Cognitive and Mobility Profile of Older Social Dancers

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OBJECTIVES: To define the cognitive and physical attributes of regular social dancing so as to help establish its health benefits and 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.

SETTING: Bronx County, New York.

PARTICIPANTS: Twenty-four cognitively normal older social dancers (OSDs) were compared with 84 age-, sex-, and education-matched older nondancers (ONDs) 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, or falls between OSDs and ONDs. Cognitive test performance was not different between OSDs and ONDs. OSDs had better balance but not strength than ONDs. OSDs had a longer mean stride ± standard deviation than ONDs (117.8 ± 10.5 cm vs 103.4 ± 20.2 cm, \( P = .008 \)) on quantitative gait assessment, with a more stable pattern during walking with reduced stance time (63.9% vs 65.9%, \( P = .01 \)), longer swing time (36.1% vs 34.1%, \( P = .01 \)), and shorter double support time (27.9% vs 30.9%, \( P = .03 \)).

CONCLUSION: The results of this study suggest that long-term social dancing may be associated with better balance and gait in older adults. J Am Geriatr Soc 54:1241–1244, 2006.

Key words: dance; elderly; balance; gait; cognition

Although social dancing is a popular form of recreation for seniors, there is little information on its long-term physical and mental benefits.\(^1\) Systematic gait and cognitive assessments of 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.\(^1\)–\(^3\)

Although 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 has any effect on specific or global measures of gait or cognition.

Cognitive and motor performance of nondisabled cognitively normal older social dancers (OSDs) participating in a community-based study was compared with that of age-, sex-, and education-matched cognitively normal older nondancers (ONDs) in this study. Based on prior research,\(^1\)–\(^3\) it was hypothesized that OSDs would have better gait, balance, and cognition than ONDs. Defining the cognitive and physical attributes of regular social dancing will help establish its health benefits and 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 older and living in Bronx County. Exclusion criteria were 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 the home, and getting up from a chair) and inability to follow instructions for study protocols.

Twenty-five OSDs were identified over a 1-year period (September 2004 to August 2005). One OSD with clinical dementia was excluded. The 24 OSDs were matched by age (± 6 months), sex, and education (± 1 year) with 84 ONDs 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, research assistants documented participation in physical and mental leisure activities, including so-
cial dancing. The questionnaire was based on a validated leisure activity scale. 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. Performance on tests of cognitive domains that exercise may influence was examined.

General Mental Status
The Blessed Information Memory Concentration test, which was used to assess general mental status, has high test-retest reliability and correlates well with Alzheimer’s pathology.

Memory
The Free and Cued Selective Reminding Test is a widely used and validated test of episodic memory.

Executive Function
A number of cognitive processes are grouped under the rubric of executive function. Performance on the Digit Span, Digit Symbol, and Block Design Tests from the Wechsler Adult Intelligence Scale—revised was examined. Performance on the Verbal Fluency Test and Trail Making Tests was also examined.

Depressive Symptoms
Depressive symptoms were assessed using the Geriatric Depression Scale.

Quantitative Gait
Research assistants conducted quantitative gait evaluations, independent of the clinician’s evaluation, using a computerized gait mat (180 × 35.5 × 0.25 inches) with embedded pressure sensors (GAITRite, CIR Systems, Havertown, PA). 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 using white lines on the floor and included 3 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.

Motor
Subjects were examined using the following validated tests of strength and balance.

Balance subtest of the Physical Performance Battery (PPB): 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. Chair rise test from the PPB: time taken (seconds) to complete five chair rises. The chair rise is a test of lower extremity strength and balance. Unipedal stance (seconds): this test measures ability to stand on one foot, selected by subject, for a maximum of 30 seconds. Grip strength (kg of force) was measured using a dynamometer.

Statistical Analysis
Baseline characteristics of eligible OSDs and ONDs, as well as their performance on cognitive and motor tests, were compared using descriptive statistics. Categorical variables were compared using the chi-square test, applying the Fisher test as appropriate. Continuous variables were compared using independent sample t tests. All tests were two-tailed, with an alpha level of 5%.

RESULTS
Study Population
Of the 24 OSDs, eight were men and 16 women. The mean age of OSDs was 80.0 and of ONDs was 80.8. The OSD danced for a mean ± standard deviation of 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 (n = 3), swing dancing (n = 3), square dancing (n = 1), and unspecified (n = 7). Of the 24 OSDs, three (12.5%) rated their dancing skills as 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, doing puzzles, and playing musical instruments) and physical (brisk walking, aerobic exercise, swimming, yoga, weight training, gardening, and light housework) leisure activities between OSDs and ONDs. Table 1 confirms balanced age, sex, and education levels of OSDs and ONDs. There were no differences in prevalence of chronic illness and falls between the two groups.

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

Motor
OSDs had better balance than ONDs, measured using the PPB and unipedal stance (Table 1), although lower extremity (chair rise) and upper extremity (grip) strength measures were not different. OSDs walked faster than ONDs. OSDs had longer steps and strides than ONDs, which resulted in shorter stance time, longer swing time, and shorter double support time, reflecting a more stable walking pattern.
DISCUSSION

This study shows that OSDs have better balance and gait patterns but not strength than ONDs. These findings in regular social dancers corroborate previous studies that have reported improvements in balance in older adults following short-term dance interventions. 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, although this is not a stable gait pattern and is associated with greater risk of falls. Quantitative gait testing in this study revealed that OSDs walked faster but took longer steps (and strides) than ONDs. They spent less time in the stance phase and more time in the swing phase, which reflects a more stable gait pattern. Although OSDs had a lower prevalence of falls than ONDs, the differences were not significant in this small sample. Older adults have more motor tone while standing and may overreact to balance perturbations. Regular dancing may modify this unsafe response. Dancing may also improve cardiovascular fitness. Findings in this and other studies 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. For instance, dancers rely more on proprioception and less on visual input than nondancers. Ballet dancers are trained to have a stable visual reference. Even in professional dancers, patterns of muscle activation in response to postural changes differ depending on the type of dancing. Professional dancers receive longer and more intensive training than OSDs, and

