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Review Article

The effectiveness of dance interventions on the cognitive functioning of people with dementia or cognitive impairment: A systematic review

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ABSTRACT

Background & Aim: Dementia significantly impair cognitive abilities, well-being, and the functioning of daily life, but there is no cure yet. In the search for non-pharmacological interventions, dance has emerged as a potential complementary therapy to support people with dementia or cognitive impairment. The aim of this study is to investigate the effectiveness of various dance interventions on the cognitive performance of people with dementia or cognitive impairment.

Methods & Materials: In accordance with the PRISMA 2020 guidelines, a systematic search was conducted in six databases (APA-PsycINFO, Web of Science, Medline, CINAHL, Embase, and Cochrane)from 2002 to 2023. The quality of the studies was rigorously assessed using the JBI tool. A narrative synthesis approach was used to summarize the findings. Effects of the interventions were presented either as Standardized Mean Difference (SMD), Weighted Mean Difference (WMD), or Mean Difference (MD). An effect size of < 0.1 is considered trivial, 0.1-0.3 is small while > 0.5 is interpreted as a large effect.

Results: The systematic results showed significant improvements in global cognition (SMD= 0.54 to 6.10), memory (SMD= 0.24 to 0.56), attention (SMD= 0.38), and language and fluency (SMD=0.61) in different dance genres such as ballroom, Latin and aerobics. However, different effects were observed in executive and visuospatial functions.

Conclusion: This systematic review shows the effectiveness of dance interventions in improving several cognitive functions in people with dementia, including memory, attention, language, and fluency. This study supports the use of dance as an effective non-pharmacological approach in dementia care and merits its consideration in treatment strategies and further research studies.

Introduction

Dementia remains an incurable disease, and researchers are investigating the value of a control to support living well with dementia or cognitive impairment (1). The ability to perform certain tasks is associated with psychological well-being and coping (2). To date, there is no therapy or means to delay the development of dementia. The number of older people worldwide is expected to increase sharply in the coming years (3). Dementia is associated with impaired social and cognitive functioning in daily life (4). Therefore, a support strategy that helps people with dementia or cognitive impairment to live with and cope with the disability, especially in task-specific activities, is of utmost importance.

Cognitive functioning can be defined as a variety of mental health abilities, including the individual's ability to learn, solve problems, make decisions, think and remember, and increase attention (5, 6). Furthermore, cognitive function can theoretically be viewed from two perspectives (i.e., negative and positive aspects). It can be defined negatively in terms of impairments

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that can range from minor (e.g., limited attention span, forgetfulness) to more severe impairments (e.g., disorientation in space and time) (7, 8). It is known that cognitive decline has a number of consequences. In particular, cognitive impairment can potentially impair an individual's ability to function effectively and thus maintain their life, including their participation in treatment processes (6, 9). Impairment in cognitive functioning has been identified as a key factor in institutionalization and poor decision-making (9). In addition, mild cognitive impairment is known to be a boundary between normal aging and dementia; however, they have a higher risk of developing Alzheimer's disease or other types of dementia (10, 11). Individuals with cognitive impairment appear disoriented and overtly forgetful, often forgetting their disorders and may not be able to communicate their consequences (12). However, regular physical activity combined with cardiovascular fitness training has been shown to reduce the risk of cognitive impairment (13, 14).

Knowledge of how to cope with dementia or cognitive impairment could help in implementing interventions aimed at promoting strategies to improve a person's ability to perform activities of daily living and alleviate disease-related psychological and behavioral symptoms. Due to this growing demand, complementary and alternative treatments are needed to address this issue. Therefore, interventions to promote cognitive functioning in people with dementia, or cognitive impairments are needed. The available empirical and theoretical evidence shows that dance interventions can be used to strengthen the self (15). Furthermore, recent research suggests that dancing can improve both physical and psychological well-being (16). Among the many benefits of dance are its social aspect, the connection it creates, and a greater awareness of another person's body when moving in unison with each other (17, 18). In light of the fact that dancing is a physical activity, a general improvement in health cannot be excluded as a possible cause.

There are a number of reviews examining the effect of dance therapy on health outcomes, including cognitive function in people with dementia or cognitive impairment (9, 19-22). Others provided practice recommendations (23); improving the health and well-being of older adults with dementia (24-28); as an intervention in nursing facilities (29); dementia-related impairments in cognitive, physical, emotional, and social functioning (30); ballroom dance as a form of rehabilitation (31); effects on quality of life, depression, cognition, neuroplasticity, and physical function (32). However, there is not yet a systematic-review of the available evidence on the effects of dance interventions on cognitive functioning for people with dementia and cognitive impairment.

While the evidence from the previously mentioned reviews may not support the efficacy of dance therapies, it is crucial to recognize that systematic -reviews may be limited to characterizing the completeness or incompleteness of the available evidence. Therefore, we included only systematic reviews which may offer evidence that could potentially be stronger than the empirical studies. Again, dancing has been shown in the literature to improve cognitive performance in people with dementia or cognitive impairment (9); however, it remains unclear what an effective dose of dancing might be (frequency, duration, and course). Hence the need for this study. Uniquely, it will provide the impetus to promote the use of dance interventions with caregivers/residents in nursing homes and people with cognitive impairments and provide the background for future research.

Methods

The 2020 version of the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA), based on the recommendations of the Cochrane Handbook, was used to guide this review (33). The author's DS, MC, and UMB designed the study. This systematic review was registered with Prospero CRD42023472981.

Eligibility criteria

Studies were included based on the following criteria derived from the PICOS acronym. *Population*: people with dementia, or cognitive impairment; *Intervention:* dance; *Comparison*: Those with no dance interventions; *Outcome*: cognitive functioning (global

cognition, language fluency, verbal fluency, executive function, learning/memory functions, attention); *Study type*: Systematic reviews or reviews with meta-analysis. Studies were excluded if they were primary studies, letters to the editor, conference reports/abstracts, or non-peer-reviewed studies such as dissertations.

