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Postural balance and falls in elderly nursing home residents enrolled in a ballroom dancing program

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ABSTRACT

The aim of this study was to investigate the influence of a ballroom dancing program on the postural balance of institutionalized elderly residents. The sample consisted of 59 sedentary elderly residents of long-stay institutions who were randomly assigned to a ballroom dancing experimental group (EG, $n = 30$) or a control group (CG, $n = 29$). The ballroom dancing program consisted of three 50-min sessions each week on alternate days over a 12-week period. The dances included the foxtrot, waltz, rumba, swing, samba and bolero. The medical records of the subjects were reviewed to determine the number of falls they experienced in the three months prior to the intervention. Postural static balance was assessed using a Lizard (Med. EU., Italy, 2010) stabilometric and posturometric platform. Only patients in the EG lost a significant amount of weight ($\Delta = -2.85$ kg) when comparing the pre- and post-test postural balance assessments. The intergroup comparison revealed a reduced lower limb weight distribution difference in the EG post-test compared to the CG post-test ($p = 0.012$). In the intragroup comparison, the EG patients experienced significantly fewer falls post-test relative to pre-test ($p < 0.0001$). This improvement was not observed for patients in the CG. In the intergroup analysis, we observed fewer falls in the EG post-test compared to the CG post-test ($p < 0.0001$). Therefore it was conclude that sedentary elderly people living in long-term institutions can improve their balance via a ballroom dancing program. This activity improved balance and reduced the number of falls in this elderly population.

1. Introduction

As part of the aging process, elderly patients undergo physical changes, particularly with respect to postural control, including vestibular, visual, somatosensory, musculoskeletal and central nervous systems alterations. These changes may alter their ability to maintain postural control, in turn affecting their activities of daily living (ADL) (Caixeta, Doná, & Gazzola, 2012). Musculoskeletal system components are responsible for joint range of motion, flexibility, muscle strength, balance and biomechanical relationships between body parts (Silva et al., 2010).

Aging must be assessed from the chronological, biological, psychic, social and functional standpoints (Lax, 2001). With advancing age, musculoskeletal capacity declines, promoting the loss of muscle mass and strength (Vale et al., 2009) and diminished nervous system and cardiopulmonary function (Evans et al., 2010). In terms of gait and balance patterns, losses in aerobic capacity and physical activity levels may compromise functional capacity in the elderly (Chien, Kuo, & Wu, 2010; de Noronha Ribeiro Daniel et al., 2011). These alterations affect the vestibular, visual and proprioceptive systems, all of which are associated with decreased postural balance in the elderly. Balance and gait changes are common in this population and may occur due to dysfunctions in the locomotor apparatus and the sensory system (Christofoletti et al., 2008). In this regard, postural instability is the result of factors that involve several organic systems in the aging process that in turn favor falls and pose a growing problem for the elderly (Alves Júnior & Paula, 2008).

For various reasons, seniors living in long-stay institutions (institutionalized) are more vulnerable to family, social and economic issues than are elderly individuals living with family

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and/or in their own homes in the community. Often, institutionalized elderly patients have fewer opportunities to independently participate in activities and tasks of daily living (e.g., domestic or recreational). Thus, many elderly residents fail to participate in physical activities that could minimize and/or alleviate the deleterious effects of aging (Tolocka and Oliveira, 2009).

Dance is a physical activity with various characteristics that benefit one's health and social relations because it is practiced in a group. This recreational activity is one of the health interventions used in individuals of advanced age (Sofianidis, Hatzitaki, Douka, & Grouios, 2009). Generally speaking, dance is the art of moving the body according to certain relationships between time and space as established by rhythm and choreography (Brown, McGuire, & Voelkl, 2008).

In this sense, ballroom dancing is a stimulating activity that promotes social integration and generates progressive harmonious movements (Allen & Irish, 2003; Borstel & Lerman, 2006; Houston, 2005).

The regular practice of ballroom dancing can be implemented in long-stay institutions (Borges et al., 2012). Engaging in physical activities during free time at these institutions increases the self-esteem and social participation of the elderly. Thus, as a physical activity, dance helps to preserve the independence of the individual by leading to fewer falls and maintaining muscle strength, support, balance, aerobic power, total body movements and lifestyle changes in the elderly. This activity may minimize the adverse effects of aging on the human body (Kattenstroth, Kolankowska, Kalisch, & Dinse, 2010). Eyigor, Karapolat, Durmaz, Ibisoglu, and Cakir (2009) observed that 8-week folklore dance improved the balance in older women. Hackney and Earhart (2009) verified that 13-week Tango and Waltz/Foxtrot dance improved the balance and walking. However, it is not very clear about the effects of ballroom dance on postural balance and preventing falls in the institutionalized elderly individuals.

