

ORIGINAL RESEARCH

Improving Postural Stability in Active Older Adults: Argentine Tango Dance as an Alternative Fall-prevention Strategy

Barbara Purkart, MSc; Blaz Bertoneclj, MA; Andreja Podlogar, BPS; Mitija Samardzija Pavletic, MSc

ABSTRACT

Context • Falls and the consequent injuries are a major global public-health issue, and fall prevention is urgently required for an aging population. Postural instability is a critical risk factor for fall prediction.

Objective • The study intended to determine the impact of dancing the Argentine tango on postural stability in active older adults.

Design • The research team designed a randomized controlled trial.

Setting • The study took place in Ljubljana in Slovenia. The work was performed at two institutions, the Studio BA tango and the Institute of Sports Medicine.

Participants • Participants were 36 active, healthy individuals aged between 65 and 70 years.

Intervention • Eighteen dancing couples were randomly divided into two groups, the intervention and the control group. Both groups continued with their regular activities, but the intervention group also attended a 12-week program for 90 minutes twice a week dancing the Argentine tango. The class started with TangoFloorTec, a program that has been adapted for older adults, and continued with BA Tango Biomechanics. Each class ended

with improvisational dancing and breathing exercises.

Outcome Measures • The research team measured sway path on a force plate during the feet-together stance for 30 seconds and the one-legged stance for 20 seconds.

Results • At baseline, no differences existed between the dancers and non-dancers in age, body mass index, or center of pressure. No falls were reported during the study. Twenty-eight participants, 7 couples in the intervention group and 7 couples in the control group, successfully completed the research protocol. Postintervention after 3 months of dancing, the intervention group had significantly better postural stability compared that of the control group ($P \leq 0.015$). The effect of the intervention was large (η_p^2 : from 0.22 to 0.44).

Conclusions • Dancing the Argentine tango can improve postural stability among already active older adults. Improved postural stability diminishes the risk of falling. The practical implication of the present study is that dancing can be more than just a hobby; it can serve as an alternative fall prevention strategy. (*Altern Ther Health Med.* 2023;29(5):201-209).

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Children and athletes show a higher incidence of falls than do older adults, although the latter are more susceptible to fall-associated injury due to osteoporosis and age-related physiological changes, such as slow protective reflexes.¹ In addition, recovery from injury can take much longer, and the

quality of the healing process is also diminished.² Falls and the consequent injuries require substantial attention from the public healthcare system, and therefore, an urgent need exists for a fall prevention strategy aimed at the aging population.³ Many preventive programs based on risk factors are available for older adults.

The role of exercise for developing improved balancing skills and reducing the risk of falls has been the focus of much research in the recent past. Several randomized controlled trials have recommended low-impact, balance-and-functional exercises as a means of fall prevention.^{4,5} An example of a low-impact group activity is Tai Chi Chuan, which one study found can reduce the rate of falls among older adults by 34%.⁵

The principles of Argentine tango resemble those of Tai Chi Chuan. Argentine tango is characterized by low-impact,

precisely determined, weight-shifting movements, which are coordinated with upper-limb movements, body rotation, music, and a dancing partner. Dancing Argentine tango doesn't force dancers into movements that must follow every bit of the music nor does it have difficult prescribed steps; rather, it's based on improvisation and stepping in different directions, adapting to different stride lengths, turning on one limb, and transferring weight from one limb to another. It is a cognitively and socially challenging activity and is deemed safe and appropriate for older adults. Some studies have shown that Argentine tango can improve stress coping, improve balance confidence and functional balance,^{6,7} and reduce symptoms of depression and anxiety.⁸

Perturbation Balance Training

Many sensory systems begin to decline in older adults, including a deterioration in sensory input and motor responses and impaired cognitive function and sensory integration.^{9,10} This decline can be the reason for inadequate balance reactions to external or internal perturbation.¹¹ Perturbation is a small change in the regular movement, happened when the person fails to control the center of mass above base of support during voluntary movement caused by or without external factors. Reflexes and temporal neuromuscular responses to perturbation diminish with age,¹² and inappropriate reactions and incorrect weight shifting are the most common causes of falls during movements.¹¹

Deterioration of the ability to control external perturbation during walking starts as soon as middle age,¹³ but perturbation-based balance training appears to be an effective approach to fall reduction among older adults. Therapist-applied perturbations in multiple directions (anterior, posterior, medial, lateral, diagonal direction...) seem to be the most practical method.¹⁴

Argentine tango can be seen as perturbation training since it's a couple's activity, where partners hold each other in open or close embrace, and this embrace means that a dancer has the opportunity to grab hold of a partner if he or she loses balance. For a dancer, grasping a partner represents external perturbation and can be a kind of unpredictable perturbation balance training in multiple directions, although this isn't emphasized when dancing.

