

Effects of seated Senior Dance® on cognitive functions in older adults with and without cognitive decline: a controlled clinical trial

Giovana Xavier Pinto Piazentin¹





Spencer Luiz Marques Payão¹ (D)

Abstract

Objective: To analyze the effects of Senior Dance® (SD) on cognitive aspects in older adults aged 60 to 85 years. Method: Non-randomized controlled clinical trial consisting of two groups: (G1) institutionalized older adults with cognitive decline and (G2) noninstitutionalized older adults without cognitive decline. Assessments were conducted using the Mini-Mental State Examination (MMSE), Brief Cognitive Screening Battery (BCSB), and Clinical Dementia Rating (CDR). The SD sessions were conducted in a seated format, for 12 weeks, twice a week, with a duration of 60 minutes each. The Mann-Whitney and Wilcoxon non-parametric tests were used for pre-intervention and post-intervention comparisons. Results: G1 consisted of 15 older adults with mild cognitive impairment (MCI) and mild dementia, while G2 consisted of 32 older adults. The Wilcoxon test showed a statistically significant difference (p value ≤0.050) in various cognitive domains assessed by the MMSE and BCSB in both groups. Specifically, significant improvements were observed in the domains of attention, calculation, and language in G1, as well as in language in G2, according to the MMSE. Additionally, significant changes were noted in the domains of incidental memory, recognition, and verbal fluency in G1, and in incidental memory, immediate memory, delayed memory, recognition, and clock drawing in G2, as assessed by the BCSB. Conclusion: It is concluded that SD had positive impacts on the cognitive functions of participants in both groups, contributing to prevention and health promotion.

Keywords: Cognition. Dance. Dementia. Aging. Older Adult. Homes for the Aged.

Research Funding: Coordenação de Aperfeiçoamento de Pessoal de Nível Superior - Brazil (CAPES) -Funding Code 001. Process number: 88887.670520/2022-00. Master's scholarship (Social Demand Program). The authors declare that there is no conflict in the conception of this work.

Faculdade de Medicina de Marília (Famema), Programa de Pós-graduação em Saúde e Envelhecimento (PPGSE), Mestrado Acadêmico. Marília, SP, Brasil.

Universidade de Marília (UNIMAR), Centro Interdisciplinar em Diabetes (CENID). Marília, SP, Brasil.

INTRODUCTION

In Brazil, about 1.7 million older adults live with dementia¹, but there is a lack of a national strategy to address cognitive assessment issues, resulting in delays in early diagnosis of dementia and access to specialized care².

In this respect, studies indicate that dance contributes to motor function and cognitive deficits in older adults by inducing plasticity in the hippocampus^{3,4}. Adam et al.⁵ identified that a dance intervention combined with relaxation demonstrated reduced levels of anxiety and depression, as well as improvements in quality of life and cognitive function in older adults with mild to moderate cognitive impairment in Malaysia, Asia. Among the different types of dance, Senior Dance® (SD) has stood out for improving the quality of life⁶, balance, and mobility in community-dwelling older adults⁷. SD is based on cultural activities from various peoples and was created in Germany in 1971, initiated by a Choreographer and Social Psychopedagogue, with the aim of providing an enjoyable activity option for older adults8.

SD is a group activity that can be performed seated or standing, consisting of rhythmic movements synchronized with music to stimulate participation and interaction among participants. It works on mobility, flexibility, and coordination, as well as attention, concentration levels, and retention skills⁸. In this context, understanding the contributions of SD as a resource that can be utilized in professional practice by physiotherapists provides relevant information about its application in older adults. Thus, the following question arises: "What are the contributions of SD, performed seated and in a group setting, to older adults with cognitive decline compared to those without cognitive decline?" Given the limited understanding of the effects of this modality on older adults with cognitive decline.

Considering the increasing proportion of individuals aged 60 years and older, and consequently the rise in degenerative diseases, we believe this study can provide theoretical and practical groundwork on Senior Dance® for future research. Furthermore, it

can contribute as a stimulus for future implementation of projects and/or initiatives in Homes for the Aged (ILPIs), as well as in primary care settings, using SD as a preventive and/or mitigating strategy for age-related changes.

In view of this, the aim of the present study was to analyze the effects of Senior Dance® on cognitive aspects in older adults aged 60 to 85 years.

METHOD

This is a non-randomized, controlled clinical trial of quantitative approach, with a parallel intervention design, two arms, and open-label masking. There was no randomization as participants were assigned to groups non-randomly, considering distinct clinical conditions. Sample size calculation was performed to analyze the intervention effect difference between groups using a one-tailed independent samples Student's t-test, with a study power of 80%, a type I error margin of 5%, a hypothetical large effect size (0.80), and an allocation ratio of 2/1 (G2/G1).

A total of 46 sample elements were obtained, with 15 in Group 1 (institutionalized older adults with cognitive decline) and 31 in Group 2 (non-institutionalized older adults without cognitive decline).

As stipulated in Resolution number 466/2012 of the National Health Council (CNS), this study was submitted to the Human Subject Research Ethics Committee (CEP) through the Brazil Platform and approved under opinion number 6.498.191. The research was registered in the Brazilian Clinical Trials Registry (ReBEC) under registration number RBR-2k6xxs7.

The study commenced following approval from the settings for research development, as well as authorization from participants and/or legal guardians through voluntary agreement, pursuant to the Informed Consent Form (ICF) for older adults in G2 and the Informed Assent Form (IAF) for participants/legal guardians of older adults in G1 residing in ILPIs.

The inclusion criteria adopted were: a) older adults of both sexes, b) aged 60 to 85 years; c) capable of verbally responding to the research instruments; d) wheelchair users or not; e) with cognitive decline based on the MMSE score and residing in ILPIs for G1, f) older adults without cognitive decline based on the MMSE score, not institutionalized for G2. The upper age limit was determined based on the age range represented in previous studies⁶⁻⁸.