Information sources

We used the following seven electronic databases APA-PsychINFO Web of Science, Medline, CINAHL, Embase, and Cochrane (Table 1). Two of the reviewers (DS and SKS) conducted the search from January 2002 to November 2023 independently.

Search strategy

Dance therapy was utilized for searching the medical subjects' headings. Specifically, we adopted and modified the search terms from the study of Salihu, Wong (34). The following keywords were used: **Dance intervention** [movement therapy* OR dance therapy* OR movement psycho* OR dance movement OR authentic movement OR therapeutic dance OR movement psycho] AND **dementia** [Alzheimer OR dement* OR cognitive impairment OR cognitive dysfunction] AND **population** [Seniors OR elderly OR older adults OR elderly OR old age] AND **study type** [Review OR Systematic review OR Meta-analysis].

The database search was limited to articles published from 2002 to 2023, to obtain the most up-to-date information, as it can be assumed that a well-organized dance study can only be found in this age range. This is due to dance becoming an established intervention in the mid-20th century (35). The search was limited to articles published in English with abstracts and full text available online. The included reference lists were manually searched to increase the robustness of the search process.

Table 1. Search syntax

Database	Search terms
APA-PsycINFO	Any Field: cognitive impairment AND Any Field: Dance therapy AND Any Field: Older adults
CINAHL	(dance intervention dance therapy or rhythmic movement) AND (dementia or alzheimers or cognitive impairment or memory loss) AND (older adults or elderly or geriatric or geriatrics or aging or senior or seniors or older people or aged 65 or 65+)
Cochrane	((dementia.mp. [mp=title, short title, abstract, full text, keywords, caption text]) OR (cognitive impairment.mp. [mp=title, short title, abstract, full text, keywords, caption text])) AND ((dance therapy.mp. [mp=title, short title, abstract, full text, keywords, caption text] OR (dance intervention.mp. [mp=title, short title, abstract, full text, keywords, caption text])) AND ((Aged.mp. [mp=title, short title, abstract, full text, keywords, caption text]) OR (elderly.mp. [mp=title, short title, abstract, full text, keywords, caption text]))
Embase	(cognitive impairment.mp. or exp cognitive defect/) AND (exp aged/ or exp aging/) AND ((Dance intervention.mp.) OR (exp dance therapy/))
Medline	(exp Dance Therapy/) AND (exp Dementia/) AND (exp Aged/)
Web of Science	(ALL=(dementia)) OR ALL=(cognitive impairment) AND (ALL=(Dance therapy)) OR ALL=(Dance intervention) AND (ALL=(Aged)) OR ALL=(elderly) AND ALL=(Review)

Selection process

Studies were selected according to the PRISMA 2020 framework. Results from the six electronic databases were exported to the reference manager (Endnote), and duplicates were removed automatically using a built-in function of the reference manager and manually by eyeballing. Titles and abstracts were screened based on the eligibility criteria (i.e. inclusion and exclusion criteria). The full-text screening was then performed to identify eligible reviews. Two reviewers (DS and SKS) conducted the screening and a third reviewer (UMB) served as a mediator when conflicts or disagreements arose.

Data extraction process

Three of the reviewers (DS, MC, and UMB) developed a Microsoft Excel spreadsheet specifically for data extraction in this systematic review. The extraction form included essential study details: author demographics (gender, age), objectives and research questions, primary study characteristics, study locations, sample sizes, population details, outcome assessment method,

cognitive functioning measures, intervention dose (course, frequency, duration), and any theoretical frameworks regarding the therapeutic effects of the dance intervention (s) assessed. The data extraction was conducted independently by two reviewers (SKS and OMER). Discrepancies were resolved through discussion, with a third reviewer (UMB) making the final decision when consensus could not be reached. For clarification on outcome assessment methods, the lead author (DS) contacted one of the review authors.

Data items

The study profile includes information on study design, demographics (sex and age), number of subjects, population characteristics, and study duration (controls, interventions, and follow-up). Extracted intervention components included: a) intervention dose (course, frequency, and duration), dance load (i.e., the total number of dances per minute), study location (i.e., setting), and relevant theories underlying the interventions. In addition, the outcome measures used to assess cognitive function, and effect sizes of the intervention and comparison groups [i.e., Standardized Mean Difference (SMD), Weighted Mean Difference (WMD), Mean Difference (MD), etc]were extracted. To ensure accuracy, data extraction was performed by two independent reviewers (DS and MC). We also collected qualitative information on the benefits and acceptability of the intervention among users and service providers.

Quality assessment of included studies

To assess the quality of the included research, we used the systematic review checklist provided by the Joanna Briggs Institute (JBI) (36). It consists of 11 items, each assessing a separate component of a systematic review. Each item can be answered "Yes," "No," "Unclear," or "Not applicable"(36). Two independent reviewers (SKS and UMB) independently evaluated each systematic review. A review of the quality ratings by a third reviewer (MC) allowed any differences between their conclusions to be resolved.To evaluate the overall quality of this review, we counted the number of "yes" responses for each item in the study. Despite the lack of classification standards in the JBI checklist for systematic reviews, we deemed a study of high quality if there were at least 70% of the requirements fulfilled, moderate quality when 50-69% of the requirements were fulfilled, and poor quality if less than 50% of the requirements were fulfilled.