Motor Control

Another problem for older adults is walking slowly and use of shorter steps. Reduced step length correlates with reduced head stability,¹⁵ and instability is a major risk factor for falls.¹⁶ Argentine tango dancers learn how to execute normal, shorter, and longer strides. The stride-length decision and execution has to be adaptable and is dependent on a dancing partner, the music, and external conditions, such as the dimensions of a room or movements of other dancing couples. Dance can teach older adults to have good control of movement in making ground contact and changing direction, to increase control of step length, and to develop awareness

when making a step. This learning can reduce fall-risk and is an effective fall-prevention strategy because direction change, tripping, and lateral motion are the most frequent reasons for backward, forward, or sideways falls.¹⁷

Turning on a limb is a more demanding movement, because a dancer should also twist the body while maintaining balance and coordinating the body's position together with the head and upper and lower limbs. Increased age correlates with reduced abilities of ankle muscles to properly control the body during movements and can cause self-induced perturbation—self-generated shift of bodyweight occurs in the absence of any external perturbation¹¹ with reduced central integration.⁹ Some studies have noted that functionally unstable older adults rely more on hip muscles.^{18,19}

Cognition

Daily activities are rarely simple and require precise movements for complex and dynamic interaction with environmental features.²⁰ Argentine tango encourages the dancer to perform complex motor activities simultaneously with cognitive processes in the brain. Dual task studies of balance control have shown age-related reduced stability when performing cognitive tasks.¹⁰ Response latency and the amplitude of the involved muscles following a perturbation by a moving platform have been shown to be slower and smaller when a cognitive task was performed;²¹ in addition, the cognitive demand of posture and gait control also increases with age.¹⁰

Depending on the different dancing roles and cognitive processes, dancers can be divided into the leader, often male, and the follower, often female. The leader is usually the initiator of movements and the major determinant of a movement's spatial and temporal characteristics. Accordingly, a leader is more focused on his own intentions and less adaptive to a dancing partner. One part of the leader's cognitive process is directed at communicating his intention to a follower. A follower is more focused on the external sensory information that allows the dancer to align her behavior, both spatially and temporally, to the behavior of the partner. One part of the follower's cognitive process is directed toward recognizing the leader's intention and executing the dancing movement.

At the beginning of learning Argentine tango, the dancing roles are clearly defined; leading is characterized by more internally driven behavior and following by externally driven behavior. Advanced dancers try to mutually follow one another, so the borders of leading and following are blurred.

Prediction of Fall Risk

A critical risk factor for fall prediction is postural instability.¹⁶ While performing postural-stability tests of double- and single-limb stances on a force plate, the center of pressure (COP) parameters has been used to identify those who had demonstrated no obvious balance impairment yet had an increased risk of fall; those who fell had a greater COP

compared to those who didn't, even among older adults without apparent balance problems or fall history.²²⁻²⁵ Fear of falling and low balance confidence are also predictors of falls.²⁰ Improved balance skills and postural stability can, therefore, reduce the risk of falling.

The current study intended to determine the impact of dancing the Argentine tango on postural stability in active older adults.

METHODS

Participants

The research team designed a randomized controlled trial. The study was performed at two institutions in Ljubljana, Slovenia. At the Studio BA tango, meetings, randomized selection of participants, and the intervention occurred. At the Institute of Sports Medicine measurements were performed. In Ljubljana, the Daily Centers of Activities for older adults; the Intergenerational Center; the Slovenian Third Age University, a university for older adults; the Alpine Association of Slovenia; and the Center for Foreign Language, recruited older adults to participate in the study.

In a previously conducted pilot study, the research team found that postural stability varied extremely with the age of the older adults and their physical activities. A sizable proportion of those over 70 were unable to complete the protocol for a 20-second test for a one-limb stance on a force plate. The research team decided to include a narrow spectrum of older adults who were regularly active and aged between 65 and 70. In a period of two months, 56 active, healthy, economically middle-class, non-fallers from Ljubljana city volunteered as prospective participants.