As exclusion criteria, the following did not participate: a) older adults involved in dance exercise programs; b) bedridden or severely ill individuals; c) those medically restricted from physical exercise; d) individuals with recent fractures and/or undergoing immobilization; e) those with less than 3 years of schooling; f) previously diagnosed with nonneurodegenerative psychiatric disorders; g) residing in day care arrangements within ILPIs (older adults who spend some hours or days and then return home) for G1. As criteria for loss: a) refusal to sign the Informed Consent Form and/or Informed Assent Form; and b) non-attendance at 75% of the sessions.

The established discontinuation criteria were: a) older adults experiencing limiting complaints; b) those who do not agree to continue during the course of the study; c) onset of pathologies that prevent continuation in the research; and d) hospitalization during the study period. The study was conducted in two distinct municipalities located in the central-west region of São Paulo state, Brazil. G1 consisted of older adults residing in two private ILPIs in Tupã (SP), Brazil, with cognitive decline as measured by the MMSE. G2 comprised non-institutionalized older adults without cognitive decline, residents of Herculândia (SP), Brazil.

The SD interventions in G1 were conducted within the ILPIs themselves. In G2, they were carried out in a space provided by the Elderly Community Center (CCI) of the municipality, with two available schedules/classes for participation.

Recruitment for participation of older adults in G2 was conducted through invitations in public places and social media. Interested individuals contacted the researcher for pre-registration and scheduling of the assessment.

Data collection was conducted at two phases: the first (Pre-intervention), carried out before the intervention began, took place from January to early February 2023, and the second (Post-intervention), conducted at the end of the 12 weeks, occurred in May 2023.

For the characterization and assessment of the profile of older adults, a semi-structured questionnaire developed by the researchers was used. Nutritional classification based on Body Mass Index (BMI) followed Lipschitz's criteria. This author recommends an acceptable range for older adults of BMI between 22 and 27 kg/m², with cutoff points for underweight and overweight defined as BMI below 22 kg/m² and above 27 kg/m², respectively.

After characterizing the older adults, cognitive assessment was conducted using the MMSE¹⁰. Cutoff points for cognitive decline were based on values proposed by Brucki et al.¹¹, adjusted for educational level: 25 points for 1-4 years of schooling, 26.5 points for 5-8 years, 28 points for 9-11 years, and 29 points for more than 11 years of schooling.

After administering the MMSE, the Brief Cognitive Screening Battery (BCSB)^{12,13} was used. The suggested cutoff scores in the Brazilian population for interpreting the BCSB are as follows: Incidental Memory: (\leq 4); Immediate Memory: (\leq 6); Learning: (\leq 6); Delayed Memory: (\leq 5); Recognition: (\leq 7); Semantic Verbal Fluency (animals) by educational level12, according to Caramelli et al.¹⁴: Illiterate (\leq 8), 1-7 years of education (\leq 11), \geq 8 years of education (\leq 12).

After identifying cognitive decline using the MMSE in G1, the Clinical Dementia Rating scale (CDR)^{15,16} was administered to assess the staging of cognitive decline in older adults. CDR classification was conducted using rules developed and validated by Morris¹⁷, utilizing the CDR[®] Dementia Staging Instrument Calculator¹⁸ scoring algorithm.

The assessment, intervention, and reassessment process was conducted by a single Physical Therapist, the researcher of this study, authorized to use the Senior Dance® choreographies upon certification from the Participation Certificate of the Directors' Meeting B-Theme: Let's Dance Together II, held in the distance education modality. Currently,

the courses for Senior Dance® are offered by the Official Senior Dance® Association, which holds the rights to the registered trademark and logo, with administrative headquarters in Joinville (SC), Brazil.

The interventions with SD in both groups were conducted over a period of 12 weeks, totaling 24 sessions, held on Mondays and Thursdays for 60 minutes each, in a seated format, forming a circle. Each session followed 5 execution stages:

- I) Initial rest for Vital Signs (SSVV) verification, including: Systolic Blood Pressure (SBP), Diastolic Blood Pressure (DBP), Heart Rate (HR), and the percentage of oxygen saturation (SpO2) before the intervention;
- II) Stretching and body warm-up, lasting 15 minutes. During this stage, the music used was based on initially identified musical preferences. The first 10 minutes were dedicated to cephalo-caudal stretching exercises. The remaining five minutes were allocated to warm-up exercises involving joint movements of the body segments to enhance attention, agility, and coordination.
- III) Execution of SD, lasting 30 minutes. In this study, a different choreography was performed in each session. The SD choreographies included: 1st session: Snap Lollipop, 2nd: Fridolin dances with plates, 3rd: Branle Bacchanale seated, 4th: Small circles, 5th: Snap Lollipop, 6th: Apat from right and left, 7th: Blue Suede Shoes seated, 8th: Small circles, 9th: Al achat seated, 10th: Butterflies, 11th: Apat combinations, 12th: The proud lady from Macedonia, 13th: Al achat seated, 14th: Fridolin dances with plates, 15th: Waving colorful scarves, 16th: Blues tip, 17th: Dos a dos trio seated, 18th: Branle Bacchanale seated, 19th: Roll in two-beat rhythm, 20th: Blues tip, 21st: Dos a dos trio seated, 22nd: Apat from right and left, 23rd: Snap Lollipop, and 24th: Fridolin dances with plates. The choreography steps were taught in stages. A speaker and chairs were used. Some choreographies included manual device resources: 30 cm wooden sticks, colorful disposable plates, colorful scarves, and butterfly finger molds.
- IV) Relaxation, return to calmness, lasting 15 minutes, composed of 10 minutes of stretching

- and five minutes of breathing exercises (slow and deep breathing), aimed at returning to their basal state, accompanied by instrumental music;
- V) Verification of vital signs HR, SpO2, SBP, DBP after the intervention.

Vital signs were obtained solely for monitoring, safety, and participants' well-being, and were not included in the results analysis. For verification, assistance was provided by Nursing professionals from each ILPI and two invited Nursing professionals to assist in Group 2.