Summary of measures and synthesis of results

In this systematic review, meta-analysis was deemed inappropriate since several of the included papers had already undergone meta-analysis. There is a risk of overstating the statistical significance of the findings when a meta-analysis is performed on a review that also includes a meta-analysis. (37). Consequently, four reviewers (MC, DS, UMB, and SKS) conducted a detailed narrative synthesis. A thorough analysis of the narrative and numerical findings and conclusions of the report was included in the narrative synthesis concerning the effects of dance therapy on adult mental health and cognitive functioning. Finally, when possible and appropriate, the conclusions of systematic reviews take into account the effect sizes (<0.1= trivial, 0.1-0.3= small, 0.3-0.5= moderate, while > 0.5 is considered a large effect)(38), study designs included in the reviews (narrative synthesis or meta-analysis), and the quality of the reviews. It was found that heterogeneity between studies varied between 0% to 40% (might not be important), to 75% to 100% (considerable heterogeneity) Sedgwick, 2015). In this study, the heterogeneity was accounted for according to this recommendation.

Results

Two hundred studies were retrieved from the six electronic databases. After deduplication of 43 studies, there were 157. One hundred and sixteen items were removed because they did not meet the eligibility criteria. After reviewing the titles and abstract, there were forty-one entries. Twenty-seven articles were excluded after full-text screening because they did not meet the eligibility criteria. Finally, fourteen studies were included in both the qualitative and quantitative synthesis (Figure 1).

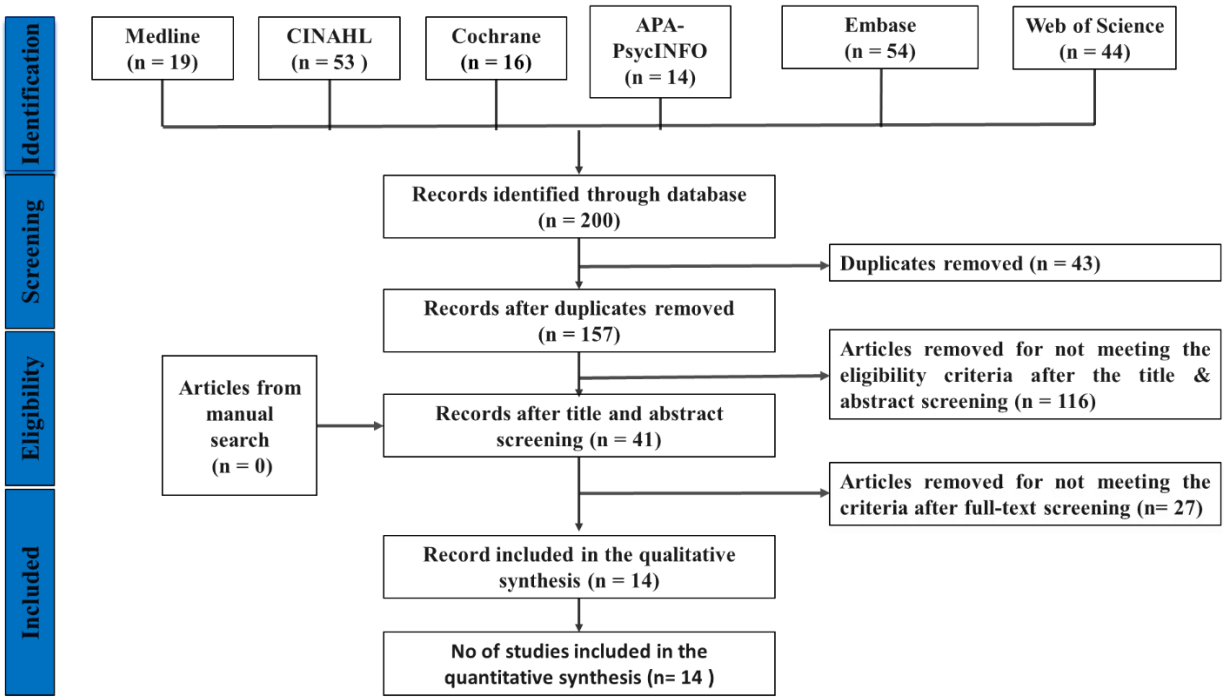

Figure 1. Prisma Flow Chart

Demographic characteristics

This systematic -review consists of 367 primary studies with 51,995 participants aged 50-100 years. Although the majority of eligible reviews (n= 7, 50%) did not report gender, women reportedly had the most participants (n= 3,429, 6.6%). The most frequently reported conditions were adults with cognitive impairment (n= 9, 64.3%), and dementia with MCI (n= 4, 28.6%) (Table 2).

Table 2. Characteristics of included studies

No	Author/year	Age in years/range	Gender	Study population	Sample size	Number of primary studies included (N)
1	Wu et al., 2018	50-85	NR	Older adults with or without cognitive impairment	3, 624	32
2	Wang et al., 2018	Females (n= 916, 69.4%)	Females (n= 926, 70.2%)	Older adults with cognitive impairment	1,319	13
3	Jiméneza, Bräuninger, and Meekums 2019	Unclear	NR	Dementia and depression	116	16
4	Whitty et al., 2020	Age range: 50-85	NR	Older adults with mild cognitive impairment	9147	64
5	Zhu et al., 2020	Age range: 65-75	Female (n= 579, 69%); Male (n= 263, 31%)	Older adults with MCI	842	5
6	Fong et al., 2021	Mean age: 65.9-85.8	Females (n= 423, 51.8%)	Older adults with mild MCI	817	11
7	Heston et al., 2021	Age range: 60–80	NR	Older adults with mild MCI plus some healthy adults	1, 412	7
8	Liu et al., 2021	Unclear	Unclear	Adults with MCI	980	14
9	Begde et al., 2022	Mean age: 50-100	58-74% were women in most of the studies	Dementia and MCI	30, 143	88

