SYSTEMATIC REVIEW

DOI: 10.4274/ejgg.galenos.2021.2021-8-2
Eur J Geriatr Gerontol 2021;3(3):134-142

Effect of Dance Therapy on the Physical Abilities of Older Adults with Dementia: A Systematic Review

Lucía Bracco[1], Gabriel Poirier[1], Arrate Pinto-Carral[2], France Mourey[1]

[1]INSERM UMR1093-CAPS, UFR des Sciences du Sport, Université de Bourgogne Franche-Comté, Dijon, France
[2]SALBIS Research Group, Department of Nursing and Physiotherapy, Universidad de León, Spain

Abstract

Music and dance are used as therapies in different diseases to improve physical function. However, no reviews have been published on the impact of dance therapy on the physical functions of older adults with dementia. We conducted a systematic review of studies that reported the quantitative results of gait quality, gait speed, endurance, balance, strength, and the ability to perform activities of daily living. Six articles that met the inclusion criteria were reviewed. The functional results of the included studies were very heterogeneous, which showed a possible positive effect on balance, walking speed, and the ability to perform activities of daily living. Future trials should explicitly and objectively set the criteria for the inclusion or exclusion of participants. In addition, randomized controlled trials with large samples are necessary to provide further evidence on the efficacy of different styles of dance compared with other types of physical activity.

Keywords: Dance therapy, older adults, dementia

Introduction

Dementia is a major public health challenge as it affects around 45 million people worldwide (1). It is one of the major causes of disability and dependency among older people (2). Impairments of memory and cognitive functions are the most characteristic signs of this pathology. However, balance and walking disorders are frequently observed (3), worsening the patient's global condition and indicating a poor prognosis. Thus, the quality of life of the patient and his/her family is severely affected (4).

Alzheimer's disease is the most common cause of dementia, causing between 50 and 75% of cases. The pharmacological treatments currently available aim at treating the symptoms, but current data show that they are only moderately effective in the best of cases (1). Faced with this observation and given the numerous mechanisms involved, many teams experiment with a reorientation of the interventions in favor of functional, psychological, and psychosocial approaches (5). These new approaches aim at optimizing the patient's well-being and quality of life as well as delay, prevent or reduce adverse outcomes of the disease.

Music and dancing are thought to induce numerous benefits on the motor function (6). Dancing involves rhythmic movements of the limbs and trunk and music provides external cues that facilitate movement (7). Music and dancing have been shown to encourage patients to develop attention, memory, rhythm, coordination, balance, and self-perception of the body in space (8). Therefore, music and dancing are commonly used as complementary therapies in various pathologies such as cardiovascular diseases (9), Parkinson's disease (10), or cancer (11).

Previous literature reviews have examined the health benefits of dance (12-18). However, there is to our knowledge no study that reviewed quantitative studies investigating the effects of dance on the functional abilities of older people with dementia. In 2017, Karkou and Meekums (14) published a systematic review about the effects of dance movement therapy (DMT) on people with dementia. The review was focused on psychosocial outcomes and age was not an exclusion/inclusion criterion.

Mabire et al. (17) included studies implementing a dance intervention for people with dementia. However, the authors did not integrate inclusion/exclusion criteria about age, types

Address for Correspondence: Lucía Bracco, INSERM UMR1093-CAPS, UFR des Sciences du Sport, Université de Bourgogne Franche-Comté, Dijon, France
Phone: +0033 07 86 95 24 49 **E-mail:** luciabracco@hotmail.com **ORCID:** orcid.org/0000-0001-7837-019X
Received: 31.08.2021 **Accepted:** 18.10.2021

Cite this article as: Bracco L, Poirier G, Pinto-Carral A, Mourey F. Effect of Dance Therapy on the Physical Abilities of Older Adults with Dementia: A Systematic Review. Eur J Geriatr Gerontol 2021;3(3):134-142

of outcomes, nor study designs. The systematic review of Ruiz-Muelle and López-Rodriguez (13) had no restrictions on the age or cognitive status of the participants.