Prospective participants were included they: (1) aged between 65 and 70 and (2) self-reported regular physical activity, such as a daily walk or cycling for at least one hour, walking in the mountains, participating in regular, weekly, group exercise or sports activities.

Prospective participants were excluded they: (1) had health problems, (2) had a history of a fall, (3) were without dancing partner, (4) had been well-trained in balance through yoga, Tai Chi Chuan, a one-limb stance exercise, or dancing because they would be expected to have small improvements during the study from the intervention.

Six participants didn't meet the inclusion criteria, and 14 didn't have a dancing partner.

The study was approved by the National Ethical Committee of Slovenia (Number: 14052019) and followed the ethical standards set forth in the Helsinki Declaration of 1975. Participants completed a signed informed consent before being enlisted into the study. The participants didn't know what the study was measuring.

Procedures and outcome measures

The study took place from January to March when weather conditions in Slovenia for outside activities are relatively stable, and all participants agreed not to change their regular physical activities during the study. Participants

were randomly assigned to one of two groups: control or intervention group. All participants continued with their regular activities, but those in the intervention group also attended a progressive Argentine tango lesson.

The testing occurred at baseline (a few days before intervention) and postintervention (a few days after 12-week intervention) by the same procedure. Upon arrival at the postural stability test site participants sat in a room for 15 minutes, to avoid any effects from prior activity of a high heart rate and blood pressure.

Before performing postural stability tests on a force plate participants' anthropometric data—age, height and weight were taken.

The primary outcome measures were COP: the total COP, the COP along the anterior-posterior axis (COP A-P), the COP along the medio-lateral axis (COP M-L) and the total COP area per second (COP area/s) in a time frame of 30s or 20s for a feet-together or one-limb stance on a force-plate, respectively.

The questionnaire provided data for the secondary outcome, assessing balance confidence.

Postural stability tests on a force plate

The force sensors detect strain with a frequency of 1000 Hz. The signals were amplified, converted from analogue to digital, and processed with software (ARS force plate, Science to Practice, Ljubljana, Slovenia). The force plate was a bilateral, strong-and-rigid steel platform equipped with eight high-tech, strain-gauge sensors for a ground reaction force measurement (Bilateral Force Plate, Science to Practice, Ljubljana, Slovenia).

Figure 1. One-limb Stance Position on a Force Plate.

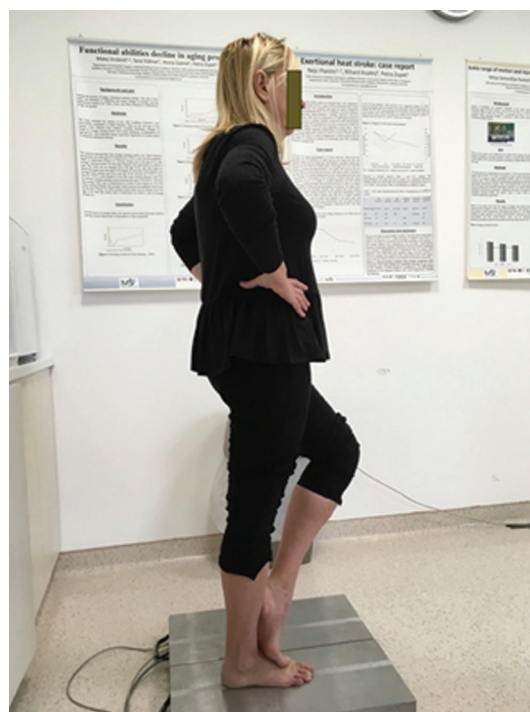


Figure 2. Lady's Front Ocho, a tango figure. It consists of basic tango elements. Figure 2.1 shows a one-leg stance; Figure 2.2, pointing in a direction; Figure 2.3, a quick weight transfer; Figure 2.4, a one-leg turn; Figure 2.5, a one-leg stance; Figure 2.6, pointing in a direction; Figure 2.7, a quick weight transfer; Figure 2.8, a one-leg turn; and Figure 2.9, a one-leg stance.



The force plate was placed on the ground to allay fears of falling.²⁶ The tests were conducted in a discrete room with a constant temperature of 22°C that was free from noise and other external distractions. Postintervention after 3 months, the tests were repeated using the same procedure, in the same room and at the same time of day. The examiners were blindfolded.

Three conditions of postural stability were assessed, first with the double-limb stance with both feet together and then standing on one leg and then the other. In the double-limb-stance test, the medial line of a participant's foot, from the big toe to the calcaneus, is parallel to the main axis between the two adjacent force plates. During the single limb stance, the weight-bearing foot was positioned in the center of one force plate.

