

Use of a Commercially Available Gaming System Console to Improve Functional Fitness in Older Adults: Nintendo Wii Active

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Abstract. To determine if the Wii Active exergame can improve older adults functional fitness (FF) and balance, compared to a Wii Fit exergame program, traditional exercise program (TRAD), and control group (CON). Interventions were 8 weeks. Wii groups trained using their corresponding exergame, TRAD in traditional classes, and CON did not alter daily activities. No differences were noted in pre measurements of FF and balance. Results were evaluated using qualitative comparisons. With respect to FF, TRAD exhibited the largest change, followed by Wii Active and little change by Wii Fit. With respect to balance, both Wii groups exhibited similar large changes. Wii Active appears to be as effective as TRAD for balance and more effective than Wii Fit for FF.

1. Introduction

Technological advancements have reached virtually every aspect of life. Medicine has been a prime beneficiary of recent technological advancements. With new and progressive thinking, research is beginning to look into untapped resources of technology to help further medicine to unforeseen heights. With the rapidly increasing older adult population, societal attention is being focused on keeping the elderly safe and healthy. As a person ages they often become less active which commonly results in a loss of balance and general decrease in fitness. As a result, more falls and accidental injuries are seen within this population. An increase in balance and strengthening should help decrease the amount of injuries seen in this population. The goal of this study is to determine if the Nintendo Wii Active ® will improve functional fitness levels (muscle strength, cardio-respiratory endurance, flexibility, and balance) as evaluated by a secondary analysis of existing data from three groups: Wii Fit programming, a traditional exercise program, and a control group. Several exercises that are available on the Wii Active® are easily translated, if not directly related, to functional activities. While a limited number of studies are published concerning the functional validity of the Nintendo Wii ®, one study concluded that improvements were seen in both the impairment and functional levels when used with a patient with cerebral palsy¹. It is hypothesized that training with Nintendo Wii Active® will increase all levels of functional fitness in the older adult when compared to the traditional and control groups. With respect to the Wii Fit group, it is hypothesized that

the Wii Active balance measures will increase similarly. However, due to the use of elastic resistance bands, the Wii Active group will result in greater upper body strength improvements.

2. Experiment, Results, Discussion, and Significance

Subjects: Ten community dwelling older adults (6 females and 4 males) responded to program advertisements and participated in the study. All participants from existing data (Wii Fit (n=4), TRAD (n=4) and CON (n=4)) were female. Participants were screened using the EASY (Exercise And Screening for You) screening tool to ensure the absence of preexisting conditions that would prevent them from safely completing the exercise protocol. In addition Nintendo, the maker of the gaming console, suggests those with pacemakers, Parkinson's disease, stroke, epilepsy, and motion sickness consult with a physician before using the software. All ten participants recruited for participation were cleared to participate.

Instruments: The study intervention utilized the Nintendo Wii gaming console, Electronic Arts Wii Active software, Nintendo Sports Wii software, and the Nintendo Wii Balance Board. Improvement in balance was evaluated (pre/post design) with the Basic Balance Master by Neurocom. The Balance Master Limits of Stability (LOS) assessment obtained the maximum distance a participant could lean in 4 directions without falling or reaching for assistance. Data collected included: End Point Excursion (EPE), Maximum Excursion (MXE), Movement Velocity (MVL), Directional Control (DCL) and Reaction Time (RTO). Functional fitness improvement was evaluated for four measures: 30 sec chair stand, 30 sec arm curl, 8-foot up and go, and a 12 min walk. General measures of height, weight, body mass index, and daily step rates were also assessed.

Procedures: This eight week intervention utilized the Nintendo Wii, Wii Active software, and Wii Balance Board. The exercise sessions took place twice a week at the Downtown Senior Center. Each classroom was set up with one television and one Wii console. One classroom served as the balance room where each participant completed a set of Wii Active balance exercises. Participants completed exercises that were sports themed and targeted improving the

individual's balance. In the second classroom, participants worked out two at a time on exercises targeting cardiovascular training, upper body strength and flexibility, lower body strength and flexibility, and balance and coordination. In both classrooms the exercise protocols were led by on screen instructors. The on screen instructors demonstrated each exercise in a video format and controlled the pace of the exercise regimen. In addition to on screen instructors researchers were in each classroom to provide safety and help in clarifying instructions when necessary. A familiarization process was used before the exercise sessions began in order to allow the participants a chance to experience the software and exercises.

Data Analysis and Results: Two females and two males (overall average 75 ± 8 years) trained using the Wii Active exergame and were compared to 4 females (71 ± 8 years) trained on the Wii Fit Exergame, 4 females (71 ± 8 years) trained in a traditional physical activity program, and 4 females serving as a control group (75 ± 1 year). Due to the small sample size, quantitative analysis would yield little meaningful information and results were evaluated using qualitative comparison. Percent change was calculated and group change was compared. With respect to functional fitness, TRAD exhibited the largest change with the largest changes being in strength and daily step improvement. The Wii Active group outperformed Wii Fit by approximately 10% on the two strength measures and was equal on measures of mobility (Up & Go and 12 min walk). Wii Fit matched the TRAD and outperformed Wii Active on daily steps increases. With respect to balance, Wii Active and Wii Fit exhibited similar large changes compared to TRAD and on some measures exceed the traditional group. Examining individual balance measures Wii Active, Wii Fit, and TRAD exhibited similar changes, although the two Wii groups exhibited greater change during the left movement. In general Wii Active, Wii Fit, and TRAD exhibited similar changes on MVL measures with the two Wii groups showing greater improvement to the left. Wii Active, Wii Fit, and

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TRAD exhibited similar changes on EPE and MXE measures with the greatest improvements in the front and back movements. Wii Active, Wii Fit, and TRAD exhibited similar changes on DCL except for the back, and most difficult movement. The two Wii groups exhibited superior performance on DCL during the back movement.

Discussion: While further research is needed in this area, this study indicates that benefits can be obtained from using a commercially available exergame. Additional research, in which the participants exercise more frequently or for longer duration may provide additional insight into the benefits that may be possible using exergames. Attitudes and beliefs of older populations toward the use of exergames would also be warranted to discover whether they are a viable option for use by this population.

Limitations: The results of this study are limited as the sample size did not include enough participants to permit quantitative analysis. In addition, male and female Wii Active data were combined and compared to all female data. Independent samples t-tests indicated no difference between males and females except for height, weight, and BMI. Impact of male/female differences was also limited by normalizing data when evaluating relative change in lieu of raw data. Small sample size and the mixed gender group is a result of recruitment and retention difficulties for Wii interventions. Attrition rate for Wii Active was 60%. Although limited, results of this study are useful in determining trends and potentials for larger scale studies.

3. Conclusions

Results of this study suggest that future research is warranted and with a larger sample size significant differences would be expected. Moreover, it appears that the Wii Active exergame could be used as an effective tool for improving balance in healthy, older adults. The use of exergames to improve the FF and balance of older adults may be especially applicable to regions such as western Kansas where there are limited medical resources and little availability of structured exercise programs.

¹Deutsch JE, Borbely M, Filler J, Huhn K & Guarrera-Bowlby P. "Use of a low-cost, commercially available gaming console (wii) for rehabilitation of an adolescent with cerebral palsy". *Physical Therapy* 2008 Oct; 88(10): 1196-1207.