No	Author/year	Age in years/range	Gender	Study population	Sample size	Number of primary studies included (N)
10	Jordan et al., 2022	Age range: 62 to 94	NR	MCI	602	9
11	Vega-Ávila et al., 2022	Mean age: 71.92 ± 5	Female (n=667, 82.5%); Male (n= 142, 17.6%)	Healthy adults and those with MCI	809	11
12	Wu et al., 2022	NR	NR	Dementia and MCI	NR	57
13	Delfa-Lobato et al., 2023	Mean age: 61.6-84.0	NR	Dementia, MCI, Parkinsonism, and older adults	1, 201	26
14	Podolski et al., 2023	Mean age: 71	Female (n = 834, 84.8%); Male (n= 149, 15.2%)	Adults with subjective cognitive decline and MCI	983	14
		Age range: 50-100	**Total number of females: 3,429, 6.6%**		**Total number of participants:51,995**	**Total number of studies included:367**

MCI: Mild Cognitive Impairment; PEDro: Physiotherapy Evidence Database; NR: Not Reported

Quality appraisal of the included studies

Following the critical appraisal of the included studies using the JBI systematic review appraisal tool, ten studies were of high quality (low risk of bias), and the remaining four studies were of moderate quality (moderate risk of bias). The performance of the included reviews on the 11-item JBI systematic review appraisal tools as follows. The review question was explicitly stated in only two studies. Moreover, the likelihood of publication bias was also assessed in only two studies. On the other hand, the eligibility criteria were appropriate and clearly stated in all the 14 studies. Similarly, the search strategy and the criteria for appraising studies were appropriate in all 14 reviews. However, critical appraisal was conducted by two or more reviewers in only 13 studies. Likewise, methods of minimizing error in data extraction were employed in 13 studies. The methods used to combine studies—narrative synthesis and meta-analysis—were appropriate in 12 studies. The data sources utilized in 11 studies were adequate; at least four databases were searched in each of the 11 studies. In 10 studies, the recommendations were supported by the reported data, and the specific direction for future research was also appropriate (Table 3).

Table 3. Critical appraisal score of the individual studies and author's conclusion

No	Author, Year	Quality score % (n)	Remark	Author's conclusion
1	**Wu et al., 2018**	82% (9/11)	High quality	Mind-body exercises, especially tai chi and dance mind-body exercise, are beneficial for improving global cognition, cognitive flexibility, working memory, verbal fluency, and learning in cognitively intact or impaired older adults.
2	**Wang et al., 2018**	82% (9/11)	High quality	Dance was effective in promoting global cognition and memory in individuals with cognitive impairment.
3	**Jiménez et al., 2019**	55% (6/11)	Moderate quality	DMT is to be included as a mainstream therapeutic treatment with older adults who have a psychiatric condition, it is important to think about different solutions to the challenges of initiating more research in the field.
4	**Whitty et al., 2020**	82% (9/11)	High quality	Interventions that integrate cognitive and motor challenges (e.g. dance, dumbbell training) had small to moderate effects on memory or global cognition in people with MCI.
5	**Zhu et al., 2020**	82% (9/11)	High quality	Aerobic dance significantly improves global cognitive function and memory in older adults with MCI. In addition, it also benefits executive function.
6	**Fong et al., 2021**	82% (9/11)	High quality	Arts-based interventions can potentially improve various aspects of cognitive functioning in older persons with MCI, although our confidence was dampened by methodological limitations such as the moderate-to-high risk of bias present in studies and heterogeneity in the way MCI was defined.

No	Author, Year	Quality score % (n)	Remark	Author's conclusion
7	**Hewston et al.,2021**	91% (10/11)	High quality	Dance probably improves global cognitive function and executive function. However, there is little difference in complex attention, and evidence also suggests little effect on learning and memory.
8	**Liu et al.,2021**	73% (8/11)	High quality	Dance interventions may positively affect cognitive function, rote memory, immediate recall, delayed recall, and attention in patients with MCI. However, the included study does not indicate that dance intervention had positive results on the improvement in executive function and balance in patients with MCI.
9	**Begde et al., 2022**	91% (10/11)	High quality	Exercise (especially multicomponent exercise programs [such as dance] including cognitive, physical, and multitasking exercises) with sufficient intensity improves the activities of daily living skills in people with dementia or mild to moderate cognitive impairment (MCI).
10	**Jordan et al.,2022**	64% (7/11)	Moderate quality	Music interventions have the potential to improve the cognitive and depressive symptoms associated with MCI. However, robust evidence is needed to ascertain these potential benefits.
11	**Vega-Ávila et al.,2022**	55% (6/11)	Moderate quality	There were mixed results regarding the effect of rhythmic physical activity on global cognition.
12	**Wu et al.,2022**	82% (9/11)	High quality	Dance Movement Therapy (DMT) can effectively improve motor function and cognitive deficits in neurodegenerative diseases. The positive effects of DMT on the mood and quality of life in neurodegenerative disease patients are controversial and require further evidence.
13	**Delfa-Lobato et al.,2023**	55% (6/11)	Moderate quality	Despite the high heterogeneity of the studies, benefits (of cultural interventions such as dance) were identified in emotional well-being and social aspects but not in clinical ones such as the deterioration of cognitive or motor function, among others.
14	**Podolski et al., 2023**	73% (8/11)	High quality	Dance Movement Intervention (DMI) improves overall psychological health in older adults without dementia. Thus, DMI may serve as a promising tool in the promotion of healthy aging and early intervention of age-related conditions.