After the 12 weeks, the groups underwent a reassessment. Reassessments for Group 1 occurred in the second half of May, while for Group 2, they occurred in the first half of May 2023. Data obtained at pre-assessment and post-assessment moments were tabulated. Qualitative variables related to the characterization of the older adult participants were described by absolute frequency (N) and relative frequency (%). Fisher's exact test (Chi-square alternative) was applied to analyze whether there was a difference in proportion distribution for sample characteristics between the groups.

For the application of the Student's t-test for independent samples, the assumption of homogeneity of variances was checked using Levene's test. Normality distribution was assessed using the Shapiro-Wilk test. Quantitative variables were described using the median and interquartile range (25th – first quartile and 75th - third quartile). To compare the pre-intervention and post-intervention moments within each group, the non-parametric Wilcoxon test was conducted. For comparison between groups (considering the difference between pre-intervention and post-intervention moments), the non-parametric Mann-Whitney test was used because the groups are independent. The significance level adopted was 5%.

DISPONIBILITY OF DATA

The entire dataset supporting the results of this study is available upon request to the corresponding author.

RESULTS

Participants G1 and G2

In G1, the initial sample of the study consisted of 60 individuals residing in ILPIs. In G2, 86 participants were enrolled. After applying the inclusion/exclusion criteria, N=47 eligible participants were obtained, with n=15 for G1 characterized by Mild Cognitive Impairment (MCI) and mild dementia by CDR, and n=32 for G2 as shown in (Figure 1).

Participant Characteristics

Table 1 presents the characteristics of participants from both groups, analyzed using Fisher's exact test. The sample evaluated consisted of 15 participants

for G1: 12 women (80.0%) and three men (20.0%), and 32 participants for G2: 30 women (93.8%) and two men (6.3%).

Regarding marital status (p=0.002*), G2 showed a higher proportion of married individuals compared to G1. Additionally, other significant differences were observed: wheelchair-bound older adults (p=0.008*), use of assistive devices (p=0.001*), nutritional status (p=0.001*), and Alzheimer's disease (p=0.001*) with G1 showing a higher frequency of these conditions compared to G2.

Furthermore, it is noteworthy that all older adults in G1 engaged in some form of physical exercise (individual or group physiotherapy) (p=0.004*), compared to G2 (walking and/or participation in health clubs), where a significantly lower proportion were engaged in such activities.

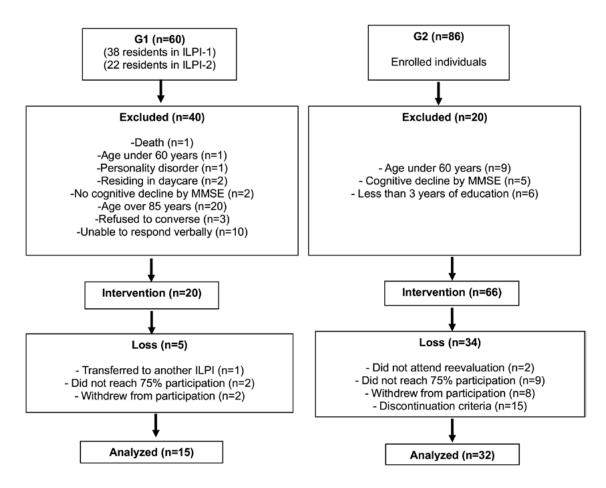


Figure 1. Flowchart of participant selection and exclusion process for both groups. Tupã, SP and Herculândia, SP, 2023.

G1: Institutionalized older adults with cognitive decline, G2: Non-institutionalized older adults without cognitive decline, n: part of the total sample, ILPI: Homes for the Aged.

Source: Authors

Table 1. Characterization of Older Adult Participants from Both Groups. Tupã, SP and Herculândia, SP, 2023.

Variables		Group	— Total	p-value	
variables	G1 n (%)	G2 n (%)	Total		
Sex				0.309	
Female	12 (80.00%)	30 (93.80%)	42 (89.40%)		
Male	3 (20.00%)	2 (6.30%)	5 (10.60%)		
Marital Status				0.002*	
Single	3 (20.00%)	1 (3.10%)	4 (8.50%)		
Married	0 (0.00%)	15 (46.90%)	15 (31.90%)		
Widowed	8 (53.30%)	12 (37.50%)	20 (42.60%)		
Divorced	4 (26.70%)	4 (12.50%)	8 (17.00%)		
Education				0.236	
ncomplete Elementary School	9 (60.00%)	16 (50%)	25 (53.10%)		
Complete Elementary School	0 (0.00%)	6 (18.80%)	6 (12.80%)		
ncomplete High School	1 (6.70%)	2 (6.30%)	3 (6.40%)		
Complete High School	1 (6.70%)	5 (15.60%)	6 (12.80%)		
ncomplete Higher Education	1 (6.70%)	0 (0.00%)	1(2.10%)		
Complete Higher Education	3 (20.00%)	3 (9.40%)	6 (12.80%)		
Wheelchair User	,		,	0.008*	
Yes	4 (26.70%)	0 (0.00%)	4 (8.50%)		
No	11 (73.30%)	32 (100.00%)	43 (91.50%)		
Assistive Device				0.001*	
<i>Y</i> es	8 (53.30%)	0 (0.00%)	8 (17.00%)		
No	7 (46.70%)	32 (100.00%)	39 (83.00%)		
Nutritional Status				0.001*	
Jnderweight	7 (46.70%)	2 (6.30%)	9 (19.10%)		
Eutrophic	5 (33.30%)	8 (25.00%)	13 (27.70%)		
Overweight	3 (20.00%)	22 (68.80%)	25 (53.20%)		
PE	, ,	,	, ,	0.004*	
Yes	15 (100.00%)	19 (59.40%)	34 (72.3%)		
No	0 (0.00%)	13 (40.60%)	13 27.70%)		
Heart Disease	,	,	,	0.999	
Yes	2 (13.3%)	5 (15.60%)	7 (14.90%)		
No	13 (86.7%)	27 (84.40%)	40 (85.10%)		
Dyslipidemia	,	, ,	, ,	0.116	
Yes	10 (66.70%)	12 (37.50%)	22 (46.80)		
No	5 (33.30%)	20 (62.50%)	25 (53.20%)		
SAH	, ,	, ,	,	0.324	
Yes	9 (60.00%)	24 (75.00%)	33 (70.20%)		
No	6 (40.00%)	8 (25.00%)	14 (29.80%)		
OM	, ,	` '	, ,	0.999	
Yes	5 (33.30%)	12 (37.50%)	17 (36.20%)		
No	10 (66.70%)	20 (62.50%)	30(63.80%)		
Parkinson's Disease	, ,	, ,	, ,	0.319	
Yes	1 (6.7%)	0 (0.00%)	1 (2.1%)		
No	14 (93.3%)	32(100.00%)	46 (97.9%)		