Our systematic review focused on quantitative trials using therapy-based dance interventions in people with dementia over the age of 65. This review aimed to analyze the effects of dance therapy on physical skills in older adults with dementia.

Materials and Methods

This systematic review was based upon the preferred reporting items for systematic reviews and meta-analyses (PRISMA) guidelines (19).

Search Strategy

Up to March 2020, an electronic search was conducted to identify relevant studies published in the following databases: PubMed, Web of Science, Scopus, and ALOIS. The search terms were «dementia», «alzheimer», «dance», «dancing», «older adults» and «elderly». bibliographic references of the included articles were examined to search for articles that had escaped the initial search strategy.

Eligibility Criteria

Our review included experimental studies, available in full text, and published in English, French, Portuguese, or Spanish. Excerpts from congresses, case reports, protocols, books, essays, and thesis were excluded.

We considered studies including individuals who met the following criteria: Individuals aged 65 or above; diagnosed with dementia; trials that were limited to participants with mild cognitive impairment, or with a mini mental state examination (20) score over 24 were excluded; studies about Parkinson's disease were excluded.

Experimental interventions aiming at finding some benefit of scheduled dance sessions were included. The sessions included movements to the rhythm of music with the presence of an instructor, therapist, or guide. We included studies reporting quantitative results regarding gait quality, gait speed, endurance, balance, strength, and the ability to carry out the activities of daily living (ADL).

Study Selection

The references of articles resulting from the research were exported to Mendeley©. We then carried out an automatic reference check to target and eliminate duplicates. Two reviewers (LB and GP) carried out an examination of article titles and abstracts for eligibility. Subsequently, the full texts of potential studies were screened to determine final eligibility for inclusion. Disagreements about the eligibility were resolved by discussion and consensus between the reviewers.

Data Extraction

One reviewer (LB) extracted the following data from the studies: Design, objective, sample characteristics, description of the intervention of the experimental and control groups, and outcome measures. These data were compiled in Table 1.

Study Quality Assessment

Two reviewers (LB and GP) independently assessed the methodological quality of each included article, using a standardized checklist of 12 predefined criteria developed following de Vet et al. (21) recommendation for the quality assessment of trials in physical therapy. The 12 criteria are: (1) comparison with a control group; (2) randomization; (3) blinding participants; (4) homogeneity of groups at baseline; (5) alternative activity for the control group; (6) intentions (7); inclusion/exclusion criteria; (8) at least two socio-demographic variables (9); comorbidity (10); intervention description (11); dropouts; (12) valid outcomes measures. If the criteria were met, a point was assigned. If the criteria were not met or were not sufficiently described, no point was assigned (Table 2).

Studies that met more than 75% of the criteria were classified as high quality. Studies that met between 50 and 75% of the criteria were considered as moderate quality. Studies that met less than 50% of the criteria were classified as low quality.

Results

A flow diagram of the study selection process is shown in Figure 1. A total of six studies were included in this systematic review. The most important excluded studies with reasons for exclusion are shown in Table 3.

Characteristics of Included Studies

Included studies were published from 2008 to 2019 and conducted in France, Brazil, Spain, Finland, Singapore, and Australia. Two were randomized controlled trials (RCT), (22,23) one was a pilot RCT, (24) one was a controlled clinical trial (25) and two used a quasi-experimental design (26,27).

A total of 208 participants were involved in this review. Among them, 135 persons were assigned to intervention groups. The mean age of participants ranged between 76 and 82 years. Mean MMSE scores were between 12 and 23.5. Participants of most studies (22-25,27) came from nursing homes and care homes. Only Koh et al. (26) included community-dwelling participants, but the participants were recruited from a day-care center for persons with dementia.

