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Cognitive And Mobility Profile Of Older Social Dancers.

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Abstract

Objectives—while social dancing is a popular form of recreation among older adults, its long-term mental and physical benefits have not been systematically assessed. Defining the cognitive and physical attributes of regular social dancing will help establish its health benefits as well as help plan future dance interventions to prevent adverse outcomes in older adults such as falls, slow gait, and dementia.

Design—Cross-sectional survey with two group comparison.

Participants—Twenty-four cognitively normal older social dancers (OSD) were compared with 84 age-, gender-, and education- matched older non-dancers (OND) participating in a community-based study.

Measurements—Motor and cognitive performance was assessed using validated clinical and quantitative methods.

Results—There were no differences in the frequency of participation in other cognitive and physical leisure activities, chronic illnesses, and falls between OSD and OND. Cognitive test performance was not different between OSD and OND. OSD had better balance but not strength than OND. OSD had longer stride compared to OND (117.8 ± 10.5 cm vs. 103.4 ± 20.2 cm, p = 0.008) on quantitative gait assessment, with a more stable pattern during walking with reduced stance time (63.9% vs. 65.9%, p = 0.01), increased swing time (36.1% vs. 34.1%, p = 0.01), and decreased double support time (27.9% vs. 30.9%, p = 0.03).

Conclusion—The results of this study suggest that long-term social dancing may be associated with better balance and gait in older adults.

Keywords

Dance; elderly; balance; gait; cognition

INTRODUCTION

While social dancing is a popular form of recreation among seniors, there is little information on its long-term physical and mental benefits.[1] Systematic gait and cognitive assessments in social dancers are lacking.[1] The limited research suggests that regular dancing may improve balance and strength, decrease risk of falls, and prevent cognitive decline.[1–5]

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While regular dancers have good body rhythm while dancing, it does not necessarily follow that social dancing will translate to a better gait pattern during normal walking. Moreover, it is uncertain whether social dancing will have its effect on specific or global measures of gait and cognition.

Cognitive and motor performance of nondisabled cognitively normal older social dancers (OSD) participating in a community-based study was compared to age-, sex-, and education-matched cognitively normal older non-dancers (OND) in this study. Based on our and prior research,[1–5] we hypothesized that OSD would have better gait, balance, and cognition than OND. Defining the cognitive and physical attributes of regular social dancing will help establish its health benefits as well as help plan future dance interventions to prevent adverse outcomes in older adults such as falls, slow gait, and dementia.

METHODS

Study population

Subjects for the current study were identified from nondisabled community-residing participants in a longitudinal gait and mobility study.[6] The aim of the study was to identify clinical markers of disability. The inclusion criteria were age 70 and over and living in Bronx County. Exclusion criteria was presence of disability (defined as inability to perform one or more of the following activities of daily living: bathing, dressing, grooming, feeding, toileting, walking around home, and getting up from a chair) and inability to follow instructions for study protocols. We identified 25 OSD over a one-year period (September 2004 to August 2005). We excluded one OSD with clinical dementia. The 24 OSD were matched by age (± 6 months), gender, and education (± 1 year) to 84 OND evaluated over the same study period with the same study protocols. The local institutional review board approved the study protocol. All subjects signed informed consents.

Dance

At study visits, participation in physical and mental leisure activities including social dancing was documented by research assistants. The questionnaire was based on our validated leisure activity scale.[5] Subjects were asked about the number of days per week they danced and the number of years they had been dancing.

Cognitive assessments

The tests included in the neuropsychological test battery have been validated for use in the normal aging population in our and other studies. We examined performance on tests of cognitive domains that may be influenced by exercise. *General mental status:* Blessed-Information-Memory-Concentration test.[7] This test has high test-retest reliability and correlates well with Alzheimer pathology.

Memory—Free and Cued Selective Reminding Test is a widely used and validated test of episodic memory.[8]

Executive function—A number of cognitive processes are grouped under the rubric of executive function. We examined performance on the Digit Span, Digit Symbol, and Block Design Tests from the Wechsler Adult Intelligence Scale-revised.[9] We also examined performance on the Verbal fluency test[10] and Trail making tests.[11]

Depressive symptoms—Geriatric depression scale.[12]

Quantitative Gait

Research assistants conducted quantitative gait evaluations, independent of the clinician's evaluation, using a computerized gait mat (180 x 35.5 x 0.25 inches) with embedded pressure sensors (GAITRite, CIR systems, NJ).[6] Subjects were asked to walk on the mat at their 'normal walking speed' for two trials in a quiet well-lit hallway. Start and stop points were marked by white lines on the floor, and included three feet each for initial acceleration and terminal deceleration. Monitoring devices were not attached to the participants during the test. The software computes quantitative parameters (see Appendix 1 for definitions) based on footfalls recorded. Each trial was one walkway in length, and values analyzed were the mean of two trials computed by the software. Excellent reliability and validity for GAITRite assessments were reported in previous research in our center and in other studies.[6,13]

Motor

We examined subjects on the following validated tests of strength and balance.

