



The effect of dual task and executive training on pattern of gait in older adults with balance impairment: A Randomized controlled trial



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ABSTRACT

Objective: The purpose of this study was to compare the effect of two different approaches of dual-task training and executive training on pattern of gait in older adults with balance impairment.

Methods: Thirty older adults with the mean age of 73.8 participated in the study. They scored 52 or less on the Berg Balance Scale (BBS), and walked with a self-selected gait speed of 1.1 m/s or less. Participants were randomly assigned to one of the three groups: experimental group one (cognitive dual-task (CDT) training) that focused on gait performance under dual task condition; experimental group two (executive function (EF) training) who underwent 3 types of training on working memory, inhibition, speed of processing; and a control group. Subjects walked 10 m, under single-task and dual-task (DT) conditions where kinematics parameters were recorded. Participants in experimental groups received 45-min training sessions, 3 times a week for 8 weeks. The data obtained was analyzed using repeated measure at a criterion *p*-value of 0.05.

Results: The results showed that after training, changes of walking speed, length of stride and step, times of stride, step, single support, and double support, were significant at $p < 0.05$. Asymmetry index in walking with dual task condition increased significantly, but after training asymmetry in DT condition decreased significantly in EF group.

Conclusions: Both training groups showed improvements in gait parameters in the post test compared with that in the control group; however, in EF training group, symmetry of limbs and inter-coordination, improved more than that in CDT group.

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1. Introduction

Maintaining balance and preserving the rhythm and stability needed for walking requires a complex system of control that is able to adapt to internal and external changes. Aging is associated with many physiological changes of the different sensory systems. Alterations of sensory and motor functions and of their central processing are not the only causes of age-related balance impairment, as cognitive aging is also an important factor (Borel & Alescio-Lautier, 2014).

The growing body of literature on motor dual-task (DT) effects has inspired a few recent investigations of dual-task training as a means to improve gait and balance. DT training has proved more

effective in improving dual-task motor performance than has single-task training (Silsupadol et al., 2009). The first studies on the subject (Silsupadol et al., 2009; Silsupadol, Siu, Shumway-Cook, & Woollacott, 2006; Vaillant et al., 2006; You et al., 2009), showed positive effects of DT interventions on physical functioning. Following that, the results of the included DT studies did not allow defining a training methodology with great effectiveness to improve physical functioning. Moreover the obtained results did not explicitly confirm functional improvements in motor-cognitive DT situations (Shigematsu et al., 2008a; Shigematsu, Okura, Sakai, & Rantanen, 2008b) or the influence of the task characteristics of the cognitive task on motor-cognitive DT performance. Results were mixed with regard to positive effects of cognitive, motor or motor-cognitive DT performance.

On the other hand, cognitive interventions have been shown to improve attention and executive functions as well as memory in seniors (Klusmann et al., 2010; Willis et al., 2006). Executive function (EF) refers to a set of higher order cognitive processes that control, integrate, organize and maintain other cognitive abilities

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