to be continued

Continuation of Table 1

Variables		Group	Т-4-1	
	G1 n (%)	G2 n (%)	— Total	p-value
Alzheimer's Disease				0.001*
Yes	6 (40.00%)	0 (0.00%)	6 (12.80%)	
No	9 (60.00%)	32(100.00%)	41 (87.20%)	
CVA				0.319
Yes	1 (6.70%)	0 (0.00%)	1 (2.10%)	
No	14 (93.30%)	32(100.00%)	46 (97.90%)	

G1: Institutionalized older adults with cognitive decline, G2: Non-institutionalized older adults without cognitive decline, n: part of the total sample, PE: Physical Exercise, SAH: Systemic Arterial Hypertension, DM: Diabetes Mellitus, CVA: Cerebrovascular accident, %: percentage, *: indicates significant difference between groups by Fisher's exact test for p-value ≤0.050. Source: Authors.

Furthermore, regarding characterization, Table 2 presents the quantitative variables related to age, body mass (pre-evaluation), height, BMI (pre-evaluation), number of medications (pre-evaluation), and participation in SD meetings. The Student's t-test for independent samples was used to compare the characteristics of the sample.

G1 exhibited a significantly lower mean body mass compared to G2 (p=0.001*), suggesting a higher frequency of underweight among G1 participants. Additionally, the BMI of G1 was considerably lower than that of G2 (p=0.001*), indicating that G1 participants had a lower BMI. It is noteworthy that G1 had a significantly higher use of medications compared to G2 (p=0.005*).

The evaluation of musical style preference used during stretching and warm-up sessions, it was observed that in G1, the sertanejo musical style was the most prominent (n=11), while classical style had a single mention, MPB two mentions, and rock one mention. There was no mention of preference for forró in this group. However, in G2, the preference for sertanejo was also predominant (n=22), with classical having two mentions and forró eight mentions. There was no mention of MPB or rock in this group.

Pre-intervention and post-intervention assessment between groups

Analysis of the comparison of differences between pre-intervention and post-intervention moments (between groups) of MMSE and BCSB by the non-parametric Mann-Whitney test is depicted in Table 3. The variables violated normal distribution, which was tested for value, difference, and residuals.

There was a statistically significant difference for MMSE (total) (p=0.001), immediate memory (p=0.038), attention and calculation (p=0.037), language (p=0.010), BCSB delayed memory (p=0.022), and recognition (p=0.030). These differences indicate that G1 exhibited lower cognitive performance in these domains compared to G2.

Pre-intervention and post-intervention assessment within each group

Analysis of the comparison of differences between pre-intervention and post-intervention moments (within each group) of MMSE and BCSB by the non-parametric Wilcoxon test is depicted in Table 4.

A statistically significant difference was obtained in G1 for MMSE total score (p=0.001‡), attention and calculation (p=0.017‡), and language (p=0.008‡) when compared to the pre-intervention moment. In G2, a statistically significant difference was observed for MMSE total (p=0.002‡) and language (p=0.038‡). These results suggest significant changes in the evaluated variables after the intervention, compared to the pre-intervention moment within each group.

Table 2. Characteristics of the groups regarding age, anthropometric variables, number of continuous-use medications, and presence. Tupã, SP and Herculândia, SP, 2023.

Variables	n	Mean	SD	SEM	p-value
Age (in years)	,			'	·
G1	15	74.13	(<u>+</u> 9.47)	2.45	0.051
G2	32	69.28	(<u>+</u> 6.78)	1.20	
Body mass (kg) (pre-intervention)					
G1	15	57.98	(<u>+</u> 13.17)	3.40	0.001*
G2	32	71.41	(<u>+</u> 11.72)	2.07	
Height (m)					
G1	15	1.57	(±0.06)	0.02	0.513
G2	32	1.56	(±0.05)	0.01	
BMI (kg/m²) (pre-intervention)					
G1	15	23.35	(<u>+</u> 4.86)	1.25	0.001*
G2	32	29.24	(±4.38)	0.77	
Number of medications					
G1	15	8.47	(<u>+</u> 5.30)	1.37	0.005*
G2	32	3.78	(<u>+</u> 2.81)	0.50	
Presence					
G1	15	85.56	(±7.85)	2.03	0.054
G2	32	80.73	(±7.76)	1.37	

G1: institutionalized older adults with cognitive decline, G2: non-institutionalized older adults without cognitive decline, n: part of the total sample, SD: Standard Deviation, SEM: Standard Error of the Mean, kg: Kilograms, m: Meters, BMI: Body Mass Index, *: indicates significant difference between groups by Student's t-test for p-value \leq 0.050. Source: Authors.

Table 3. Comparison of the difference between pre-intervention and post-intervention moments between groups by the Mann-Whitney non-parametric test. Tupã, SP and Herculândia, SP, 2023.