Participants were asked to maintain a static position while keeping their upper limbs in a fixed position at the waist and focusing their gaze on the wall at eye level, approximately three meters away. For each test session, one training trial was included before data collection.

The research team recorded three repetitions of the 30-second, feet-together limb stance, a reliable and valid procedure for older adults,²⁷ and a 20-second, one-limb stance, which one study had found represents two-thirds of the average time that people aged between 60 and 70 could manage.²⁸

For the one-limb stance, the other limb was elevated so that the femur was parallel to the standing limb while the elevated foot was resting on the distal, anterior portion of the tibia and tarsal bones. The participant maintained this position for the entire duration of the test (Figure 1). The data collection occurred when the participants reached the static phase after elevating the limb.²⁹

If the participant made an error during a test, such as the elevated foot touching the platform's surface during the single-limb stance or the participant moving his or her hands away from the waist, the measurement was discarded, and the participant repeated the test on the other limb. This happened between 6 and 8 times during the full set of

recordings for each group, without any noticeable differences between the groups.

A 30-second resting period between repetitions was to avoid the fatigue effect. Tests were performed in a randomized order to avoid a systematic effect. The participants selected the preferred limb with which to start when the one-limb stance was to be performed. To prevent falls, the examiner stood close to the participants during all the tasks.

Randomization

The dancing couples were randomly assigned to the control group (n = 18) or the intervention group (n = 18) using block randomization—BABA AB ABBA BBAA AABB.

Argentine Tango Intervention

The tango sessions were held in a dancing hall with space for 18 dancers. The hall had wooden-parquet flooring and a professional sound and lighting system as well as mirrors for monitoring correct posture. The participants were guided by professionals with more than 20 years of experience in teaching Argentine tango. The music used was Argentine tango from the golden age, tango nuevo and neotango.

The intervention group took part in 24 tango classes, biweekly for 90 minutes, for 12 weeks. Argentine tango steps begin from a one-limb stance (Figure 2.1), first by pointing in a direction (Figures 2.2 and 2.6), with the sole of the foot touching the floor without a load. Quick weight shifting is followed by the movement of the free limb back to the starting position (Figures 2.3 and 2.7). Unlike social dances no one step must follow another, the next step can be in any direction.

One-limb postural stability is learned while moving the free limb forward, backward, sideways or in circular motion and through weight shifting. In addition to the steps, a dancer also learns how to make a turn on the limb (Figures 2.4, 2.5, 2.8, and 2.9). Figure 2 is just an example of one tango figure consisted of a step forward, a turn, and a step forward.

The classes started with 10 minutes of warm-up and the TangoFloorTec program. Warm-up included circumductive, peripheral-and-rotational, spinal-joint movements while contracting the pelvic floor, shoulder, hip, and deep-spinal stabilizing muscles.

TangoFloorTec uses basic tango movements in lying positions, otherwise this movements are conducted in the standing position. This was followed by 10 minutes of basic tango elements standing in front of a mirror, the emphasis being on postural alignment and weight shift.

A 60-minute instruction session on dancing techniques BA Tango Biomechanics was performed in pairs, with the woman as the follower and the man as the leader, always with the same dancing partner as recommended for beginners because of simplicity. BA Tango Biomechanics was developed as a system of coordinated body movements through tango elements—one-leg stance, pointing, weight transfer, collecting feet, turn—and has been structured from simple-to-more-complex tango figures—cross, ocho, sacada, gancho, bole, volcada, colgada, and lift.

The class ended with 10 minutes of cooling down—five minutes of dancing and 5 minutes of a breathing exercise, with a visualization to music in a sitting position.

Balance Confidence test

Participants completed Activities-specific Balance Confidence Scale questionnaire according to the research team’s instructions, while they were sitting and waiting for the postural stability test. Activities-specific Balance Confidence Scale questionnaire require participants to rate 16 items ranging from 0 (no balance confidence) to 100 (perfect balance confidence) while performing specific activities of daily living.

Statistical Analysis

The total COP, COP A-P, COP M-L, and COP area/s were calculated and taken as parameters for the evaluation of postural stability. The average of three successful repetitions for each test underwent further statistical analysis with SPSS, version 23 for the Mac OS (IBM, New York, NY, USA). The Shapiro-Wilk test, Levene’s test, and Mauchly’s test were all used to verify the normal distribution of the data, equality of variances, and sphericity.