Table 4. Dose of dance interventions

No	Author, Year	Duration	Frequency/ or number of sessions	Course
1	**Wu et al., 2018**	20-60 minutes	1-4 times per week	NR
2	**Wang et al., 2018**	30-90 minutes	1-3/week	6-40 weeks
3	**Jiménezа, Bräuninger, and Meekums 2019**	NR	NR	NR
4	**Whitty et al., 2020**	NR	2-3 times/week	12-72 weeks
5	**Zhu et al., 2020**	30-90 minutes	1-3 times/week	12-43 weeks
6	**Fong et al., 2021**	30-90 minutes	1-5 times/week	8-40 weeks
7	**Heston et al., 2021**	35–60 minutes	1– 3×/week	12–52 weeks
8	**Liu et al., 2021**	25-60 minutes	1-7 times/week	NR
9	**Begde et al., 2022**	25–60 minutes	1–3 days/ week	12–40 weeks
10	**Jordan et al., 2022**	30-60 minutes	Once	12-40-weeks
11	**Vega-Ávila et al., 2022**	35-90 minutes	1-3 times/week	NR
12	**Wu et al., 2022**	30-minutes to 80-hours	NR	8-96 weeks
13	**Delfa-Lobato et al., 2023**	NR	NR	NR
14	**Podolski et al., 2023**	35-120 minutes	1-3 times/week	6-40 weeks

NR: Not reported

Dose of dance interventions

Generally, the duration of interventions ranges from 20 to 4 800 minutes with a frequency of 1 to 7 times per week over a period of 6 to 78 weeks (Table 4).

Types of dance interventions

As shown in Table 5, different types of dance interventions were included in this review ranging from ballroom dances (international, Latin, and double), Poco-poco dance, Yangko dance, Quaternary dance, Chinese Square dance, Tango dance (with and without partner), Jitterburg dance, Tai Chi dance, Salsa dance, Rumba dance, Waltz dance, and Chacha-Blues dance. Other examples include movement music therapy or dance movement intervention, or multi-task movement with music therapy, Latin American dance training, dance rug, video game dance, standard dance aerobics format, aerobic or choreographed aerobic dance, special dance for seniors (Agilando), structured music-based multi-task exercises classes, virtual reality dance

exercises, Turo (mixed qigong dance), Latin American dance, incorporated strategies-based dance, dance physiotherapy, Sardinian Folk dance, Irish set dance classes, fitness dance and Bailamos dance.

Effects of dance interventions on global cognition

As shown in Table 5, a significant improvement in global cognition was observed, with large effect sizes in a range of SMD= 0.54, Z= 3.55, p< 0.001 (39) to 6.10 (95% CI= 4.70–7.50, p<0.001(22). Another cognitive effect reported was that dance could improve cognitive flexibility or switching attention, or help alleviate a wide range of age-related impairments (40).

Effects of dance interventions on language fluency

A significant improvement in language fluency was found in the dance group, with a mean difference of 13.2 ± 1.3 compared with the control group, 12.6 ± 2.2; p<.05(41). In addition, a small (MD 0.29, 95% CI 0.11–1.23; p= 0.013) (42),to large (SMD = 0.61; 95% CI= 0.25-0.96; p= .008) effect size was reported (43) (Table 5).

Effects of dance interventions on verbal fluency

As shown in Table 5, it was reported that dancing in the intervention group led to a significant improvement in verbal fluency compared to the control group (p= 0.048(40). On the contrary, a non-significant improvement with a small effect size MD= 0.22; 95% CI: –3.43, 3.88; p= 0.9 was observed (21).

Effects of dance interventions on executive function

A large [(MD= -3.16, 95% CI: -7.16 to -0.85, p= 0.1^2 = 0%)] and [(MD= -4.12, 95% CI= -21.28 to 13.03, p= 0.64; I^2= 53%)] non-significant improvement in executive function was reported (22, 41).However, one study reported a significant change in executive function (β= -0.248, 95% CI -62.506 – 0.278, p= 0.048) (42) (Table 5).

Effects of dance interventions on learning and memory functions

There is evidence that dance interventions can have an effect on memory functions. As shown in Table 5, to be specific, the immediate recall memory magnitude of effects ranges from small (SMD 0.24, 95% CI 0.0, 0.46, p= 0.004; I^2 = 28%) (21) to large (MD = 0.54, 95% CI: 0.30, 0.78, p< 0.0001; I^2= 0% (41). For the delayed memory, a significant improvement was reported with moderate (SMD = 0.46; 95%CI: 0.30, 0.62; p< 0.00001; I^2 = 0%) (21) to large (SMD= 0.56, 95% CI: 0.26 to 0.86, P= 0.0002; I^2= 0%) effect sizes (41). A significant improvement in Visuospatial and learning memory was reported with a small (SMD= 0.16 (0.01, 0.32), I^2 = 0%, p = 0.03) (44) to large (MD of 2.29, 95% CI= -1.79 to 6.38; p = 0.27) effect sizes(Heston et al., 2021).Episodic memory was reported to show a significant small improvement (β = 0.326, 95% CI: 1.005–6.773, p = 0.009) (39, 42). Similarly, the effect on rote memory seems to be of large magnitude and significance (MD= -2.12, 95% CI: -4.02 to -0.21, p= 0.03, I^2= 0%) (41). In addition, a 30-minute dance intervention improves story recall in patients with MCI compared to health education or music (39).

Effects of dance interventions on attention

There is evidence that a dance intervention could potentially improve attention, although the effect is only small (SMD= 0.38, 95% CI: 0.13 to 0.64, p = 0.003; I^2 = 0%) (41).On the contrary, a small (β= 0.154, 95% CI -1.728–7.217, p= 0.225) (42) to large (MD = 3.07, 95% CI= -0.81, 6.95; p= 0.12) but insignificant improvements were reported (22) (Table 5).

Other effects

Finally, a trivial (β= 0.038, 95% CI-1.475–1.991, p= 0.76) and insignificant effect was reported that dance potentially had no effects on processing speed (42). There was also a small but significant improvement in right hippocampal volume (β= 0.379, 95% CI= 0.117, 0.488, p= 0.002) and total hippocampal volume (β= 0.344, 95% CI= 0.082, 0.446, p= 0.005) (39) (Table 5).