The dance style was found to vary between studies. Brami et al. (25) used a virtual dance intervention. During the program, choreographies followed an increasing level of difficulty concerning the rhythm, intensity, and complexity

Table 1. Summary of included studies

Author (country)	Study design	Inclusion criteria/exclusion criteria	Sample/mean age/mean score MMSE/place of recruitment	Intervention/control group	Main results
Brami et al. (25) (France)	Controlled clinical trial	MMSE ≤21/ Inability to walk without technical aids. Uncorrected visual or hearing disorders. Contraindication to physical activity.	N=22 84.55±6.7 IG: 14.17±5; CG: 13±4.7 Long term care units	Virtual dance (Dance central on Xbox One) 2 days/week; 45 minutes; 12 weeks CG: Keeping daily habits	Intragroup: Not significant changes. Intergroup: Significant difference in favor of the IG in TUG (p=0.02) and gait speed test (4 meters) (p=0.02).
Borges et al. (23) (Brazil)	Randomized controlled trial	Autonomy for carrying out ADL; No regular physical activity in the past 3 months/ Heart disease, high blood pressure, and uncontrolled asthmatic bronchitis, osteoarthritis, recent fracture, tendinopathy and prostheses, neurological disorders, severe obesity, and the use of drugs that may affect attention.	N=60 IG: 66±6.8; CG: 67±7.2 IG: 22.7; CG: 24.2 Long-stay institution	Ballroom dancing (foxtrot, waltz, rumba, swing, samba, and bolero) 3 days/weeks; 50 minutes; 12 weeks CG: Keeping daily habits. Committed to not perform any systematic physical activity during the 12-week experiment	Intragroup: Significant improvement in the autonomy to performance of the ADL (p<0.0001) and in body balance (p=0.002) Intergroup: Significant difference in favor of the IG in the autonomy to performance of the ADL (p=0.011) and in body balance (p=0.04).
Gomez Gallego & Gomez Garcia (27) (Spain)	Quasi-experimental	Medically diagnosed with mild to moderate dementia / Aphasia or deafness that makes intervention difficult	N=42 77.5±8.3 15.02±5.40 Retreatment home	Music therapy and dance therapy 2 days/week; 45 minutes; 6 weeks	Barthel index: Not significant changes (p=0.338).
Hokkanen et al. (22) (Finland)	Randomized controlled trial	? /?	N=29 IG: 79.9±7.7; CG: 84.5±3.4 IG: 12.08±5.53 Dementia nursing home	Dance and movement therapy (DMT) 1 day/week; 30-45 minutes; 9 weeks CG: Keeping daily habits	Intragroup: Not significant changes in NOSGER. Intergroup: CG shows a significant deterioration in the self-Care subscale (p=0.001).
Koh et al. (26) (Singapore)	Quasi-experimental	Age ≥65; Medically diagnosed with mild to moderate dementia; Able to walk independently or with aids/ Severe hearing or visual impairment; Cancer, end-stage renal failure; Overtly violent or suicidal; Other progressive neurological conditions.	N=37 80.1±6.9 (N=21) 17±4.7 Daycare center for persons with dementia	Creative dance intervention 1 day/week; 60 minutes; 8 weeks	Not significant improvement in 6-meter gait speed (p=114), in the FMI (p=0.075) and in CONFbal scale (p=0.234).
Low et al. (24) (Australia)	Pilot Randomized controlled trial	Age ≥65; Dementia diagnosis; MMSE: 10-23; Able to walk independently or with aids/ Fully blind or deaf; Limited life expectancy; Floridly psychotic; Medically advised not to exercise; Very high falls risk; Non-English speaking	N=18 ? ? Nursing home	Dance program. Popular music from the 40s, 50s, and 60s. 3 days/week; 45 minutes; 16 weeks GC: Music and socialization control	At 16 weeks decrease in the mean SPPB score.

