The study concluded that Wii Fit Exer-gaming motivates an individual to exercise that leads to decreased pain levels and improved anxiety/ depression levels.[14] The current

Table I: Descriptive of the participants

Variable		Group A (Wii Fit) N (%)	Group B (exercise) N (%)	Total N (%)
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%)

Table II: Within group analysis of variables

Variable	Group	Baseline Mean ± SD	Post 8 weeks Mean ± SD	P value
ABC	Group A	84.22 ± 5.52	87.09 ± 4.01	0.000***
	Group B	86.23 ± 4.62	82.13 ± 3.03	0.000***
Euro 5Q 5L-Mobility	Group A	2.90 ± 0.70	1.64 ± 0.66	0.000***
	Group B	2.36 ± 0.61	2.33 ± 0.73	0.000***
Euro 5Q 5L- Self Care	Group A	2.06 ± 0.62	1.25 ± 0.44	0.004**
	Group B	2.06 ± 0.69	2.16 ± 0.69	0.001**
Euro 5Q 5L-Usual Activities	Group A	2.29 ± 0.64	1.35 ± 0.48	0.003**
	Group B	2.30 ± 0.59	1.86 ± 0.57	0.000***
Euro 5Q 5L-Pain/ Discomfort	Group A	1.77 ± 0.56	1.19 ± 0.40	0.054
	Group B	2.10 ± 0.54	2.23 ± 0.62	0.13
Euro 5Q 5L-Anxiety/ Depression	Group A	2.09 ± 0.65	1.32 ± 0.47	0.002**
	Group B	2.00 ± 0.45	2.13 ± 0.57	0.096
Euro 5Q 5L-Visual Analogue Scale	Group A	76.12 ± 7.15	84.83 ± 6.51	0.000***
	Group B	75.83 ± 4.74	80.33 ± 3.92	0.000***

SD= standard deviation, *** p-value ≤ 0.001 ** p-value ≤ 0.05
ABC= Activities-specific balance confidence scale
Euro-5Q-5L= European Quality of Life-5 Dimensions-5 Levels
Group A= Wii Fit/ Experimental group
Group B= Exercise/ Control group

study supports the results of previous study with improved levels of VAS, euro 5Q5L- pain/ discomfort and euro 5Q5L- anxiety/ depression.

A study was conducted by Franco et al. to investigate the effects of Wii Fit on quality of life which contradicted the results of current study concluding that Wii Fit exer-gaming does not have any statistically significant impact in quality of life. [15]

The study was limited in a fact that gender distribution in both group was not equal that could cause gender bias in the results. Also, only short-term effects of exer-gaming on balance confidence and quality of life was interpreted on a small sample size. It is recommended to conduct the study with equal distribution of gender in both groups, increase the time span and sample size so that exer-gaming can be incorporated in daily routine activity and training.

Table III: Post-intervention between group analyses of variables

Variable	Exercise (Mean ± SD)	Wii Fit (Mean ± SD)	P value
ABC	82.13 ± 3.03	87.09 ± 4.01	0.000***
Euro 5Q 5L-Mobility	2.13 ± 0.73	1.64 ± 0.66	0.008**
Euro 5Q 5L-Self care	2.16 ± 0.69	1.25 ± 0.44	0.000***
Euro 5Q 5L-Usual activities	1.86 ± 0.57	1.35 ± 0.48	0.000***
Euro 5Q 5L-Pain/ discomfort	2.33 ± 0.62	1.19 ± 0.40	0.000***
Euro 5Q 5L-Anxiety/ depression	2.13 ± 0.57	1.32 ± 0.47	0.000***
Euro 5Q 5L-Visual Analogue Scale	80.33 ± 3.92	84.83 ± 6.51	0.002**

SD= standard deviation, *** p-value= <0.001 ** P-value ≤ 0.05
ABC= Activities-specific balance confidence scale
Euro-5Q-5L= European Quality of Life-5 Dimensions-5 Levels
Group A= Wii Fit/ Experimental group
Group B= Exercise/ Control group

Conclusion

All subjects who participated in training with the Wii Fit exer-gaming showed statistically significant improvements in balance confidence and quality of life, although clinical presentation has improved in participants of both groups. Given the potential positive impact that the exer-gaming has on balance confidence and quality of life, physical therapists may want to incorporate these activities as part of a rehabilitation program.

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