Table 5. Dance therapy's impact on cognitive outcomes

No	Author/ Year	Dance types	Outcomes	Measures	Impact of dance therapy on outcomes		Effect size/ Comments
					Significant	Not significant	
1	Wu et al., 2018	Dance exercises (Ballroom & other unspecified dances)	Global cognition	MMSE	✓		MD = 1.12; 95% CI = 0.16- 2.08; p= .02
			Working memory	Digit span test		✓	No significant effect p = 0.74
			Language fluency	Verbal fluency test	✓		SMD= 0.61; 95% CI= 0.25-0.96; p= .008
2	Wang et al., 2018	Dance exercises (Ballroom & other unspecified dances)	Global cognition	MMSE, MoCA, ADAS-Cog	✓		SMD= 0.84; 95% confidence interval, 0.23–1.46; p = 0.007; I^2 = 87%
			Memory	MMSE			SMD= 0.27; 95% confidence interval, 0.02–0.52; p= 0.04; I^2= 8%
3	Jiménez, Bräuninger, and Meekums 2019	Dance therapy/ Dance Movement Therapy (unspecified)	Cognition	NR		✓	Increased communication, delay cognitive decline, and immediate acute short-term effects on memory recall
4	Whitty et al., 2020	Aerobic dance	Global cognitive performance	NR		✓	No effects on global cognition in people with or without MCI
			Memory	NR	**Unclear**		Small effect on the memory primary outcome.
			Executive function	NR		✓	No effects on executive functioning.
5	Zhu et al., 2020	Jitterburg, tango, taichi, salsa, rumba, waltz, and chacha blues dances	Global cognition	MMSE	✓		MD= 1.43; 95%CI: 0.59, 2.27; p= 0.0009
				ADAS-Cog	✓		MD= –2.30; 95% CI: –3.60, –1.00; p= 0.0005
			Verbal fluency	VFT		✓	MD= 0.22; 95%CI: –3.43, 3.88; p = 0.9
				FAS	✓		MD= 1.73; 95%CI: 0.58,2.88; p = 0.003
			Executive function	TMT-A	✓		MD= –2.37; 95%CI: –4.16, –0.58; p= 0.010
				TMT-B	✓		MD = –16.07; 95%CI: –30.03, –2.11; p= 0.020
			Memory (immediate recall)	Digit Span Task, RBMT1 and RAVLT	✓		SMD = 0.24; 95%CI: [0.01, 0.46]; p= 0.04; I^2 = 28%
			Memory (delayed recall)	WMSR, RAVLT, RBMT2	✓		SMD= 0.46; 95%CI: 0.30, 0.62; p< 0.00001; I^2 = 0%
6	Fong et al., 2021	International ballroom dance, Latin dance training, Movement music therapy, and dance movement intervention	Domain-specific cognitive functions- complex attention, memory, learning, language, and perceptual and motor functions.	MMSE	✓		A significant domain-specific cognitive effect was achieved.
			Learning and memory	MMSE	✓		Dance reportedly had effects on learning and memory.
7	Heston et al., 2021	Dance movement therapy, ballroom dance, and video game dance	Global cognitive function	MMSE	✓		MD of 1.58 (95% CI = 0.21–2.95; P = 0.02, I^2 = 97%
				MoCA		✓	MD of 1.95 (95% CI = -0.34 to 4.23; P= 0.10, I^2 = 91%

No	Author/ Year	Dance types	Outcomes	Measures	Impact of dance therapy on outcomes		Effect size/ Comments
					Significant	Not significant	
					✓		**Subgroup analysis with subjects with MCI**
			Visuospatial learning and memory	SDMT		✓	MD of 6.10 (95% CI = 4.70–7.50, P< 0.001 MD of 2.29 (95% CI = -1.79 to 6.38; P= 0.27)
				WMS	✓		MD was 3.02 (95% CI = 1.38–4.65; P< 0.001)
			Complex attention	TMT-A		✓	MD= 3.07 (95% CI = -0.81 to 6.95; p= 0.12
						✓	**Subgroup analysis with subjects with MCI**
			Executive function	TMT-B		✓	MD of -1.38 (95% CI= -10.94 to 8.17; P= 0.78) MD = -4.12 (95% CI = -21.28 to 13.03, P = 0.64; I^2 = 53%)
8	Liu et al., 2021	Ballroom dance, Latin dance, standard dance-based aerobics Format, aerobic dance, Poco-Poco dance, Chinese Square Dancing, dance rug, and Yangko	Global cognition		✓		SMD = 0.73, 95% CI: 0.47 to 0.99, P< 0.00001; I^2 = 69%
			Rote memory	TMT-A	✓		MD = -2.12, 95% CI: -4.02 to -0.21, P= 0.03, I^2 = 0%
			Executive function			✓	MD = -3.16, 95% CI: -7.16 to -0.85, P= 0.1[2]; 0%
			Immediate recall		✓		MD = 0.54, 95% CI: 0.30 to 0.78, P< 0.0001; I^2 = 0%.
			Delayed recall		✓		SMD = 0.56, 95% CI: 0.26 to 0.86, P= 0.0002; I^2 = 0%
			Attention		✓		SMD = 0.38, 95% CI: 0.13 to 0.64, P= 0.003; I^2 = 0%
			Language		✓		Dance group, 13.2 ± 1.3; control group, 12.6 ± 2.2; P < 0.05)
9	Begde et al., 2022	Not specified	Visuospatial function	TMT	✓		SMD = 0.16 (0.01, 0.32), I^2=0 % p= 0.03
10	Jordan et al., 2022	Multitask music with movement therapy	Global cognitive	MMSE	✓		Significant improvements were found in motor planning tests and frontal assessment battery scores.
			State attention		✓		
			Executive function		✓		
			Immediate memory		✓		
			Delayed memory		✓		
			Story memory		✓		
11	Vega-Ávila et al., 2022	Tango dance, square dance, special dance for seniors (Agilando), dance movement intervention, international ballroom dance, senior dance, aerobic dance, choreographed aerobic dances, and structured music-based multi-task exercise classes.	Global cognition	MoCA, MMSE and RBANS	✓		Dance intervention results in significant improvements in MMSE. Specifically, in comparison with the control group, the dance intervention showed significant differences (p<.001). There was a significant difference between week 9 and week 18 in MoCA (p< 0.001, p= 0.000 respectively).A significant improvement in RBANS was observed in the intervention group after six months of dance intervention (p ≤ .001), while no improvement was noted in the control group (p = 0.360).
			Episodic memory	WMS-RLM	✓		β = 0.326, 95% CI: 1.005–6.773, p = 0.009).
			Attention	DST		✓	β = 0.154, 95% CI -1.728–7.217, p= 0.225
			Executive function	TMT B	✓		β = -0.248, 95% CI -62.506 – 0.278, p = 0.048
			Visuospatial function	TCF 1	✓		t (48) = -2.68, p = 0.010
				TCF 2	✓		t (48) = -3.48, p = 0.001
			Language	VFC, BNT, and LVF	✓		MD 0.29, 95% CI 0.11–1.23; p = 0.013
			Processing speed	SDMT		✓	β = 0.038, 95% CI -1.475–1.991, p = 0.767