NOSGER: Nurses' observation scale for geriatric patients, ADL: Activities of daily living, TUG: Timed up and go test, GDLAM: The autonomy protocol of the Latin American Group for Maturity, composed of five tests: Gait speed (10 meters), chair stand test, time to rising from a ventral decubitus position, time to putting on and taking off a t-shirt, SPPB: Short physical performance battery, FMI: Functional independence measure

Table 2. Methodological quality of the studies according to de Vet et al. (21)

Author	1	2	3	4	5	6	7	8	9	10	11	12	Total
Brami et al. (25)	1	0	0	0	0	1	1	1	0	1	1	1	7
Borges et al. (23)	1	1	0	0	0	1	0	1	0	1	1	1	7
Gomez Gallego and Gomez Garcia (27)	0	0	0	0	0	1	1	1	1	1	0	1	6
Hokkanen et al. (22)	1	1	0	1	0	1	0	0	0	1	0	1	6
Koh et al. (26)	0	0	0	0	0	1	1	1	0	1	1	1	6
Low et al. (24)	1	1	0	0	1	1	1	0	0	1	1	1	8

1: Met criteria, 0: Did not meet criteria

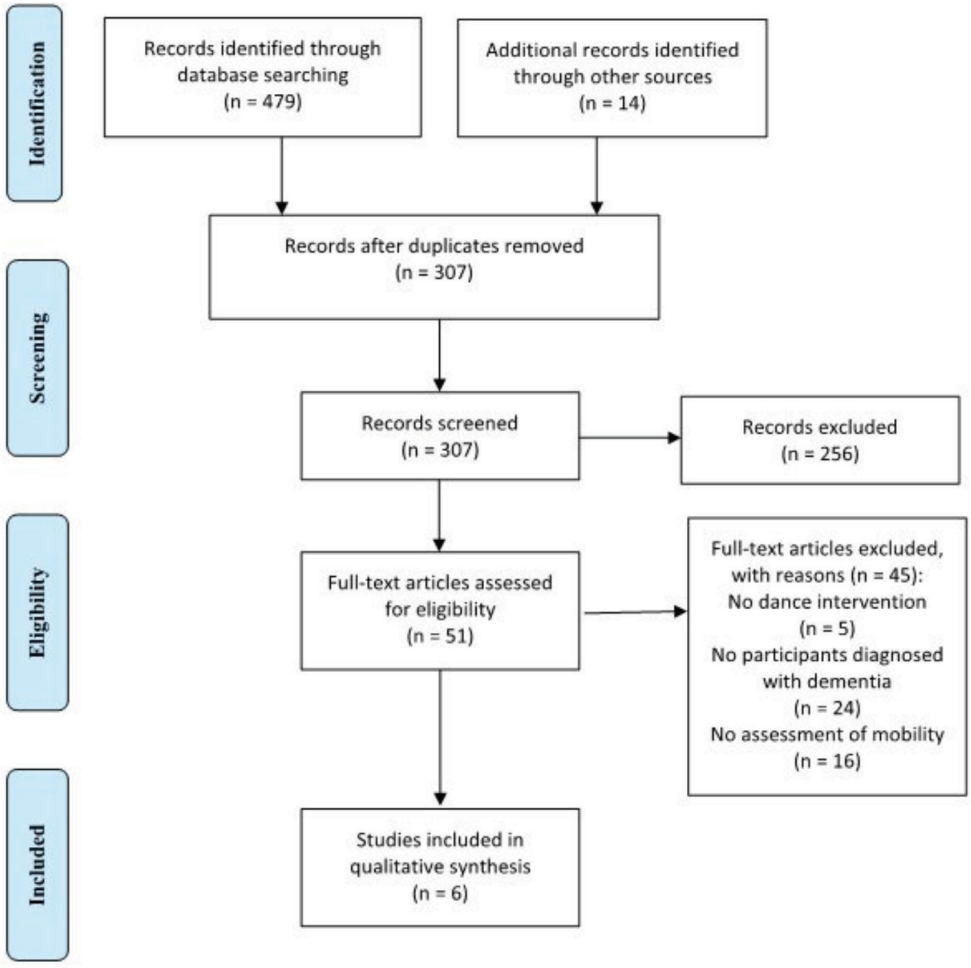

Figure 1. Study selection. Flow diagram based on the PRISMA statement (19)

