

# Exergaming Intervention for Sedentary Middle-Aged Adults Improves Lower Extremity Functional Fitness and Quality of Life

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## Abstract

Interactive video game technology, known as exergaming, has been extensively utilized in rehabilitative settings. This technology may help increase self-efficacy, which could promote physical activity and functional fitness. The purpose of this study was to compare functional fitness and self-efficacy in relationship to exercise tests and self-reported questionnaires. Middle-aged sedentary men and women (n=12) completed functional fitness tests and self-efficacy questionnaires before and after engaging in self-selected, low to moderate-intensity exergaming for 20 min/3d/wk for eight weeks. Exercise using interactive video game technology increased functional fitness after exergaming as measured by 30-second Sit-To-Stand repetitions (14.2 - 16.8,  $p < 0.05$ ). All participants reported with 100% confidence they would continue to exercise if an interactive video game system was available. Exergaming improved lower extremity functional strength and endurance in sedentary middle-aged adults as well as their confidence to continue exercising.

## Background

Regular participation in physical activity is one of the most effective ways to prevent obesity, cardiovascular disease and other morbidities[1] as well as improve quality of life and increase functional independence in middle-aged adults with and without disabilities[2]. In order to implement this behavior change, alternative, innovative, long-term, economically feasible interventions and therapeutic approaches are needed. Interactive video game systems controlled through arm gestures and body motions are becoming increasingly popular and widely promoted. One such commercially-available and relatively inexpensive platform is the Nintendo Wii® originally released in 2006. The Wii introduced a novel style of active gameplay by using wireless controllers that interact with players through a motion-detection system. The potential advantages of utilizing the Wii therapeutically was first reported in 2007[3]. The proposed benefits included improving post-stroke patients' fine and gross motor co-ordination, balance, and strength. Indeed, the term "Wii-habilitation" is used in the literature to describe the benefits of the Wii system during patient rehabilitation[4]. Theoretically, if the exercise intensity reached while playing the Wii is moderate, such participation has the potential of meeting the physical activity guidelines established by the American College of Sports Medicine[5]

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## Objectives

To measure the changes attributable to Wii game play in participant:

- Functional fitness (Sit-To-Stand Repetitions)
- General health (SF-36 Health Survey)
- Exercise intensity level (% age-predicted max heart rate)

## Nintendo Wii Exercises

Mode	Options
Aerobic	Hula Hoop, Basic Step, Synchronized Running, Rhythmic Boxing
Strength	Push-up, Side Plank, Front Lunge, Triceps Extension, Leg Raise
Balance	Table Tilt, Penguin Slide, Soccer Heading, Ski Slalom/Jump
Yoga	Palm Tree, Warrior, Downward-Facing Dog, Triangle, Roman Chair

## Methods

- 12 sedentary adults, 50-64 years old, recruited locally
- 24 exercise visits (20 min/visit, 3 visits/wk) over 8 weeks
- Pre- and post-study tests and questionnaires
- SAS Statistical Suite version 9.1
- Frequencies computed for nominal, Likert-style variables
- Means and standard deviations computed for all scale data
- Two-way ANOVA and paired samples t-test (two-tailed)

## Subject Demographics

Age (years) 2 Males, 10 Females	56.6 ± 3.6
Height (cm)	160.0 ± 46.2
Weight (kg) pre-study	79.2 ± 19.1
Weight (kg) post-study	79.1 ± 19.2
Fat Mass (kg) pre-study	31.5 ± 10.0
Fat Mass (kg) post-study	31.6 ± 11.4
Fat Mass % pre-study	39.6 ± 7.7
Fat Mass % post-study	39.5 ± 7.9
Ethnicity	
Caucasian	10
African American	1
Asian	1

Values expressed as Mean ± SD.

## Results

Figure 1. Sit-To-Stand Repetitions

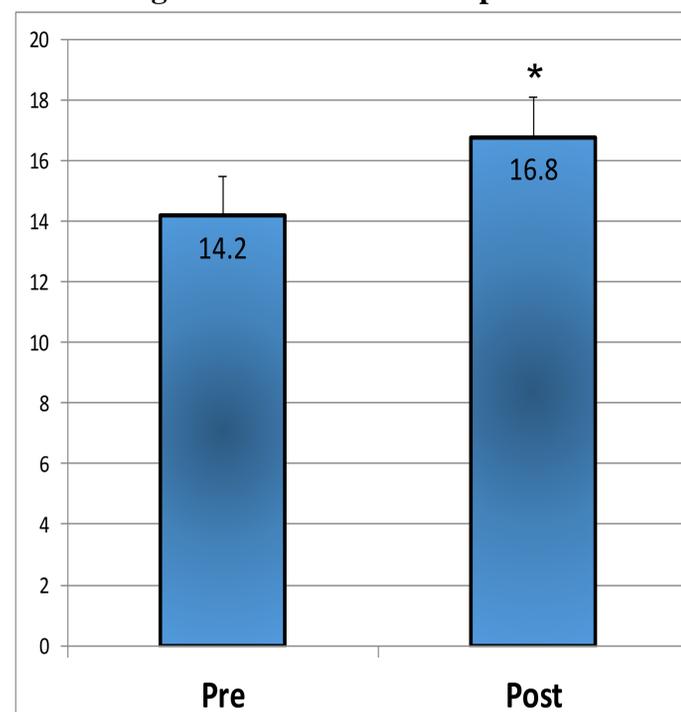


Figure 1: STS before and after Nintendo Wii Exergaming. Paired t-tests were performed on values between time points. \* Post-exergaming values were significantly different than pre-exergaming values,  $p < 0.05$ .