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Table 1. Comparison of Demographic, Cognitive, and Balance Status of Older Social Dancers (OSDs) and Older Nondancers (ONDs)

<table>
<thead>
<tr>
<th>Variables</th>
<th>OSDs</th>
<th>ONDs</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, mean ± SD</td>
<td>80.0 ± 6.5</td>
<td>80.8 ± 4.9</td>
<td>.54</td>
</tr>
<tr>
<td>Female, %</td>
<td>70.1</td>
<td>69.7</td>
<td>.82</td>
</tr>
<tr>
<td>High school or higher, %</td>
<td>88.4</td>
<td>87.5</td>
<td>.87</td>
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<tr>
<td>Medical illnesses, %</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>20.8</td>
<td>10.3</td>
<td>.18</td>
</tr>
<tr>
<td>Hypertension</td>
<td>41.6</td>
<td>33.3</td>
<td>.47</td>
</tr>
<tr>
<td>Coronary artery disease</td>
<td>8.0</td>
<td>5.8</td>
<td>.10</td>
</tr>
<tr>
<td>Osteoarthritis</td>
<td>37.5</td>
<td>35.6</td>
<td>.99</td>
</tr>
<tr>
<td>Rheumatoid arthritis</td>
<td>0.0</td>
<td>1.1</td>
<td>.99</td>
</tr>
<tr>
<td>Stroke</td>
<td>8.3</td>
<td>9.2</td>
<td>.63</td>
</tr>
<tr>
<td>Falls</td>
<td>4</td>
<td>11</td>
<td>.29</td>
</tr>
<tr>
<td>Cognitive tests, mean ± SD</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Blessed test score</td>
<td>2.0 ± 1.9</td>
<td>2.0 ± 2.0</td>
<td>.92</td>
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<td>Free and Cued Selective Reminding Test score</td>
<td>47.9 ± 0.3</td>
<td>47.9 ± 0.8</td>
<td>.79</td>
</tr>
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<td>Block design score</td>
<td>23.1 ± 8.5</td>
<td>23.1 ± 8.9</td>
<td>.97</td>
</tr>
<tr>
<td>Digit span total</td>
<td>14.5 ± 2.9</td>
<td>14.9 ± 3.5</td>
<td>.52</td>
</tr>
<tr>
<td>Digit Symbol Substitution score</td>
<td>45.3 ± 16.9</td>
<td>46.1 ± 14.2</td>
<td>.75</td>
</tr>
<tr>
<td>Verbal Fluency Test score</td>
<td>39.1 ± 14.0</td>
<td>37.8 ± 13.4</td>
<td>.67</td>
</tr>
<tr>
<td>Trail Making Test A, seconds</td>
<td>54.3 ± 19.0</td>
<td>54.9 ± 20.0</td>
<td>.95</td>
</tr>
<tr>
<td>Trail Making Test B, seconds</td>
<td>146.5 ± 74.7</td>
<td>165.4 ± 114.4</td>
<td>.95</td>
</tr>
<tr>
<td>Geriatric Depression Scale score</td>
<td>1.9 ± 1.7</td>
<td>2.1 ± 1.8</td>
<td>.87</td>
</tr>
<tr>
<td>Balance, mean ± SD</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Balance score (range 0–4)</td>
<td>3.7 ± 0.6</td>
<td>3.3 ± 0.9</td>
<td>.03</td>
</tr>
<tr>
<td>Unipedal stance, seconds</td>
<td>12.2 ± 10.1</td>
<td>7.2 ± 8.2</td>
<td>.04</td>
</tr>
<tr>
<td>Chair rise, seconds</td>
<td>12.8 ± 4.0</td>
<td>14.4 ± 6.6</td>
<td>.36</td>
</tr>
<tr>
<td>Grip strength, kg</td>
<td>24.0 ± 7.7</td>
<td>21.7 ± 6.8</td>
<td>.17</td>
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</tbody>
</table>

SD = standard deviation.

(Note: Gait parameters are for the right side.)
it is not known whether regular social dancing will result in the same postural adaptations seen in professional dancers.

It was previously reported that older adults who danced frequently had a lower risk of developing dementia than those who rarely danced or never danced, but cognitive test performance was not significantly different between OSDs and ONDs 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. Matching by these variables may, hence, reduce cognitive differences between OSDs and ONDs.

Limitations of this preliminary study include its cross-sectional design, which does not permit inferences on causality, the small sample size, and variable amount of social dancing in the OSD group. Despite comparable levels of physical and cognitive leisure activities, OSDs had better gait and balance, suggesting activity-specific benefits. Comparisons of OSDs 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. Although 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 centers. 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 other studies corroborate these findings, social dancing could be examined as a feasible and enjoyable way to encourage sedentary older adults to increase physical activity to improve their health.

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Author Contributions: Dr. Verghese was responsible for developing the study design, acquisition of data, analysis and interpretation of data, and initial draft of the manuscript.

Sponsor’s Role: The sponsor had no role in the design, methods, subject recruitment, data collections, analysis, or preparation of the manuscript.

REFERENCES


Appendix 1. Definition of Gait Parameters

Velocity (cm/s) 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.