No	Author/ Year	Dance types	Outcomes	Measures	Impact of dance therapy on outcomes		Effect size/ Comments
					Significant	Not significant	
				TMT A		✓	B = -0.159, 95% CI -18.733–4.204, p = 0.210
			Verbal recognition memory (post-intervention)	WMS-III	✓		MD 1.03, 95% CI 0.15–1.91, p= 0.003 in the intervention compared to the control group.
			Verbal recognition memory (follow-up)	WMS-III	✓		MD 2. 06, 95% CI 0.79–3.32, p = 0.003in the intervention compared to the control group.
			Visual delayed recall	WMS-III	✓		**Intervention group**: MD .29, 95% CI 0.38–4.21, p = 0.022 **Control group: MD** 1.57, 95% CI 0.18–2.96, p = 0.030
12	Wu et al., 2022	Aerobic dance, virtual reality dance exercise, quaternary dance, partnered community Tango dance, Turo (mixed Qigong dance), Double ballroom and Latin American dance, incorporated strategies-based dance, dance physiotherapy, Tango dance (partnered and non-partnered), Sardinian folk dance, Irish set dance classes, dance group. Chinese square dance, fitness dance, and BAILAMOS.	Global cognition	MoCA, MMSE, and FUCAS	✓		SMD = 0.54, Z = 3.55, p< 0.001
					✓		SMD = 0.73, 95%CI = 0.47 to 0.99, p < 0.00 SMD = 0.48, 95%CI = 0.21 to 0.74
			Immediate and delayed recall performance	RAVLT and RBMT-1 RBMT-2, WMS, and word memory	✓		p = 0.003; p = 0.004; and p= 0.001
			Story memory recall				Compared with health education or music, a 30-minute dance intervention improves story recall in patients with MCI.
			Episodic memory		✓		β= 0.326, 95%CI= 1.005 to 6.773, p= 0.009)
			Right hippocampal volume		✓		β= 0.379, 95% CI= 0.117 to 0.488, p = 0.002
			Total hippocampal volume		✓		β = 0.344, 95% CI= 0.082 to 0.446, p = 0.005
13	Delfa-Lobato et al., 2023	Group dance and group music and dance	Cognition	NR			Due to the small sample size of the music and dance treatment type, results cannot be interpreted.
14	Podolski et al., 2023	Ballroom dance, choreography, square dance, creative dance, folkloric dance, dance movements, eurhythmy, aerobic dance, standard dance, music and tai chi (combined), and dance therapy (flamenco).	General cognitive function	MMSE, MoCA, and NPI	✓		Effect size: 0.50, 95% CI 0.12, 0.98, p-value: 0.02, I^2 = 79.6%

RE: Random effect; FE: Fixed effect; TMT A or B: Trail Making Test; MoCA: Montreal Cognitive Assessment; RMD: Raw Mean Differences; CI: Confidence Interval; Stroop: Stroop Word-Color test; MMSE: Mini-Mental State Examination; SMD: Standardized Mean Difference; NR: Not Reported; RBANS: Repeatable Battery for the Assessment of Neuropsychological Status; MD: Mean Difference; LVF: Letter Verbal Fluency; BNT: Boston Naming Test; LVF: Letter Verbal Fluency; WMS-III: Wechsler Memory Scale third edition; TCF: Taylor figure test copy; FUCAS: Function and Cognitive Assessment Test; RAVLT: Rey Osterrieth Complex Figure Test copy and delay recall; RBMT-1 and 2: Rivermead Behavioral Memory Test-1 or 2; WMS: Wechsler Memory Scale; WMSR: Wechsler Memory Scale-Revised; NPI: Neuropsychiatric Inventory; SDMT: Symbol Digit Modalities Test.

Discussion

This review provides a comprehensive overview of dance therapy for cognitive impairment. To our knowledge, this is the first review to assess the effectiveness of different dance interventions on cognitive function in dementia patients using a systematic review. Overall, the study suggests varying degrees of impact on different aspects of cognitive impairment in dementia patients, although the results are very heterogeneous. The key dance therapies include ballroom dancing, poco-poco dancing, yangko dancing, quartet dancing, Chinese square dancing, tango dancing, jitterburg dancing, tai chi dancing, salsa dancing, rumba dancing, and waltz dancing. The interventions were conducted over a period of at least 6 weeks and up to 78 weeks and targeted outcomes such as learning and memory functions, global cognition, language fluency, verbal fluency, attention, and executive functions. These findings are consistent with other non-pharmacological interventions such as exercise and music therapies that promote cognitive function in people with dementia (45-47). Therefore, it might have implications for better planning of geriatric care to improve the overall quality of life and well-being of those affected.