Figure 2. Heart Rate

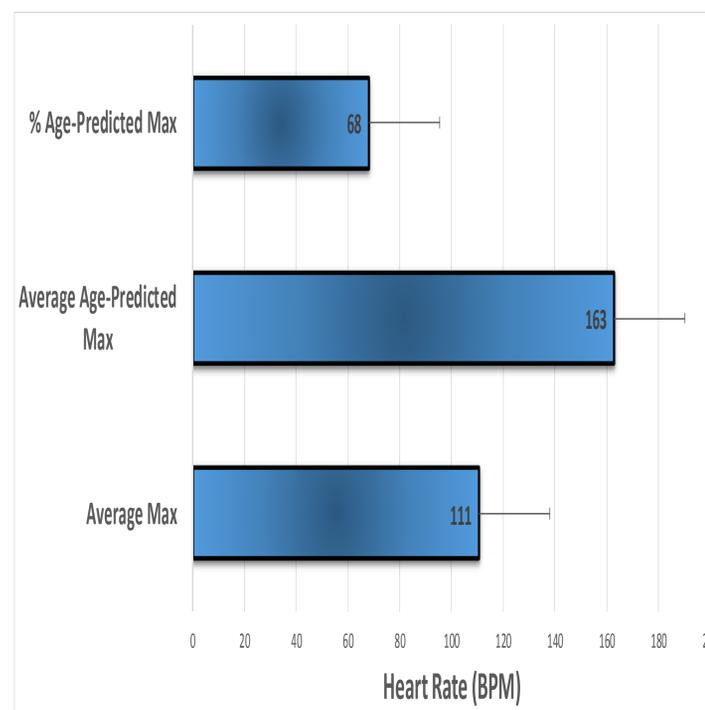


Figure 2: Heart Rate during Nintendo Wii Exergaming. All values meet ACSM guidelines for moderate-intensity exercise.

## Results

Figure 3. SF-36 Physical Functioning

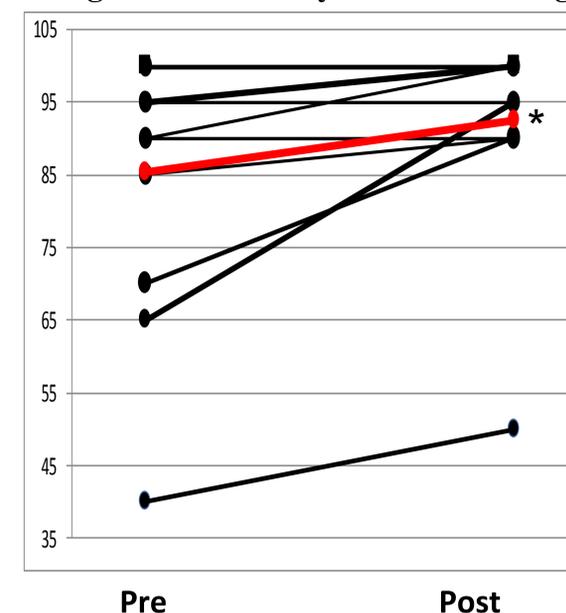


Figure 3: SF-36 Physical Functioning Scores before and after Nintendo Wii Exergaming. Paired t-tests were performed on values between time points. Trendline, \*  $p < 0.08$ .

## Discussion

While the SF-36 PF score merely approached statistical significance, this could be due to the limited number of participants. A larger sample size may have resulted in a stronger outcome.

Yoga, strength, balance, and aerobic training have all been found to reduce fatigue, increase fitness levels, and improve quality of life. Nintendo Wii could minimize aging-related barriers to physical activity by enabling individuals to exercise in their homes. Perhaps most importantly, exercising on the Wii may be fun which can result in higher intensities and provide distraction or relief from daily problems and stress, and help foster intrinsic motivation to promote routine physical activity.

## Conclusion

Exergaming improved lower extremity functional strength and non-vestibular balance, as well as participants' confidence in their ability to perform transitional movements, thereby potentially reducing the risk for falls and consequently improving the quality of life in middle-aged adults. Additionally, Nintendo Wii game play elicited a voluntary moderate-intensity exercise level in previously sedentary study participants. Interactive video game systems should be considered a viable option for convenient, enjoyable, in-home exercise programs to assist individuals in meeting ACSM physical activity guidelines.