Accordingly, the aim of the present study was to assess the effects of a ballroom dancing program on the postural balance and incidence of falls in the elderly residents of a long-stay institution.

2. Methods

2.1. Sample

A total of 150 elderly residents of long-stay institutions in Rio de Janeiro state, Brazil, were invited to participate in the study. The individuals were functionally autonomous in ADL and had not engaged in any regular physical activity for at least three months.

The exclusion criteria included any condition that could prevent a participant from undergoing tests or interventions, such as cardiopathy, hypertension, uncontrolled asthmatic bronchitis, osteoarthritis, recent fracture, tendinitis, neurological problems and severe obesity, as well as the use of a pros thesis or medication that could cause attention disorders. The elderly with cognitive impairment, especially memory function, were excluded, to carry out the required assessment about falls in the study.

After applying the inclusion and exclusion criteria, the 62 elderly patients selected were randomly allocated by simple draw to two groups: the EG, which underwent a ballroom dancing program, and the CG. However, there was sampling loss because of falls suffered by three of the subjects, which precluded their completion of the study. Thus, the final sample comprised 30 individuals in the EG (age, 68 ± 8.33 years; body mass index – BMI, 24.63 ± 3.28 kg/m^2) and 29 in the CG (age, 67 ± 7.70 years; BMI, 25.84 ± 5.22 kg/m^2).

The study was approved by the Human Research Ethics Committee of Castelo Branco University (protocol no. 0042/2009), in accordance with guidelines established by the Declaration of Helsinki (WMA, 2008).

2.2. Data collection procedures

A 150-kg capacity/100-g resolution Filizola (Brazil) mechanical scale equipped with a stadiometer was used to measure the body mass and height following the International Society for the Advancement of Kinanthropometry protocol (Marfell-Jones, Olds, Stewart, & Carter, 2006).

The subjects' medical records were reviewed to determine the number of falls in the six months prior to the intervention. The number of falls during the experimental period was also recorded.

Fall assessment: The information about the number of falls was obtained from interviews performed in the last six months before the intervention period and at the end of the study. The information about the amount of falls obtained in the interview was confirmed with medical records to avoid memory bias. A fall was defined as any unintentional movement of the body to a level below the initial position with an inability to fix it in a timely manner, as determined by multifactorial circumstances that might compromise the body's stability (Pereira et al., 2002).

Postural balance was assessed using a Lizard (Med. EU, Italy) stabilometric and posturometric platform.

The human body oscillates constantly to remain as close as possible to an ideal center of gravity, which is visualized as a load in kilograms (kg) varying continuously over the six support points of the foot. The width of the area encompassed by the projection toward the center of gravity, the direction of oscillation, the velocity and the distance from the ideal center of gravity have specific significance related to muscle tonus, the somatosensory system and receptor efficiency. The platform works via load cells that instantly record any weight change and convert the analog signal before sending it to a computer, which organizes and renders the data legible. The current is low, and the signal is amplified and operated by a microprocessor. Reading is performed using software that encodes the data sent by the telemetric signals of the sensors installed in the load cells in the support base of the platform. The measuring units are in kilograms (kg), and each cell has six pressure points on the foot soles. The values shown are obtained from the difference between the values reached when distributing the body weight on the right and left sides, between pressure points and between the total mean of all points (kg) (Pinto et al., 2010).

Tests on the stabilometric and posturometric platform were performed under the following conditions: physical space with white walls, ambient light with no contrast or diffuse rays, no extraneous noise during the testin gand a 3-meter distance between the wall and the platform; a walker was available as protection against any imbalance. During the 10-min tests, the rater remained behind the platform, and at his signal, the subjects' feet were centered according to marks located on the base of the device. The individuals were instructed to keep their eyes open and to look in a horizontal direction.

2.3. Intervention

The ballroom dancing program consisted of three 50-min sessions each week on alternate days over a 12-week period. The dances included the foxtrot, waltz, rumba, swing, samba and bolero. The basic class structure was composed of a 10-min warm-up period of flexibility exercises (10 s each) and low intensity dance movements. The main part of the session involved a range of higher intensity rhythms lasting 30 min. The class ended with a 10-min relaxation period accompanied by music (Chart 1, Borges et al., 2012). The exercise intensity level was controlled by the Borg