Descriptive statistics for a participant’s age and body mass index were also recorded. The final data analysis was performed with a two-way, mixed-model, analysis of variance for repeated measures (ANOVA RM). Dependent variables were total COP, COP A-P, COP M-L and COP area/s. The research team calculated the Fisher F value and selected $P < .05$ as the level of significance. Partial eta squared was calculated to determine the effect size.

RESULTS

Participants

Eighteen dancing couples, 36 participants, were included in the study (Figure 3).

Figure 3. The Consolidated Standards of Reporting Trial’s Flow Chart of the Progress Through the Phases of a Parallel Randomized Trial With Two Groups, With Inclusion and Exclusion Criteria.

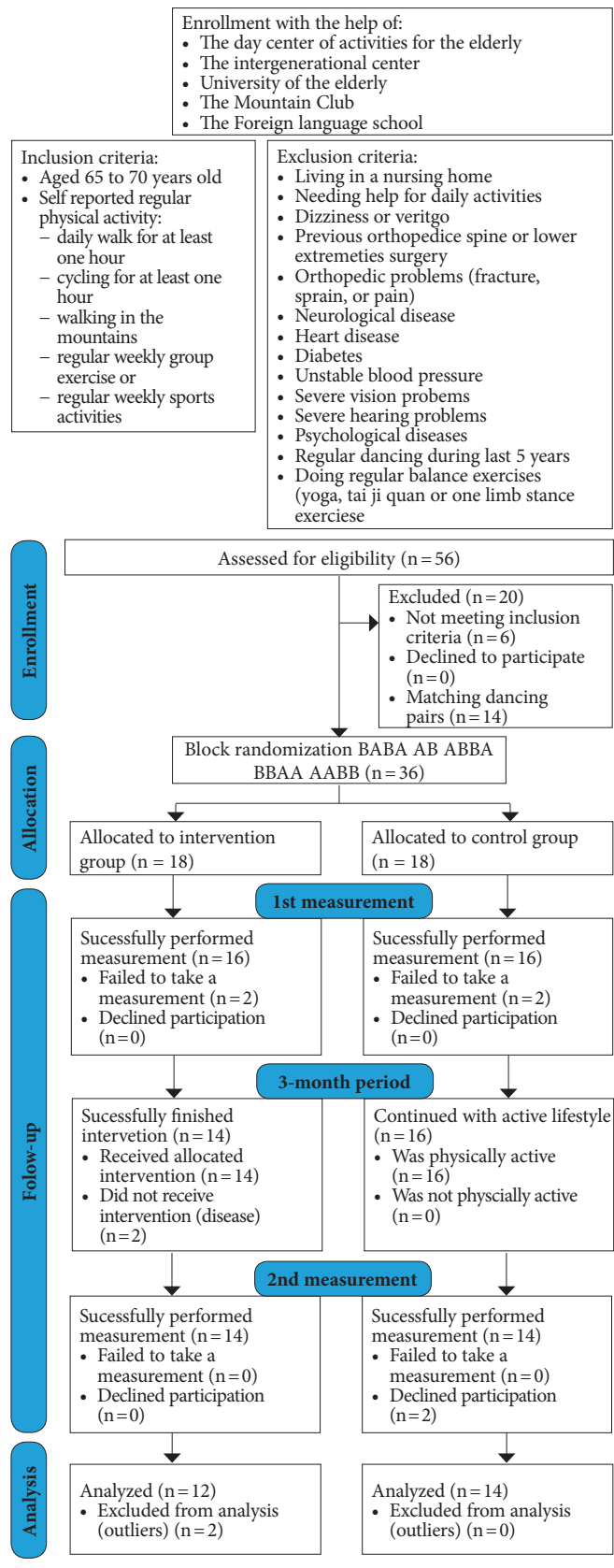
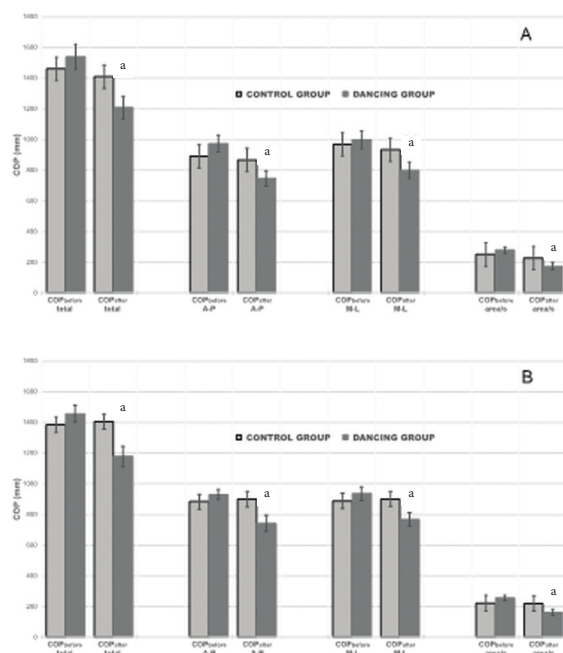


