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LETTER TO THE EDITOR

Exercise with active video game or strength/balance training? Case reports comparing postural balance of older women

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Introduction

It is established that physical exercise improves physical capabilities of older adults. The American College of Sports Medicine recommends aerobic, strength and endurance, stretching and balance exercises to maintain physical function [1]. Currently, exercise with active videogames (exergames) has been shown as an effective additional training method to improve physical capabilities and other outcomes in different populations [2]. Bock et al. [3] have recently showed an improvement on biomarkers (e. g. HbA1c and lipid profile) of people engaged in an exergame intervention compared to traditional exercise (e.g. treadmill). However, comparisons among traditional exercise methods and exergames are unusual, which does not allow us affirming that this new intervention is equivalent to the already-known methods. To our knowledge, there is no study comparing the effects of exergames and strength training on the physical function of older adults. Therefore, this study aimed to analyze the effect of exergames and strength/balance training on postural balance of older women. Our hypothesis is that exergames may improve postural balance similarly to strength training.

Methods

This research was conducted from October 2016 to July 2017. It is in accordance with rules to perform researchers with humans and was approved by the Ethical Committee of the State University of Montes Claros (1.365.041/2015). Eleven older women who met the inclusion criteria: aged 60 years, preserved communication ability, and independent ambulation and the exclusion criteria: utilization of psychotropic medication, cognitive impairment, and acute musculoskeletal injury participated of this study. Participants were allocated through a random sheet into two groups: strength/balance (SBG, $n = 5$) and virtual reality-based exercise (EXG, $n = 6$). They performed 24 sessions, twice a week, 30–45 min each. Intensity was prescribed according to rated perceived exertion (5–6 points, moderate) as recommended by ACSM [1].

SBG performed upper and lower limb exercises comprising 3×15 repetitions of rowing squat and 3×10 repetitions of lunge, squat on trampoline, lat pull down, and shoulder adduction combined with elbow extension at high pulley.

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EXG performed exercises with virtual reality using the Nintendo Wii® and its platform Wii Balance Board®. The following games were used: rowing squat (3 × 15 repetitions), in line lunge (3 × 10 repetitions), table tilt (01 set until the end of game), sword play duel and sword play showdown (01 set until the end of game). Muscle actions of these exercises were chosen to equalize both groups.

Wii Balance Board was used to record the center of pressure (CoP) coordinates from postural balance. Procedures were adopted as described previously [4]. Mean velocity (MV, cm/s) and elliptical area (EA, cm^2) were calculated from CoP coordinates. Descriptions (means, standard deviation) were used to summarize mean velocity (MV) and elliptical area (EA) with open (OE) and closed eyes (CE) of each group.

Difference (Δ) between pre- and post-training outcomes was calculated. Mann–Whitney *U* test ($p \leq 0.05$) was used to compare data. Effect size was applied (Cohen's *d*) within and between groups. Cohen's *d* classification followed recommendations according to Hopkins (https://www.sportsci.org/resource/stats/). Analyses were conducted in Matlab®.

Results

Age, body mass and height were not different between groups ($p > 0.05$). After 24 sessions, postural balance was not different between groups ($p > 0.05$). EXG showed a smallest decreasing on MV (OE) (mean Δ = −0.80), while SBG increased this outcome (mean Δ = 0.30). However, MV (CE) increased in both groups (EXG, mean Δ = 0.45; SBG, Δ = 0.60). EA (OE) was reduced in EXG (mean Δ = −0.28). On the other hand, this outcome increased in SBG (mean Δ = 0.53) resulting in a worse postural control compared to EXG. Results of EA (CE) were also reduced in EXG (mean Δ = −0.07), which was in line with the improvement on postural balance control. Conversely, there was an increasing of this outcome in SBG (mean Δ = 0.55). Effect size was slightly better in EXG than in SBG (Online Appendix 1). EXG reduced EA (OE) (small effect) while SBG increased this outcome (small effect).

Discussion

EXG showed a similar postural balance performance related to SBG at the end of the 24 sessions. According to the effect size, the reduction of the EA of oscillation in EXG was −0.40 and −0.24 (Cohen's *d*) with OE and CE, respectively. These findings present not only equivalent perspectives but rather a slight superiority of EXG compared to strength/balance training. This result is related only to postural balance, thus, we cannot infer any improvement in other outcomes.

Cognitive and motor capabilities play an important role in functional autonomy. Hence, interventions with virtual reality-based exercise may improve older people's functionality. Interface provided through body movement and virtual environment interaction stimulates spatial–temporal orientation, spatial navigation, memory and executive functions [5]. Specific neural circuitry associated with cognition and sensory–motor integration (fronto-parietal circuitry) may be activated during this type of task, which may increase the ability to spatial perception, thus improving postural control [5]. Furthermore, the interaction between the user and the active videogame requires simultaneous physical and cognitive abilities (dual task), which is associated with better functional autonomy of older adults [5].

Improvements on postural balance and gait are probably related to better sensory–motor integration due to required coordinated movements and executive functions in the activities provided by exergames [5]. In this context, whether physical exercise is recommended to improve physical capabilities of older adults [1], our findings show that virtual reality-based exercise is equivalent (or better than) to strength/balance exercises to improve postural balance. Specifically, it is possible to infer that this new kind of intervention could be part of an active routine of older people, especially if the aim is to increase postural balance. Although many studies have shown that older adults undergoing interventions with exergames had improved postural balance, up to now, there is no comparison of this intervention with other traditional exercise methods related to it.

Although this study has a small sample, it provides useful information (e.g. effect size) to allow future sample size calculation to reach statistical power to detect significant difference between interventions.

In conclusion, virtual reality-based exercise showed a slightly better clinical effect on postural balance of older women than strength/balance training. Nevertheless, these data are preliminary outcomes from a small sample and should be replicated. This intervention may be used in future investigation with a large sample size to confirm its effectiveness.

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Compliance with ethical standards

Conflict of interest Authors declare no conflict of interest.

Statement of human and animal rights All procedures performed in studies involving human participants were in accordance with the ethical standards of the Ethical Committee of the State University of Montes Claros (1.365.041/2015) and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent All participants signed an informed consent to participate in this research.

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