CHANGES IN POSTURAL CONTROL POST AN 8-WEEK DANCE PROGRAM IN FEMALE ELDERLY

Angélica Lodovico[1]; Roberta Castilhos Detanico Bohrer[1]; Christina Cruz Paramustchak Cepeda[2]; Paulo Cesar Barauce Bento[1]; André Luiz Felix Rodacki[1]

[1]Federal University of Paraná, Sector of Biological Sciences, Curitiba, Paraná, Brazil
[2]Positivo University, Nucleus of Biological and Health Science, Curitiba, Paraná, Brazil

This study investigated the effect of an 8wk dance program on orthostatic postural control in elderly. Thirty-four elderly participants were randomly assigned to dance group (DG: n=19; 69.1 ± 6.57 years, 72.5 ± 11.7kg) and control group (CG: n=15; 71.5 ± 7.45 years; 70.9 ± 9.3kg). A force plate was used to measure three dimensional ground reaction force data in three conditions: narrow stance position eyes open and closed and tandem position eyes open, randomly registered over a period of 60 seconds pre and post the intervention. The mean velocity sway and the COP path area were calculated. The results showed that the ballroom dancing program with low/moderate intensity significantly improved balance. Dance would be an optimal activity for an elderly population since it can improve postural control and thus prevent fall incidence.

KEY WORDS: BALANCE, TRAINING, AGING, FALLS

INTRODUCTION: Aging is related to a progressive remodeling of the neuromuscular system that, in conjunction with muscle mass, strength and power reduction can cause decreased reactive capacity and as a consequence, result in spatial orientation and balance changes (Horak, 2006; Melzer et al., 2008). Balance deficits make the elderly more prone to falls, which may cause serious injuries or death.

In an attempt to improve postural control in the elderly, different strategies have included high-resistance (Granacher et al., 2009), low/moderate intensity (Bellew et al., 2003; Orr et al., 2006), strength and balance exercises (Park et al., 2008; Kim & Lockhart, 2010), aquatic exercises (Melzer et al., 2008), Tai Chi Chuan (Pereira et al., 2008) and dance (Sofianidis et al., 2009).

Dancing may be an interesting stimulus for older people since it increases social skills, self-esteem and causes cardiorespiratory and muscular improvements. In addition, the multidirectional displacements, turnouts and the coordination associated with visual, vestibular and memory requirements represent important demands imposed to the postural control system that may produce balance improvements (Sofianidis et al., 2009; Kim et al., 2011; Bläsing et al., 2012). This study investigated the effect of an 8wk dance program on orthostatic postural control in elderly females.

METHODS: Thirty-four elderly women were randomly assigned to the dance (DG: n=19; 69.1 ± 6.57 years, 72.5 ± 11.7kg) or control group (CG: n=15; 71.5 ± 7.45 years; 70.9 ± 9.3kg). Procedures were granted by the University Ethics Committee. A force plate (AMTI, model OR6-7, USA) was used to measure three dimensional ground reaction forces data, sampling at a frequency of 100 Hz. Narrow stance position with eyes open (C1); narrow stance position with eyes closed (C2) and; tandem position with eyes open (C3) stability tests were randomly registered over a period of 60s pre- and post- intervention. Force and moment data were filtered (2^{nd} order Butterworth low pass filter, cut off frequency 10Hz) and used to calculate the mean velocity and area of COP sway in each condition by using a customized Matlab routine (version 7.0, MathWorks, USA). The COP area was estimated by 95% confidence ellipse. Basic steps of four dance rhythms were applied (two per week): Country, Waltz, Bolero and “Forró” (a typical Brazilian dance). The session intensity ranged from 60 to 70% of the maximum heart rate with the exertion perceived rate from 12 to 16 at the Borg Scale (6-20), according to the ACSM’s recommendation (ASCM, 2009). A repeated measures two-way ANOVA was applied and the significance level set at $p<0.05$.

RESULTS: The groups did not differ in their anthropometric characteristics (body mass and stature) and age ($p>0.05$). Training effects were assessed comparing the results between pre- and post- training in the control and dancing group (Table 1).

Table 1. Sway Velocity and CoP area (mean±SD) during narrow stance position with eyes open (C1); narrow stance position with eyes closed (C2) and tandem position with eyes open (C3) pre- and post- eight weeks of dance program.

		CG (n=15)		DG (n=19)	
		Pre	**Post**	**Pre**	**Post**
Velocity Sway (cm/s)	C1	1.81 ±0.52	1.83 ±0.59	1.76 ±0.43	1.35 ±0.33*
	C2	2.26 ±0.82	2.28 ±0.62	2.53 ±1.16	1.65 ±0.45*
	C3	3.20 ±0.63	3.31 ±1.03	4.55 ±1.27	3.08 ±0.96*
COP Area (cm^2)	C1	4.86 ±2.71	4.95 ±2.85	4.91 ±2.29	3.48 ±2.05*
	C2	4.06 ±2.22	4.22 ±2.81	6.66 ±4.08	3.97 ±2.42*
	C3	5.75 ±1.71	5.89 ±2.79	7.86 ±4.42	4.71 ±3.29*

NOTE: CG: control group; DG: dancing group; *p<.05 – interaction (time x intervention).