Table 1. Descriptive Statistics for Number of Participants, Ages, Body Mass Index, and Economic and Social Status of Participants

Group	n	Age Mean ± SD	Body Mass Index Mean ± SD	Economic Status	Social Status
Control group	14	67.4 ± 2.1	25.3 ± 2.8	Middle class	Retired
Experimental group	14	67.0 ± 1.9	25.2 ± 2.9	Middle class	Retired

Figure 4. Center of Pressure Measurements on the Force Plate for the Left Limb (5A) and right-limb (5B) stances. A two-way, mixed, repeated-measures analysis of variance (ANOVA) showed a significant difference, with a standard error of the mean, between the groups and a large main effect for the dancing intervention in standing on the left and right limbs for all variables.



^a $P \leq .015$ in comparing dancers in the intervention group and non-dancers in the control group

Abbreviations: After, postintervention after 3 months; before, at baseline; COP A-P, sway path in the antero-posterior direction; COP area/s total, total sway area per second; COP M-L, sway path in the medio-lateral direction; COP total, total sway path.

In comparing the control group to the intervention group at baseline, no significant differences existed in age— 67.4 ± 2.1 years and 67.0 ± 1.9 years, respectively; body mass index— $25.3 \pm 2.8 \text{ kg/m}^2$ and $25.2 \pm 2.9 \text{ kg/m}^2$, respectively; economic class—middle class; or social status—retired (Table 1).

Baseline Postural Stability

The inability to obtain results from Force plate’s software caused 4 participants to be dropped from the study after the first measurements. Standing steady on one limb was obviously too difficult for two of the participants. Their results were reflected in a standard deviation (SD) from the group’s average ranging from 2.6 to 13.0 (data not shown); therefore, they had to be excluded from further statistical analysis.

All variables were normally distributed and an assumption of a homogeneity of variances was made after the exclusion of the outliers. No significant differences existed between the groups in the feet-together and one-limb stance measurements for the COP variables at baseline.

Attendance in Argentine tango intervention

Seven couples, 14 participants, attended all 24 dancing classes, one couple, 2 participants, attended 22 classes. One couple, 2 participants, dropped out due to illness before the intervention began.

Second Measurement of Postural Stability

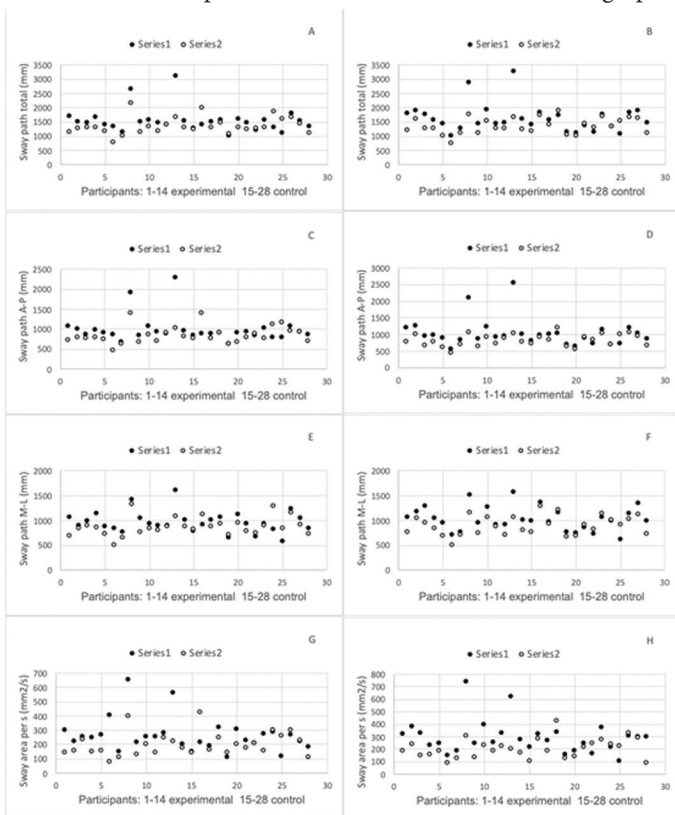
No falls were reported during the study for either group. One couple, 2 participants, in a control group didn’t arrive for the second measurement. Fourteen couples, 28 participants (including outliers) successfully completed the second testing protocol.