Dementia is known to have a significant impact on the memory and learning abilities of affected individuals (48, 49). Accordingly, a key finding of this study shows that the dance intervention has a positive effect on immediate memory recall, indicating the ability of people with dementia to remember short-term events such as recent conversations. However, the improvement in delayed memory recall was classified as moderate. This is an indication that the long-term memory of people with cognitive impairments such as dementia is difficult to recall despite dance therapy. Dance movements can also improve spatial and learning memory as well as episodic memory, were further findings of this review, each with a small magnitude of effect. From the above results, it is clear that dance can serve as an embodied learning process in which movements are associated with specific sequences that ultimately contribute to memory consolidation. In addition, the physicality of dance also stimulates muscle memory, which reinforces the memorization of steps. For people with cognitive impairments such as dementia, regular dancing can improve both learning and memory performance, promoting cognitive benefits beyond dance.

Improvement in global cognition and attention were two related outcomes found in this review, with a large significant effect size, which may be related to the ability of dance to engage different cognitive processes such as problem-solving and perception. Dancing requires the individual to integrate a combination of sensory information, motor skills, and, in some cases, emotional expression. These holistic approaches to movement promote cognitive flexibility and encourage the mind to adapt and respond to different stimuli. When dance is viewed as therapy, the combination of physical activity, creative expression, and cognitive engagement contributes to an overall improvement in cognitive function. Similarly, attention deficit is one of the main challenges associated with living with dementia, and dance routines could compensate for these challenges by trying to focus on the given tasks. The overall effect of dance on cognition/attention may be linked to the sense of social connectedness that creates a supportive, inclusive environment. This is especially true when considering the interpersonal interactions during group dance sessions, which contribute to the emotional well-being of people with dementia and reduce feelings of isolation and depression. Positive emotional experiences have been associated with cognitive improvements (50), highlighting the reciprocal relationship between emotional and cognitive domains. Similarly, the predictable patterns and structured nature of dance routines can provide a sense of familiarity and comfort, potentially reducing the anxiety and fear associated with cognitive impairment. This emotional regulation in turn has a positive effect on cognitive functions, which is why it is necessary to include dance as a routine in facilities that care for people with dementia.

Another key finding of this review is the positive association between dance therapy and both language and verbal fluency. This was particularly evident in the group dance as opposed to the individual dance, where participants were asked to comprehend and respond to verbal cues, promoting receptive language skills. Continuous

interaction provides a dynamic platform for cognitive stimulation, potentially improving language processing and comprehension. In addition, the collaborative nature of these dance sessions requires communication for coordination and synchronization between participants. Such interpersonal communication serves as a practical tool for the dance routine and functions as a cognitive exercise that engages the language centers in the brain (51). Collaborative verbal exchanges can include explicit instructions and expressions of encouragement. This is influenced by the shared enjoyment and sense of achievement that people with dementia can experience through group dancing, which might improve their verbal skills. In addition, the rhythmic and musical elements of dance can serve as a memory aid and improve the recall of words and speech in people with dementia. The synchronization of movements in different patterns provides a structured framework that coincides with cognitive processes (52), which can alleviate language-related challenges beyond the dance session and positively promote language or fluency in daily interactions.

Although a large but non-significant effect of executive function of dance was found in this study, some recent evidence emphasizes the ability of dance to promote the neurocognitive domains and motor aspects of executive function (20, 53). From a cognitive perspective, people who dance need to absorb and retain different movement sequences, which requires constant use of bodily functions. This cognitive demand serves as a motive for the body, which can improve cognitive flexibility and the ability to adapt to key stimuli. On the other hand, the motor perspective refers to sensorimotor engagement in dance therapies, which ultimately affects executive functions. Coordinated movement sequences require precise motor planning and execution, which leads to adaptive body control. In addition, the temporal and spatial aspects of dance require effective planning and organization. Dancers must anticipate and synchronize their movements with temporal cues and spatial arrangements, improving their ability to follow different routines. These complex processes require executive functions that improve over time through systematic practice. Therefore, further longitudinal studies should allow a clear distinction between dance and executive functions.

Limitations

The findings in this study provide a solid foundation for the most comprehensive review of the effectiveness of dance therapies in improving cognitive function in people with dementia. However, a major limitation relates to the weaknesses of the included reviews and the uncertain/mixed evidence in their primary studies. As this is a systematic review of existing systematic reviews, it was not possible to combine the results using a statistical test such as a meta-analysis. Moreover, since narrative synthesis was employed, care should be taken with this systematic review's conclusions. It is important to keep in mind that this strategy might not be able to address the problems brought about by several meta-analysis results in the included reviews, which may be the consequence of several research that have contributed repeatedly. Lastly, research has demonstrated that a dance intervention must be delivered by a certified therapist in order for it to be therapeutic. (54). Nevertheless, we are unable to guarantee that every study was conducted by a licensed dance therapist, so our conclusion should be treated with caution.

Conclusion

Dance therapies, especially those that are carried out over several sessions, have a significant positive effect on the cognitive functions of people with dementia. Effects were found on learning and memory performance, global cognition, and attention as well as on language and fluency in people with dementia. These results can serve as a basis for formulating appropriate measures in practice to promote the use of non-pharmacological interventions such as dance in hospitals and elderly care facilities. The findings also have implications for academia and research to investigate different dance routines through cohort studies that take into account people’s cultures and abilities.

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Conflict of interest

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