PRISMA: Preferred reporting items for systematic reviews and meta-analyses

of the movements. Borges et al. (23) proposed a ballroom dance program with various musical rhythms (foxtrot, waltz, rumba, swing, samba, and bolero). Gomez Gallego and Gomez Garcia (27) used musical therapy sessions with songs that were appreciated by the participants. Sessions included: A welcome song, rhythmic accompaniment activities with clapping and musical instruments, movements with background music, dance therapy with rings and balls, and a farewell song. The interventions of Hokkanen et al. (22) consisted of DMT sessions.

Koh et al. (26) used a person-centered creative dance intervention, which comprised simple warm-up physical exercises, improvised movement based on culturally appropriate music familiar to the generation of the participants, collaborative exercises that required arm movement coordination, and social occasions for greeting

and sharing with the therapist and other participants. Low et al. (24) used a program led by a professional dancer. Popular music from the 40s, 50s, and 60s, and a mixture of dance types (ballroom, tango, folk dance) were incorporated.

Main Functional Outcomes

Three studies assessed balance (23-25) and one assessed balance confidence. Borges et al. (23) found significant improvements using stabilometric and postural platform assessments. Brami et al. (25) and Low et al. (24) assessed the balance component in the short physical performance battery (SPPB). Low et al. (24) did not report the results for each subtest. However, the mean SPPB score was reported to decrease from 6.8±1.6 to 5.9±1.8 after 16 weeks of intervention. Brami et al. (25) found no significant differences in balance after the intervention. Otherwise Koh et al. (26) found a non-significant improvement in balance confidence, evaluated using the CONFbal scale.

Gait speed was measured in four studies (23-26). Borges et al. (23) found a significant intragroup improvement in the 10-metre gait speed (pre-test: 21.67±6.22 s, post-test 16.05±4.06 s, $p<0.05$) and a significant intergroup difference in the post-test (CG: 22.06±5.16 s, $p<0.05$). Brami et al. (25) found significant intergroup differences in the 4-metre gait speed post-test (CG: 8.27±1.24 s, IG: 5.96±1.46 s, $p=0.02$) but non-significant intragroup improvement (pre-test: 6.69±1.68 s, $p=0.25$; post-test: 5.96±1.46 s). Koh et al. (26) used a 6-metre gait speed and found a non-significant improvement (pre-test: 0.72±0.20 m/s, post-test: 0.76±0.22 m/s, $p=0.114$).

Gomez Gallego and Gomez Garcia (27) and Koh et al. (26) assessed performances in ADL with respectively the Barthel index and the functional independence measure. Both studies reported no significant improvement. Hokkanen et al. (22) used the nurses' observation scale for geriatric patients (NOSGER) to assess behavioral aspects of mental functioning in daily life. Control and intervention groups did not differ according to the total NOSGER score. However, the control group deteriorated on the self-care subscale compared to baseline. Borges et al. (23) also measured performance in two daily life activities: The time to stand up from a ventral decubitus position and the time to put on and take off a t-shirt. The authors found a significant improvement after the intervention for both performances.

Quality Assessment

The overall quality of included studies was moderate. The mean quality score was 6.5, with a range of 6 to 8. No trial blinded neither participants nor professionals. Only one study [Low et al. (24)] had a control group engaged in another activity (music appreciation and socialization groups also led by the dance teacher). Only one trial (27) reported comorbid conditions in participants.

Discussion

This systematic review aimed to analyze the effects of dance therapy on functional outcomes in older adults with dementia. According to the trials examined, dance-based interventions may lead to improved physical abilities in older people with dementia. Only Borges et al. (23) found a significant improvement in balance and lower limb strength. Walking speed and timed up and go performance significantly improved in two studies (23,25). ADL performance significantly improved in Borges et al. (23). Additionally, Hokkanen et al. (22) reported a significant intergroup difference after the intervention.