- **a.** Balance subtest on the Physical performance battery.[14] Participants were scored 1 if they could hold a side-by side stand for 10 seconds but were unable to hold a semitandem stand for 10 seconds, 2 if they held a semitandem stand for 10 seconds but were unable to hold a full tandem stand for more than 2 seconds, 3 if they held the full tandem stand for 3 to 9 seconds, and 4 if they held the full tandem stand for 10 seconds.
- **b.** Chair rise test from the Physical performance battery.[14] Time taken (seconds) to complete 5 chair rises. The chair rise is a test of both lower extremity strength as well as balance.[14,15]
- **c.** Unipedal stance (seconds). This test measures ability to stand on one foot, selected by subject, for a maximum of 30 seconds.
- **d.** Grip strength (kilograms force) was measured with a dynamometer.

Statistical analysis

Baseline characteristics of eligible OSD and OND as well as their performance on cognitive and motor tests were compared using descriptive statistics. Categorical variables were compared with Chi-square test applying Fishers test as appropriate. Continuous variables were compared using independent sample t-test. All tests were two-tailed with an alpha level of 5%.

RESULTS

Study population

Of the 24 OSD, 8 were men and 16 women. The mean age of OSD was 80 years (OND 80.8 y). The OSD danced for 4.3 ± 3.0 days per month (range 1–12 days). The mean duration of social dancing was 36.5 ± 26.5 years (range 3–75 years, median 30 years). The types of dancing included ballroom dancing (n = 10), line dancing (3), swing dancing (3), square dancing (1), and unspecified (7). Of the 24 OSD, 3 (12.5%) rated their dancing skills as expert, 10 (41.7%) as intermediate, 3 (12.5%) as beginners, and 8 (30.3%) did not rate themselves. However, none of the OSD were professional or competitive dancers. Other than dancing, there were no significant differences in the frequency of participation in other cognitive (watching television, reading newspapers, writing for pleasure, playing board or card games, puzzles, and playing musical instruments) and physical leisure activities (brisk walking, aerobic exercises, swimming, yoga, weight training, gardening, and light housework) between OSD and OND. Table 1 confirms balanced age, gender, and education levels among OSD and OND. There were no differences in prevalence of chronic illness and falls between the two groups.

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Cognition

Table 1 shows that there were no significant differences in performance on tests of general and specific cognitive status including executive function.

Motor

OSD had better balance than OND measured by the PPB and unipedal stance (Table 1). However lower extremity (chair rise) and upper extremity strength (grip) measures were not different. OSD walked faster than OND. OSD had longer steps and strides than OND, which resulted in decreased stance time, increased swing time and decreased double support time reflecting a more stable walking pattern (Table 2). There were no significant group differences in gait and cognitive parameters when the group was stratified by sex (data not shown).

DISCUSSION

This study shows that OSD had better balance and gait patterns but not strength than OND. These findings in regular social dancers corroborate previous studies that have reported improvements in balance in older adults following short-term dance interventions.[3,4,16] Regular dancing may improve balance in several ways. Older adults attempt to improve stability by shortening their step length and increasing their double-support time.[17,18] However, this is not a stable gait pattern and is associated with increased risk of falls.[19] Quantitative gait testing in this study revealed that OSD walked faster but took longer steps (and strides) than OND. They spend less time on the stance phase and more time in the swing phase, which reflects a more stable gait pattern.[17–19] While OSD had a lower prevalence of falls than OND, the differences were not significant in this small sample. Older adults have increased motor tone while standing and may over-react to balance perturbations.[1] This unsafe response may be modified by regular dancing. Dancing may also improve cardiovascular fitness. Findings in this and other studies[20,21] also raise the possibility that increasing step or stride length in older adults could be examined as an intermediate study endpoint in rehabilitative interventions to improve balance and reduce risk of falls.

Professional dancers are reported to have better balance, and may show different postural adaptation to balance perturbations than nondancers.[1,22,23] For instance, dancers rely more on proprioception and less on visual input than nondancers.[23] Ballet dancers are trained to have a stable visual reference.[23] Even among professional dancers patterns of muscle activation in response to postural changes differ depending on the type of dancing.[24] Professional dancers receive longer and more intensive training than OSD, and it is not known if regular social dancing will result in the same postural adaptations seen in professional dancers.