Variables	G1			G2			. 7
	Median	25th	75th	Median	25th	75th	— p-value
MMSE (total)	3	2	4	1	-0.75	2	0.001*
MMSE orientation	1	-1	1	0	0	0	0.056
MMSE immediate memory	0	0	1	0	0	0	0.038*
MMSE attention and calculation	1	0	1	0	0	1	0.037*
MMSE recall	1	-1	2	0	0	1	0.410
MMSE language	1	0	2	0	0	0.75	0.010*
BCSB incidental memory	1	0	2	1	0	2	0.963
BCSB immediate memory	1	-1	1	1	0	2	0.259
BCSB learning	0	0	1	1	0	1	0.794
BCSB delayed memory	0	0	1	1	0	2	0.022*
BCSB recognition	2	1	3	1	0	2	0.030*
BCSB verbal fluency	2	0	3	1	-1	2	0.240
BCSB clock drawing	0	-1	1	0	0	0.75	0.960
Clinical Dementia Rating	0	0	0	0	0	0	0.999

G1: institutionalized older adults with cognitive decline, G2: non-institutionalized older adults without cognitive decline, 25th: first quartile, 75th: third quartile, *: indicates significant difference between groups by Mann-Whitney test for p-value \leq 0.050, MMSE: Mini-Mental State Examination, BCSB: Brief Cognitive Screening Battery. Source: Authors.

Table 4. Comparison of the difference between pre-intervention and post-intervention moments within each group by the Wilcoxon non-parametric test. Tupã, SP and Herculândia, SP, 2023.

Variables	Pre-intervention			Post-intervention			h
variables	Median	25th	75th	Median	25th	75th	— p-value
			G1 (n:	=15)			
MMSE (total)	20	18	23	23	22	25	0.001‡
orientation	8	5	9	8	6	9	0.439
immediate memory	2	2	3	3	3	3	0.096
attention and calculation	3	0	4	1	0	1	0.017‡
recall	1	0	1	2	0	2	0.088
language	7	6	8	8	7	9	0.008‡
BCSB incidental memory	4	2	5	5	4	6	0.020‡
BCSB immediate memory	5	4	6	5	4	6	0.118
BCSB learning	5	4	7	6	5	7	0.347
BCSB delayed memory	5	2	5	5	2	6	0.177
BCSB recognition	7	6	9	9	8	10	0.001‡
BCSB verbal fluency	6	5	7	6	4	10	0.029‡
BCSB clock drawing	2	1	8	2	1	9	0.223
Clinical Dementia Rating	0.5	0.5	1	0.5	0.5	1	1.000
			G2 (n=	32)			
MMSE (total)	28	27	29	29	28	30	0.002‡
orientation	10	10	10	10	10	10	1.000
immediate memory	3	3	3	3	3	3	0.157
attention and calculation	5	4	5	5	4	5	0.106
recall	2	1.25	3	2	2	3	0.133
language	9	8	9	9	9	9	0.038‡
BCSB incidental memory	5.5	4	6	6.5	6	7	0.001‡
BCSB immediate memory	7	6	7.8	8	7	8	0.001‡
BCSB learning	8	7	8	8	7.3	9	0.079
BCSB delayed memory	6.5	5	8	8	7	9	0.001‡
BCSB recognition	9	8	10	10	10	10	0.002‡
BCSB verbal fluency	11	10	13	12	11	14	0.199
BCSB clock drawing	9	8	10	9	8	10	0.042‡

G1: institutionalized older adults with cognitive decline, G2: non-institutionalized older adults without cognitive decline, 25th: first quartile, 75th: third quartile, n: part of the total sample, MMSE: Mini-Mental State Examination, BCSB: Brief Cognitive Screening Battery, \ddagger : indicates significant difference in relation to the pre-intervention moment within each group by the Wilcoxon non-parametric test for p-value ≤ 0.050 . Source: Authors.

10 of 14

DISCUSSION

The present study analyzed the effects of Senior Dance® (SD) on cognitive aspects in older adults. Among the 47 participants analyzed, there was a predominance of females in both groups. Venancio¹9 also highlights a predominance of female participation in dance activities. Regarding institutionalization, the predominance of females is supported by another study²0.

It was observed that the majority of institutionalized older adults were widowed. This finding suggests that being widowed may influence the decision to institutionalize. However, it is important to consider that the family support network is not the only contributing factor to institutionalization. Other factors such as lack of a caregiver, family conflicts, abandonment, housing issues, and health problems also contribute to institutionalization²¹. The frequency of incomplete primary education in this study reflects the Brazilian educational reality²². These findings highlight the importance of considering education when assessing cognitive functions, as it influences memory, attention, executive function, and language²³. Moreover, low education levels can also interfere with the execution of SD, as it requires understanding instructions given by the instructor during its application, such as concepts of laterality. Therefore, it is necessary to demonstrate movements step by step and use accessible language that is understandable to older adults without resorting to infantilization.

The frequency of low weight in G1 and overweight in G2 highlights nutritional differences between the groups. Moser et al.²⁴ point out that deficient nutritional status was identified in (59.8%) of institutionalized older adults, which is a potential factor for dependency among older adults in this context. Older adults with deficient nutritional status may face challenges in actively participating in SD. Meanwhile, overweight and/or obesity could influence movement ability, mobility, and motivation.

Both studied groups presented frequent comorbidities such as dyslipidemia, Systemic Arterial Hypertension (SAH), and Diabetes Mellitus (DM). There was a statistically significant difference

between the groups for Alzheimer's Disease (AD). These findings are consistent with the study by Lini et al.²⁵, which assessed the prevalence of dementia in institutionalized older adults, with AD being more frequent.

Data indicate a risk association between SAH and DM with the development of AD²⁶. Research conducted in Brazil suggests that 32.3% of dementia cases can be attributed to seven modifiable risk factors, including DM, SAH, midlife obesity, physical inactivity, depression, smoking, and low education levels²⁷.