The CG showed no changes throughout the study ($p>0.05$), while the DG showed reductions after the intervention period (pre- and post-) in all experimental conditions ($p<0.05$). The mean sway velocity showed the greatest decrease after the intervention (34%), followed by tandem (31.8%) and the narrow stance with eyes open condition (23.7%) In the same way, the largest decrease in the CoP area was identified during the condition C2 (40.4%), followed by the condition in which the individuals were evaluated in tandem position with visual information (40%).

DISCUSSION: The results showed that an intervention period of 8 weeks was sufficient to promote important gains in the static balance in the experimental group, while no changes were observed in the control group.
Results confirmed previous findings that larger CoP oscillations occur when visual information is absent or when a more challenging component is present (O’Connor et al., 2008; Palm et al., 2009). Despite the visual information deprivation and the reduced base in the tandem position imposed an important postural control challenge for the elderly, the dance-based group was able to reduce the CoP oscillations (velocity and area), which may be attributed to improvements on the somatosensory and vestibular systems, since no changes in the visual information was expected in response to training.
The results are in line with the findings reported by Sofianidis et al. (2009), who found postural improvements after a comparable intervention period of Greek dancing. The constant changes of direction and base of support, the specific demands on lower limb muscles and the need to adjust body position in space according to the choreography may have positively impacted the postural control system. Although it is difficult to determine the impact of the program on each component of the postural system, it is likely that the turns and changes in direction may have also imposed a relevant vestibular stimulus.

CONCLUSION: This study showed the positive effect of a ballroom dancing program with low/moderate intensity on static balance and consequently effective way to reduce the risk of falls in elderly. Dance-based programs’ exercises have been proposed as an attractive option, since many seniors have had positive experiences with dancing as it is able to improve not only social interaction but also sensorimotor aspects. In addition, dance can take many forms, is inexpensive and can be performed by individuals of different ages as a relevant strategy to improve the postural control system.

REFERENCES:

American College of Sports Medicine (ACSM), 2009. ACSM'S Resource Manual for Guidelines for Exercise Testing and Prescription. Philadelphia: Lippincott Williams & Wilkins, 8th ed.

Bellew, J.W.; Yates, J.W.; Gater, D.R., 2003. The initial effects of low-volume strength training on balance in untrained older men and women. Journal of Strength and Conditioning Research 17 (1), 121-8.

Bläsing, B.; Calvo-Merino, B.; Cross, E.S.; Jola, C.; Honisch, J.; Stevens, C. J., 2012. Neurocognitive control in dance perception and performance. Acta Psychologica 139 (2), 300-8.

Granacher, U.; Gruber, M.; Gollhofer, A., 2009. Resistance training and neuromuscular performance in seniors. International Journal of Sports Medicine 30 (9S), 652-7.

Horak, F., 2006. Postural orientation and equilibrium: what do we need to know about the neural control of balance to prevent falls? Age and Ageing 35 (S2), 7-11.

Kim, S.; Lockhart, T., 2010. Effects of 8 weeks of balance or weight training for the independently living elderly on the outcomes of induced slips. International Journal Rehabilitation Research 33 (1), 49–55.

Kim, S.H.; Kim, M.; Ahn, Y.B.; Lim, H.K.; Kang, S.G.; Cho, J.H.; Park, S.J.; Song, S.W., 2011. Effect of dance exercise on cognitive function in elderly patients with metabolic syndrome: A pilot study. Journal of Sports Science and Medicine 10, 671-8.

Melzer, I.; Elbar, O.; Tsedek, I.; Oddsson, I.I., 2008. A water-based program that include pertubation exercises to improve stepping responses in older adults: study protocol for a randomized controlled cross-over trial. BMC Geriatrics, 8-19.

O'Connor, K.W.; Loughlin, P.J.; Redfern, M.S.; Sparto, P.J., 2008. Postural adaptations to repeated optic flow stimulation in older adults. Gait & Posture 28, 385-91.

Orr, R.; Vos, N.J.; Singh, N.A.; Ross, D.A.; Stavrinos, T.M.; Fiatarone-Singh, M.A., 2006. Power Training Improves Balance in Healthy Older Adults. Journal of Gerontology: Medical Sciences 1A, 78-85.

Palm, H.G.; Strobel, J.; Achatz, G.; Von Luebken, F.; Friemert, B., 2009. The role and interaction of visual and auditory afferents in postural stability. Gait & Posture 30 (3), 328-33.

Park , H.; Kim, K.J.; Komatsu, T.; Park, S.K.; Mutoh, Y., 2008. Effect of combined exercise training on bone, body balance, and gait ability:a randomized controlled study in community-dwelling elderly women. Journal of Bone and Mineral Metabolism 26, 254-9.

Pereira, M.M.; Oliveira, R.J.; Silva, M.A.F.; Souza, L.H.R.; Vianna, L.G., 2008. Effects of Tai Chi Chuan on knee extensor muscle strength and balance in elderly women. Revista Brasileira de Fisioterapia 12 (2), 121-6.

Sofianidis, G.; Hatzitaki, V.; Douka, S.; Grouios, G., 2009. Effect of a 10-week traditional dance program on static and dynamic balance control in elderly adults. Journal of Aging and Physical Activity 17, 167-180.