The primary finding was a significant difference ($P \leq .015$) between the groups, with a large main effect from the dancing intervention when standing on the left limb ($P \leq .006$, η_p^2 : from 0.27 to 0.44) as well as on the right limb ($P \leq .015$, η_p^2 : from 0.22 to 0.27) for all variables (Figure 4).

When participants were standing with their feet together, the second measurements for the intervention group were lower than those of the first, but the difference between the means wasn’t significant (Table 2).

The results of two participants (outliers) were outstanding: ranging from a standard deviation of -0.2 to 4.9 SD (data not shown) away from the group’s average (Figure 5).

Figure 5. Postural Steadiness Measurements at Baseline (Series1) and Postintervention (Series2) Dancing the Argentine Tango (n = 28, including outliers). Figures 4.A, 4.C, 4.E, and 4.G show the average of 3 successful repetitions using the right-limb stance, and Figures 4.B, 4.D, 4.F, and 4.H using the left-limb stance on the force plate. Notice the outstanding postintervention improvement of the two outliers on the graph marked as participant no. 8 and participant no. 13.



Abbreviations: Sway path A-P, sway path in the antero-posterior direction; Sway area per s, total sway area per second; Sway path M-L, sway path in the medio-lateral direction.

Table 2. Postural Steadiness Measurements at Baseline and Postintervention for the Control Group Performing Normal Activities and the Intervention Group Dancing the Argentine Tango (n = 26; without outliers). The table shows the results of a Two-way Mixed Analysis of Variance (ANOVA), with the means being obtained by averaging three successful repetitions while standing on a force plate with the feet together, on the left and right limbs.

Variable/Group	Standing With Feet Together			Standing on the Left Limb				Standing on the Right Limb			
	Baseline Mean ± SD	Postintervention Mean ± SD	P _{F-test}	Baseline Mean ± SD	Postintervention Mean ± SD	P _{F-test}	η _p ²	Baseline Mean ± SD	Postintervention Mean ± SD	P _{F-test}	η _p ²
COP total (mm)											
Control group	1730 ± 295	1638 ± 361	.081	1458 ± 296	1409 ± 280	.001 ^a	0.40	1387 ± 215	1406 ± 274	.006 ^a	0.27
Intervention group	1792 ± 354	1535 ± 349		1538 ± 268	1208 ± 222			1458 ± 147	1179 ± 172		
COP A-P (mm)											
Control group	727 ± 90	718 ± 73	.711	889 ± 179	865 ± 182	<.001 ^a	0.44	884 ± 106	900 ± 217	.011 ^a	0.27
Intervention group	709 ± 89	708 ± 96		974 ± 191	747 ± 151			931 ± 110	744 ± 112		
COP M-L (mm)											
Control group	1408 ± 303	1308 ± 390	.058	969 ± 225	934 ± 196	.003 ^a	0.31	889 ± 190	901 ± 173	.009 ^a	0.25
Intervention group	1492 ± 352	1203 ± 355		996 ± 178	800 ± 160			936 ± 109	768 ± 115		
COP area/s total (mm²/s)											
Control group	257 ± 76	197 ± 66	.492	250 ± 78	229 ± 94	.006 ^a	0.27	222 ± 67	219 ± 84	.015 ^a	0.22
Intervention group	282 ± 107	200 ± 57		279 ± 76	174 ± 44			255 ± 61	162 ± 49		

^aP ≤ .015 when comparing the dancers in the intervention group and the non-dancers in the control group.

Abbreviations: COP A-P, sway path in the antero-posterior direction; COP area/s total, total sway area per second; COP M-L, sway path in the medio-lateral direction; COP total, total sway path; P_{F-test}, results of a 2-way mixed analysis of variance; SD, standard deviation; η_p², partial eta squared.