The average number of continuous use medications in G1 was higher than in G2. It is a consensus that the use of five or more medications indicates polypharmacy²⁸, which is more likely in patients with dementia²⁹. Thus, our results can be explained by the inclusion of patients with AD, Cerebrovascular accident (CVA), and Parkinson's disease in G1 who require the use of more medications.

A cross-sectional study examined the association between polypharmacy, cognitive function, and comorbidities (depression, SAH, and/or DM), finding that older adults with polypharmacy were more likely to have cognitive impairment than those without polypharmacy³⁰.

Comorbidities such as depression and chronic conditions often require additional pharmacological therapies, contributing to polypharmacy and consequently exacerbating cognitive impairment in older adults. In this regard, a multidisciplinary approach becomes necessary, aiming to implement management strategies that mitigate the adverse effects of medications and promote the overall well-being of older patients. Regarding musical style, both groups showed a preference for country music. Our data also corroborate a study by Corrêa et al.31, where results demonstrate that music representing life experiences, such as country music in institutionalized older adults with dementia, can evoke feelings of life satisfaction, memories, and joy compared to classical music.

These results suggest the importance of assessing and considering musical preferences when developing therapeutic interventions with older adults, as music can evoke different emotions and serve as an important tool for strengthening memory and emotions.

Despite including only older adults with MCI and mild dementia in G1, the low cognitive performance was already expected. The scores of cognitive tests MMSE and BCSB in G1 showed inferior performance compared to G2.

In our study, in G1, we had the participation of older adults who were wheelchair users and/or used some walking aid device. Oliani et al.³² evaluated cognitive functions in institutionalized older adults diagnosed with probable dementia, distinguishing between independent individuals and wheelchair users, and observed more preserved cognitive functions in independent older adults using BCSB.

G2 developed a better understanding and execution of the choreography movements, while G1 had more difficulty performing them, especially when the music was played, as they had to follow the rhythm.

However, the data presented in Table 4, through the within-group post-intervention analysis, showed that the SD intervention had a positive impact on the cognitive functions of older adults, improving memory capacity, attention, and language skills in G1 as assessed by the MMSE. In G2, a significant difference was observed in the domains of total score and language, which indeed reflects an overall improvement in cognition.

Chan et al.³³ point out that the application of dance as a therapy improves cognitive function, attention, memory, and visuospatial abilities in older adults with MCI.

In relation to BCSB (Table 4), the domains of incidental memory, recognition, and verbal fluency showed statistically significant differences in G1, while incidental memory, immediate memory, delayed memory, recognition, and clock drawing showed significant differences in G2. Hewston et al.³⁴ quantified that dance also improved executive function, which is assessed by verbal fluency and clock drawing.

In G1, where improvements were observed in cognitive domains of total score, attention and calculation, and language assessed by MMSE, and incidental memory, recognition, and verbal fluency by BCSB, these domains are fundamental for learning and retaining instructions and choreographies during SD practice. Additionally, improvement in the language domain facilitates understanding of verbal instructions during dance.

In G2, where there were significant improvements in the domains of total score and language by MMSE, and incidental memory, immediate memory, delayed memory, recognition, and clock drawing by BCSB, this reflects an overall improvement in cognition. This improvement may result in an enhanced ability to learn and perform new movements/choreographies more easily.

Our study presents some important limitations that should be considered when interpreting the results. Among them, we can highlight: a) the sample size was affected by participant non-adherence due to various factors such as cognitive limitations that prevented the application of scales and questionnaires, low education level, and criteria for discontinuation of study participation; b) absence of a control group, making it impossible to compare with the group that received the intervention; c) cognitive test results were obtained after the 12-week period, so it is not possible to express how long improvements in cognitive domains persisted.

This study provides evidence of the therapeutic benefits of SD in cognitive aspects, encouraging the inclusion of SD in rehabilitation and health promotion programs, whether individually, in one-on-one sessions, or in groups, offering an enjoyable and inclusive physical activity for older adults of different profiles. Moreover, SD can be applied across all age groups.

The importance of investing in evidence-based preventive interventions to address population aging is emphasized. Implementing SD programs in the community and/or in care institutions can reduce healthcare costs, improve the quality of life for older adults, and decrease the demand for healthcare services.

12 of 14

CONCLUSION

Senior Dance[®], in the seated modality, provided positive impacts on cognitive functions, encompassing the domains of total score, attention and calculation, and language in Group 1, as well as total score and language in Group 2 as assessed by the Mini-Mental State Examination. Additionally, improvements were observed in the domains of incidental memory, recognition, and verbal fluency in Group 1, and incidental memory, immediate memory, delayed memory, recognition, and clock drawing in Group 2, as assessed by the Brief Cognitive Screening Battery of participating older adults.

The findings of our study suggest that the Senior Dance® modality can be used as a promising, cost-effective preventive and therapeutic strategy for institutionalized and non-institutionalized older adults, contributing to health prevention and promotion. There is a need for further studies on

the long-term effects of Senior Dance® on cognitive functions in older adults, considering the possibility of including a control group, both among older adults with and without cognitive decline.

AUTHORSHIP

- Giovana Xavier Pinto Piazentin Conception, design, data interpretation; manuscript writing; responsible for all aspects of the work, ensuring issues related to the accuracy or integrity of any part of the work.
- Eduardo Federighi Baisi Chagas Data analysis and critical review.
- Spencer Luiz Marques Payão Supervision; manuscript writing; critical review; approval of the final version to be published