Nonetheless, the evidence of a positive impact of dance on the physical abilities of older adults with dementia seems insubstantial. The literature we reviewed failed to provide convincing evidence for several reasons. First, the small number of studies and participants included. In this sense, it is worth recognizing the difficulty of conducting studies of this type. Most of these people are under legal protection measures and it is not easy to obtain agreement from persons in charge for their participation in investigations. Furthermore, older adults with dementia often experience complex psycho-emotional states, (e.g., apathy or mood swing), which may result in low participation in the proposed activities. One can note that heterogeneity is a characteristic of this population. It is therefore difficult to develop a specific activity for a group of people with different abilities. These constraints possibly result in small samples in all the studies we reviewed. Only Borges et al. (23) recruited more than 50 participants.

Otherwise, the quality of the included studies was moderate. Only four trials had a control group, of which only three were randomized; no study blinded the participants and/or the therapist; only two trials provide data about the homogeneity of the groups at baseline and Brami et al. (25) showed an important baseline imbalance in the physical abilities. Only Low et al. (24) proposed an alternative activity to the control group, resulting in an improvement in the internal validity of the trial (28). In contrast, Hokkanen et al. (22) make no mention of the inclusion/exclusion criteria, although it was the only study to report the type of dementia of the participants. Borges et al. (23) make no mention of dementia in the inclusion/exclusion criteria.

The studies analyzed presented the results of small, heterogeneous samples, with different inclusion/exclusion criteria, different intervention kinds, and diverse tools of measurement. This diversity made it difficult to draw conclusions regarding the effect of dance therapy on these people.

Many unanswered questions remain, including the ideal intensity and frequency, appropriate dance styles, and

comparisons with an alternative activity. Future studies should have clearer inclusion and exclusion criteria, be based on large samples, propose an alternative activity to the control group, and use validated instruments to produce reliable, comparable results. Furthermore, these studies should present information such as participants' comorbidities to measure their impact on the results.

In our review, four fundamental factors led us to exclude articles. First, many papers referred to interventions about people with cognitive impairment (29-34) but few articles included people diagnosed with dementia. Many articles were unclear regarding participant inclusion and exclusion criteria, which made the eligibility stage difficult. The review by Ruiz-Muelle and López-Rodríguez (13) about dance for people with Alzheimer's disease included articles that we excluded because we found no reference to Alzheimer's disease or other dementias. For example, one of the inclusion criteria for Marquez et al. (35) was an adequate cognitive status, while Lazarou et al. (32) included people with mild cognitive impairment but not dementia. Although they were unclear in their inclusion criteria, the mean MMSE score of the intervention group was 27.6±2.19, showing that they were not people with dementia.

Moreover, we were tempted to include certain articles that did not speak of dementia, but which reported neuropsychological tests that revealed significant cognitive problems among participants. This was the case of the study by Hackney et al. (36) which excluded people with a history of neurodegenerative disease. However, the mean montreal cognitive assessment score was 22.5±4 in the intervention group, showing a certain degree of cognitive problems, and even dementia, among the participants (37).

We included all the studies that used dance as the main intervention instrument. We did not consider some studies, because they used dancing in a small part of the intervention and not as the main tool (38-40).

Many of the analyzed studies were conducted using a qualitative design (41-44). We decided to restrict ourselves to trials using a quantitative design because we considered it difficult to objectify and analyze changes in physical function in a qualitative way. Furthermore, in general, qualitative studies aim to observe psychosocial and behavioral aspects and exclude the results of physical function.

Interventions performed on people with dementia primarily seek psychosocial, behavioral, emotional, and neurocognitive benefits (45-50). The motor component, fundamental for independence in ADL, is less frequently considered. However, there is evidence of the relationship between the ability to carry out ADL and depression (51), agitation (52), etc.