Balance Confidence

The research team believes that participants rated the Activities-specific Balance Confidence Scale unrealistically and overestimated the grades they gave. Twenty-three participants (82%) rated all 16 questions as having 100% balance confidence. Four participants (14%) rated 15 questions as having 100% balance confidence and gave a 90% balance confidence rating for walking on icy sidewalks. One participant (4%) rated 14 questions as having 100% balance confidence, gave an 80% balance confidence rating for walking on icy sidewalks, and gave an 90% balance confidence rating for stepping onto or off an escalator while holding onto parcels such that she can't hold the railing.

DISCUSSION

12-week dancing Argentine tango biweekly improved postural stability in active older adults. Overall, the results of the current randomized controlled study are in accordance with those of previous two studies^{6,7}. Hackney Kantorovich and Earhart included in their study much younger older adults (participants were older than 55 years old) as they were included in the current study (participants were between 65 and 70 years old). In their study saw some improvement in the functional test One Leg Stance by healthy adults and some gains by people with Parkinson disease.⁷ The current randomized controlled study showed statistical difference between dancers and nondancers because the research team used a force plate, which provide more sensitive measurement results. McKinley with her research team on fragile adults older than 60 years showed increase in walk speed after 10-week Argentine tango intervention.⁶

Older adults those who fell were found to had higher COP than those who did not fall COP is the difference even among older adults without apparent balance problems^{22,23,24,25}. Since the current study's intervention group had a smaller COP than the control group after the intervention, the research team assumed that the dancers had a lower risk of falling, probably an extended time to the first fall and a lower number of falls.

The current study's participants were active, healthy non-fallers, aged between 65 and 70 years old. They didn't have a sedentary lifestyle nor did they have orthopedic problems, but still 4 individuals failed to complete 20 seconds of unipedal standing while some participants stood on one limb without any visually detectable problems. The research team's observation is in line with its previous conclusions from its pilot study, which implied that age-related decline can be highly variable among older adults and is not determined solely by age.¹⁸ The current research team believes that the difference between the intervention and the control group would be even greater and the effect of the intervention even larger if the study had been conducted with unhealthy or fall-prone older adults.

The current research team's observational experience has shown that elderly dancers can learn to notice and correct external and self-evoked balance perturbation, thus reducing

the likelihood of falls during movements.¹¹ The team's recommendation for future studies is to measure dancers' balance reactions on unexpected external perturbation conducted by movable force plate.

The current research team has visually observed that dancing leads to better head-body-extremities coordination and better abilities of ankle muscles to control the movements even by turning on one limb, thus might diminishing the risk of falls.^{15,16} For the future studies, the team recommends assessment of the head-body-extremities coordination.

The current study's results showed an improvement in balance abilities for followers and leaders, and the research team assumes that this occurred due to training anticipatory and compensatory postural adjustments. The team recommends that future research is directed toward studying how dance can influence a dual task and whether different muscle strategies and recruitment can develop with dance training, given the difference between older and younger people, as was found in Kanekar and Aruin's study.³⁰

The current research team would like to find a safe group activity for older adults with high-level cognitive and balance requirements. Argentine tango allows the dancers great amount of choices in movement, since the dancer can choose to move and travel to any direction, to turn or to stay in a place. Learning to stepping in any direction diminish the risk of falling.¹⁷ The tango dancer has also free interpretation of tempo and rhythm, no prescribed as Salsa or Walls. Beside that the team would like to find also an activity that encourages people to have fun and create new social networks. Advancing physical, cognitive, and psychosocial functions by dancing Argentine tango would thus diminish the risk of falling, reduce the likelihood of a first fall happening, and probably also prevent the number of future falls.

The current research team was unable to evaluate the influence of the dance training on balance confidence, because the participants' ratings on the Activities-specific Balance Confidence Scale were unrealistic, with overestimated grades, despite the team's guidance.

The biggest limitation of the current study was the study's short duration. Also, the research team was unable to monitor the number of falls after the study and the time to the first fall. Limitations of the study were also the exclusion of 14 women because they didn't have a male dancing partner, self-reporting of physical activities (not controlled), and the narrow age range and economic status of participants.

CONCLUSIONS

Results of the current study have shown that dancing can improve postural stability among already active older adults. Improved postural stability diminishes the risk of falling. The practical implication is that dancing is more than just a hobby; it can serve as an alternative fall prevention strategy.

AUTHORS' DISCLOSURE STATEMENT

The authors received no funding for the study. We have no conflicts of interest to disclose.

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