Edited by: Yan Nogueira Leite de Freitas

REFERENCES

- Melo SCD, Champs APS, Goulart RF, Malta DC, Passos VMDA. Dementias in Brazil: increasing burden in the 2000–2016 period. Estimates from the Global Burden of Disease Study 2016. Arq Neuro-Psiquiatr [Internet]. dezembro de 2020 [Access April 29, 2024]; 78(12):762–71. Available at: https://doi. org/10.1590/0004-282X20200059
- Mattke S, Corrêa Dos Santos Filho O, Hanson M, Mateus EF, Neto JPR, De Souza LC, et al. Preparedness of the Brazilian health-care system to provide access to a disease-modifying Alzheimer's disease treatment. Alzheimer's & Dementia [Internet]. janeiro de 2023 [Access April 29, 2024];19(1):375–81. Available at: https://doi.org/10.1002/alz.12778
- Wu CC, Xiong HY, Zheng JJ, Wang XQ. Dance movement therapy for neurodegenerative diseases: A systematic review. Front Aging Neurosci [Internet]. 8 de agosto de 2022 [Access April 29, 2024];14:975711. Available at: https://doi.org/10.3389/fnagi.2022.975711
- Rehfeld K, Müller P, Aye N, Schmicker M, Dordevic M, Kaufmann J, et al. Dancing or Fitness Sport? The Effects of Two Training Programs on Hippocampal Plasticity and Balance Abilities in Healthy Seniors. Front Hum Neurosci [Internet]. 15 de junho de 2017 [Access April 29, 2024];11:305. Available at: https:// doi.org/10.3389/fnhum.2017.00305

- Adam D, Ramli A, Shahar S. Effectiveness of a Combined Dance and Relaxation Intervention on Reducing Anxiety and Depression and Improving Quality of Life among the Cognitively Impaired Elderly. SQUMJ [Internet]. 2 de fevereiro de 2016 [Access April 29, 2024];16(1):e47-53. Available at: https://doi.org/10.18295/squmj.2016.16.01.009
- 6. Nadolny AM, Trilo M, Fernandes JDR, Pinheiro CSP, Kusma SZ, Raymundo TM. A Dança Sênior® como recurso do terapeuta ocupacional com idosos: contribuições na qualidade de vida. Cad Bras Ter Ocup [Internet]. 2020 [Access April 29, 2024];28(2):554–74. Available at: https://doi.org/10.4322/2526-8910.ctoAO1792
- Franco MR, Sherrington C, Tiedemann A, Pereira LS, Perracini MR, Faria CSG, et al. Effect of Senior Dance (DanSE) on Fall Risk Factors in Older Adults: A Randomized Controlled Trial. Physical Therapy [Internet].
 de abril de 2020 [Access April 29, 2024];100(4):600–8.
 Available at: https://doi.org/10.1093/ptj/pzz187
- Cassiano JG, Serelli L da S, Torquetti A, Fonseca K, Cândido SA. Dança sênior: um recurso na intervenção terapêutico ocupacional junto a idosos hígidos. RBCEH [Internet]. 23 de outubro de 2010 [Access April 29, 2024]; 6(2). Available at: https://doi. org/10.5335/rbceh.2012.174

- 9. Lipschitz DA. Screening for nutritional status in the elderly. Prim Care. 1994 Mar;21(1):55-67. PMID: 8197257.
- Folstein MF, Folstein SE, McHugh PR. "Mini-mental state". Journal of Psychiatric Research [Internet]. novembro de 1975 [Access April 29, 2024];12(3):189– 98. Available at: https://doi.org/10.1016/0022-3956(75)90026-6
- Brucki SMD, Nitrini R, Caramelli P, Bertolucci PHF, Okamoto IH. Sugestões para o uso do miniexame do estado mental no Brasil. Arq Neuro-Psiquiatr [Internet]. setembro de 2003 [Access April 29, 2024];61(3B):777–81. Available at: https://doi. org/10.1590/S0004-282X2003000500014
- 12. Nitrini R, Brucki SMD, Yassuda MS, Fichman HC, Caramelli P. The Figure Memory Test: diagnosis of memory impairment in populations with heterogeneous educational background. Dement neuropsychol [Internet]. abril de 2021 [Access April 29, 2024]; 15(2):173–85. Available at: https://doi.org/10.1590/1980-57642021dn15-020004
- 13. Smid J, Studart-Neto A, César-Freitas KG, Dourado MCN, Kochhann R, Barbosa BJAP, et al. Declínio cognitivo subjetivo, comprometimento cognitivo leve e demência diagnóstico sindrômico: recomendações do Departamento Científico de Neurologia Cognitiva e do Envelhecimento da Academia Brasileira de Neurologia. Dement neuropsychol [Internet]. setembro de 2022 [Access April 29, 2024];16(3 suppl 1):1–24. Available at: https://doi.org/10.1590/1980-5764-DN-2022-S101PT
- 14. Caramelli P, Carthery-Goulart MT, Porto CS, Charchat-Fichman H, Nitrini R. Category Fluency as a Screening Test for Alzheimer Disease in Illiterate and Literate Patients. Alzheimer Disease & Associated Disorders [Internet]. janeiro de 2007 [Access April 29, 2024];21(1):65–7. Available at: http://10.1097/WAD.0b013e31802f244f
- Fagundes Chaves ML, Camozzato AL, Godinho C, Kochhann R, Schuh A, De Almeida VL, et al. Validity of the Clinical Dementia Rating Scale for the Detection and Staging of Dementia in Brazilian Patients. Alzheimer Disease & Associated Disorders [Internet]. julho de 2007 [Access April 29, 2024];21(3):210–7. Available at: https:// 10.1097/WAD.0b013e31811ff2b4
- Hughes CP, Berg L, Danziger W, Coben LA, Martin RL. A New Clinical Scale for the Staging of Dementia. Br J Psychiatry [Internet]. junho de 1982 [Access April 29, 2024]140(6):566–72. Available at: https://doi.org/10.1192/bjp.140.6.566