We previously reported that older adults who danced frequently had a reduced risk of developing dementia compared to those who rarely danced or never danced.[5] However, cognitive test performance was not significantly different between OSD and OND in this study. Both groups had comparable levels of participation in leisure activities other than dancing, which may also minimize cognitive differences. Matching was done by age, sex, and education, all of which have been shown to be strongly associated with risk of dementia in our and other studies. Matching by these variables may, hence, reduce cognitive differences between OSD and OND.

Limitations of this preliminary study include its cross-sectional design that does not permit inferences on causality, the small sample size, and variable "dose" of social dancing in the OSD group. Despite comparable levels of both physical and cognitive leisure activities, OSD had better gait and balance suggesting activity specific benefits. Comparisons of OSD with other control groups such as inactive older peers, master athletes, or chess players in future studies will help further define specific benefits of this activity. While there were no group differences in disease severity and matching was done on key variables, the possibility that the association between dancing and physical performance might in part reflect unmeasured disease severity or residual confounding by unmeasured variables rather than the benefits of dancing cannot be discounted.

Social dancing is a popular and accessible form of recreation in senior citizen centers.[1] The long-term effects of regular social dancing on adverse outcomes such as mobility, falls, and cognitive decline in older adults should be addressed in the context of future clinical trials and longitudinal studies. If these findings are corroborated by other studies, social dancing could be examined as a feasible and enjoyable way to encourage sedentary older adults to increase physical activity to improve their heath.[1]

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Appendix 1. Definition of gait parameters

Velocity (cm/second) is the distance covered on two trials divided by ambulation time.

Step length is measured from the heel point of the current footfall to the heel point of the previous footfall on the opposite foot.

Cadence is the number of steps taken in a minute.

Stride length is the distance between the heel points of two consecutive footfalls of the same foot (left to left, right to right).

Double support is the time elapsed between first contact of the current footfall and the last contact of the previous footfall, added to the time elapsed between the last contact of the current footfall and the first contact of the next footfall.

Support base is the perpendicular distance from heel point of one footfall to the line of progression of the opposite foot.

Table 1

Comparison of demographic, cognitive, and balance status of OSD and OND.

Variables	*OSD*	*OND*	*P-value*
Age	80.0 ± 6.5	80.8 ± 4.9	0.54
Women, %	70.1	69.7	0.82
High school or higher, %	88.4	87.5	0.87
Medical illnesses			
Diabetes, %	20.8	10.3	0.18
Hypertension, %	41.6	33.3	0.47
Coronary artery disease, %	8.0	5.8	0.10
Osteoarthritis, %	37.5	35.6	0.99
Rheumatoid arthritis, %	0.0	1.1	0.99
Strokes, %	8.3	9.2	0.63
Falls, %	4	11	0.29
Cognitive tests, mean ± SD			
Blessed test, score	2.0 ± 1.9	2.0 ± 2.0	0.92
FCSRT, score	47.9 ± 0.3	47.9 ± 0.8	0.79
Block design, score	23.1 ± 8.5	23.1 ± 8.9	0.97
Digit span, total	14.5 ± 2.9	14.9 ± 3.5	0.52
Digit symbol substitution, score	45.3 ± 16.9	46.1 ± 14.2	0.75
Verbal fluency test, score	39.1 ± 14.0	37.8 ± 13.4	0.67
Trailmaking test A, time	54.3 ± 19.0	54.9 ± 20.0	0.95
Trailmaking test B, time	146.5 ± 74.7	165.4 ± 114.4	0.95
Geriatric depression scale, score	1.9 ± 1.7	2.1 ± 1.8	0.87
Balance, mean ± SD			
Balance score (range 0–4)	3.7 ± 0.6	3.3 ± 0.9	0.03
Unipedal stance, sec	12.2 ± 10.1	7.2 ± 8.2	0.04
Chair rise, sec	12.8 ± 4.0	14.4 ± 6.6	0.36
Grip strength, kg	24.0 ± 7.7	21.7 ± 6.8	0.17

OSD: older social dancers, OND: older non dancers,

FCSRT: Free and cued selective reminding test

Table 2

A comparison of quantitative gait parameters (mean ± SD) during normal walking between older social dancers (OSD) and older non-dancers (OND). The gait parameters are for the right side.

Variable	*OSD*	*OND*	*P-value*
Velocity, cm/sec	100.5 ± 18.7	87.2 ± 23.6	0.02
Cadence, steps/min	101.9 ± 12.9	99.9 ± 14.3	0.94
Step length, cm	58.6 ± 5.9	52.3 ± 10.2	0.01
Stride length, cm	117.8 ± 10.5	103.4 ± 20.2	0.008
Swing, %	36.1 ± 1.9	34.1 ± 2.9	0.01
Stance, %	63.9 ± 1.9	65.9 ± 2.9	0.01
Double support, %	27.9 ± 3.3	30.9 ± 5.0	0.03
Support base, cm	8.9 ± 3.1	10.6 ± 4.3	0.16