Table 3. Excluded studies and reasons

First author (year of publication)	Reason for exclusion
Abreu and Hartley (53)	Study design: Case description/intervention.
Barnes et al. (38)	Intervention: The intervention is named "integrative exercise program" and this included the dance sequences in the séance. However, and most of the session is made up of other kinds of exercise.
Bisbe et al. (54)	Inclusion criteria: Normal general cognition, defined by a mini-mental state examination (MMSE) (48,49) score ≥24.
Dominguez et al. (29)	Participants: There are no references to dementia, only to mild cognitive impairment (MCI).
Douka et al. (30)	Participants: There are no references to dementia, only to MCI.
Esmail et al. (31)	Exclusion criteria: MMSE ≤24.
Hackney et al. (36)	Participants: There are no references to dementia.
Hamill et al. (48)	Outcomes: No assessment of mobility function.
Hernández et al. (55)	Intervention: The intervention is called "physical activity" and it incorporates the dance sequences in the séance. However, there is no reference to "dance therapy" and most of the session is made up of conventional exercises of rehabilitation.
Ho et al. (49)	Outcomes: Results not yet available.
Ho et al. (56)	Outcomes: Results not yet available.
Ho et al. (57)	Outcomes: No assessment of mobility function.
Hokkanen et al. (50)	Outcomes: No assessment of mobility function.
Krug et al. (39)	Intervention: Dance was a little part of a program including multiple activities (functional and psychosocial therapeutic activities).
Lazarou et al. (32)	Participants: Here are not references to dementia, only to MCI.
Marquez et al. (35)	Participants: There are no references to dementia. Inclusion criteria: Adequate cognitive status as assessed by a version of the MMSE. Not provide the mean of MMSE. Outcomes: No assessment of mobility function.

Table 3. Continued

First author (year of publication)	Reason for exclusion
Meng et al. (33)	Participants: Here are not references to dementia.
Merom et al. (58)	Exclusion criteria: Had significant cognitive impairment determined by <21 points on the telephone interview of cognitive status, which is the telephone modification of the MMSE, equivalent to 24.
Merom et al. (59)	Exclusion criteria: MMSE ≤24.
Qi et al. (60)	Inclusion criteria: MMSE score between 25 and 30.
Wang et al. (34)	Participants: There are no references to dementia, only to MCI.

Agreements and Disagreements with Other Studies or Reviews

The conclusions drawn from this review partially agree with the conclusions of the included studies. Dance seems to be an intervention appreciated by older people (41) and could bring great benefits. According to Hwang and Braun (12), strong evidence suggests that dance, regardless of style and intensity, significantly improves older adults' functional fitness. However, we cannot be sure that this statement also applies to older persons with dementia. Gomez Gallego and Gomez Garcia (27) and Koh et al. (26) pointed out the need to expand the sample and add a control group to measure the placebo effect.

No trial met the inclusion criteria of the review by Karkou and Meekums (14). The lack of clarity in the selection of participants was one of the reasons. In our review, two of the six articles included did not detail the inclusion and exclusion criteria. This lack of information was recurrent and made it difficult to analyze the results. We agree with Mabire et al. (17) in that detailed information about the dance intervention was incomplete and unclear in some studies. Future research should focus on examining the effectiveness and efficiency of these interventions, by comparing the cost-benefit with that of other interventions.

Conclusion

Even though dance interventions targeting older people with dementia are appreciated and enjoyed, the scientific evidence regarding their benefits on physical abilities is moderate to poor. Although some studies showed an improvement in balance, walking speed, and the ability to carry out ADL, the results of the different studies are heterogeneous and did not allow us to establish an intervention model, with a determined intensity, frequency, and duration, that could be more effective than others. Most existing trials have not compared dance interventions with alternative activities. Therefore, it is unknown whether dance therapy interventions are more effective than other types of non-drug interventions.