- 17. Morris JC. The Clinical Dementia Rating (CDR): Current version and scoring rules. Neurology [Internet]. novembro de 1993 [Access April 29, 2024];43(11):2412. Available at: https://doi.org/10.1212/WNL.43.11.2412-a
- CDR® Calculator | National Alzheimer's Coordinating Center [Internet]. naccdata.org. [Access June 9, 2023]. Available at: https://naccdata.org/datacollection/tools-calculators/cdr
- Venancio RCDP, Carmo EGD, Paula LVD, Schwartz GM, Costa JLR. Efeitos da prática de Dança Sênior[®] nos aspectos funcionais de adultos e idosos. Cad Bras Ter Ocup [Internet]. 2018 [Access April 29, 2024];26(3):668–79. Available at: https://doi.org/10.4322/2526-8910.ctoAR1111
- 20. De Oliveira LFS, Wanderley RL, De Medeiros MMD, De Figueredo OMC, Pinheiro MA, Rodrigues Garcia RCM, et al. Health-related quality of life of institutionalized older adults: Influence of physical, nutritional and self-perceived health status. Archives of Gerontology and Geriatrics [Internet]. janeiro de 2021 [Access April 29, 2024];92:104278. Available at: https://doi.org/10.1016/j.archger.2020.104278
- Pinheiro NCG, Holanda VCD, Melo LAD, Medeiros AKBD, Lima KCD. Desigualdade no perfil dos idosos institucionalizados na cidade de Natal, Brasil. Ciênc saúde coletiva [Internet]. novembro de 2016 [Access April 29, 2024];21(11):3399–405. Available at: https://doi.org/10.1590/1413-812320152111.19472015
- 22. Kretschmer AC, Loch MR. Autopercepção de saúde em idosos de baixa escolaridade: fatores demográficos, sociais e de comportamentos em saúde relacionados. Rev bras geriatr gerontol [Internet]. 2022 [Access April 29, 2024];25(1):e220102. Available at: https://doi.org/10.1590/1981-22562022025.220102.pt
- 23. Suemoto CK, Bertola L, Grinberg LT, Leite REP, Rodriguez RD, Santana PH, et al. Education, but not occupation, is associated with cognitive impairment: The role of cognitive reserve in a sample from a low-to-middle-income country. Alzheimer's & Dementia [Internet]. novembro de 2022 [Access April 29, 2024];18(11):2079–87. Available at: https://doi.org/10.1002/alz.12542
- 24. Moser AD, Hembecker PK, Nakato AM. Relação entre capacidade funcional, estado nutricional e variáveis sociodemográficas de idosos institucionalizados. Rev bras geriatr gerontol [Internet]. 2021 [Access April 29, 2024];24(5):e210211. Available at: https://doi.org/10.1590/1981-22562021024.210211.pt

- 25. Lini EV, Doring M, Machado VLM, Portella MR. Idosos institucionalizados: prevalência de demências, características demográficas, clínicas e motivos da institucionalização. RBCEH [Internet]. 27 de dezembro de 2014 [Access April 29, 2024];11(3). Available at: https://doi.org/10.5335/rbceh.v11i3.4482
- 26. Xu W, Tan L, Wang HF, Jiang T, Tan MS, Tan L, et al. Meta-analysis of modifiable risk factors for Alzheimer's disease. J Neurol Neurosurg Psychiatry [Internet]. 20 de agosto de 2015 [Access April 29, 2024];jnnp-2015-310548. Available at: https://doi.org/10.1136/jnnp-2015-310548
- 27. Oliveira D, Jun Otuyama L, Mabunda D, Mandlate F, Gonçalves-Pereira M, Xavier M, et al. Reducing the Number of People with Dementia Through Primary Prevention in Mozambique, Brazil, and Portugal: An Analysis of Population-Based Data. Anstey K, Peters R, organizadores. JAD [Internet]. 13 de agosto de 2019 [Access April 29, 2024];70(s1):S283–91. Available at: https://doi.org/10.3233/JAD-180636
- Holst SS, Karstoft K, Jensen MEJ, Andersen TRH, Unkerskov J, Vermehren C. Definition of and delimitation of polyfarmaci. Ugeskr Laeger. 16 de outubro de 2023;185(42):V05230302.
- 29. Growdon ME, Gan S, Yaffe K, Steinman MA. Polypharmacy among older adults with dementia compared with those without dementia in the UNITED STATES. J American Geriatrics Society [Internet]. setembro de 2021 [Access April 29, 2024];69(9):2464–75. Available at: https://doi.org/10.1111/jgs.17291

- 30. Rasu RS, Shrestha N, Karpes Matusevich AR, Zalmai R, Large S, Johnson L, et al. Polypharmacy and Cognition Function Among Rural Adults. Abner E, organizador. JAD [Internet]. 21 de julho de 2021 [Access April 29, 2024];82(2):607–19. Available at: https://doi.org/10.1111/jgs.17291
- 31. Corrêa L, Caparrol AJDS, Martins G, Pavarini SCI, Gratão ACM. Efeitos da música nas expressões corporais e faciais e nos sintomas psicológicos e comportamentais de idosos. Cad Bras Ter Ocup [Internet]. 2020 [Access April 29, 2024];28(2):539–53. Available at: https://doi.org/10.4322/2526-8910. ctoAO1889
- 32. Oliani MM, Christofoletti G, Stella F, Gobbi LTB, Gobbi S. Locomoção e desempenho cognitivo em idosos institucionalizados com demência. Fisioter mov [Internet]. 2007 [Access April 29, 2024] 20(1):109–14. Available at: https://repositorio.ufms.br/bitstream/123456789/4945/1/Fisioterapia%20 em%20Movimento.pdf
- 33. Chan JSY, Wu J, Deng K, Yan JH. The effectiveness of dance interventions on cognition in patients with mild cognitive impairment: A meta-analysis of randomized controlled trials. Neuroscience & Biobehavioral Reviews [Internet]. novembro de 2020 [Access April 29, 2024];118:80–8. Available at: https://doi.org/10.1016/j.neubiorev.2020.07.017
- 34. Hewston P, Kennedy CC, Borhan S, Merom D, Santaguida P, Ioannidis G, et al. Effects of dance on cognitive function in older adults: a systematic review and meta-analysis. Age and Ageing [Internet]. 28 de junho de 2021 [Access April 29, 2024];50(4):1084–92. Available at: https://doi.org/10.1093/ageing/afaa270