Future trials should explicitly set out the criteria for inclusion/exclusion of participants, setting limits through validated measurements. To evaluate the efficacy of dance therapy, RCT with large samples are required, with alternative activities proposed to the control group. It is also essential to implement validated instruments in the search for relevant results. Besides, it is important to detail the methodology of the interventions, stating the resources necessary for their implementation.

Ethics

Peer-review: Externally peer-reviewed.

Authorship Contributions

Concept: L.B., A.P.C., F.M., Design: L.B., G.P., A.P.C., F.M., Data Collection or Processing: L.B., G.P., Analysis or Interpretation: L.B., G.P., A.P.C., F.M., Literature Search: L.B., G.P., Writing: L.B., G.P., A.P.C., F.M.

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: This study was been funded in the context of a PhD program by ISATIS Association. This collaboration between Inserm U1093 Cognition, Action and Sensorimotor Plasticity Laboratory. Université dé Bourgogne, and ISATIS Association is framed in a convention of financial contribution for the realization of a doctoral thesis.

References

1. Lane CA, Hardy J, Schott JM. Alzheimer's disease. Eur J Neurol 2018;25:59-70.
2. Agüero-Torres H, Fratiglioni L, Guo Z, Viitanen M, von Strauss E, Winblad B. Dementia is the major cause of functional dependence in the elderly: 3-year follow-up data from a population-based study. Am J Public Health 1998;88:1452-1456.
3. Montero-Odasso M, Perry G. Gait Disorders in Alzheimer's Disease and Other Dementias: There is Something in the Way You Walk. J Alzheimers Dis 2019;71:S1-S4.
4. Hoe J, Hancock G, Livingston G, Woods B, Challis D, Orrell M. Changes in the quality of life of people with dementia living in care homes. Alzheimer Dis Assoc Disord 2009;23:285-290.
5. Lee DA, Tirlea L, Haines TP. Non-pharmacological interventions to prevent hospital or nursing home admissions among community-dwelling older people with dementia: A systematic review and meta-analysis. Health Soc Care Community 2020;28:1408-1429.
6. Bremer Z. Dance as a form of exercise. Br J Gen Pract 2007;57:166.

7. Rabbia J. Dance as a community-based exercise in older adults. Top Geriatr Rehabil 2010;26:353-360.
8. Hackney ME, Earhart GM. Recommendations for implementing tango classes for persons with Parkinson disease. Phys Ther Fac Publ 2010;6.
9. Rodrigues-Krause J, Farinha JB, Krause M, Reischak-Oliveira Á. Effects of dance interventions on cardiovascular risk with ageing: Systematic review and meta-analysis. Complement Ther Med 2016;29:16-28.
10. Carapellotti AM, Stevenson R, Doumas M. The efficacy of dance for improving motor impairments, non-motor symptoms, and quality of life in Parkinson's disease: A systematic review and meta-analysis. PLoS One 2020;15:e0236820.
11. Bradt J, Shim M, Goodill SW. Dance/movement therapy for improving psychological and physical outcomes in cancer patients. Cochrane Database Syst Rev 2015;1:CD007103.
12. Hwang PW, Braun KL. The Effectiveness of Dance Interventions to Improve Older Adults' Health: A Systematic Literature Review. Altern Ther Health Med 2015;21:64-70.
13. Ruiz-Muelle A, López-Rodríguez MM. Dance for people with Alzheimer's disease: a systematic review. Curr Alzheimer Res 2020;16:919-933.
14. Karkou V, Meekums B. Dance movement therapy for dementia. Cochrane Database Syst Rev 2017;2:CD011022.
15. Fernández-Argüelles EL, Rodríguez-Mansilla J, Antunez LE, Garrido-Ardila EM, Muñoz RP. Effects of dancing on the risk of falling related factors of healthy older adults: a systematic review. Arch Gerontol Geriatr 2015;60:1-8.
16. Jimenez J, Brauninger I, Meekums B. Dance movement therapy with older people with a psychiatric condition: a systematic review. Arts Psychother 2019;63:118-127.
17. Mabire JB, Aquino JP, Charras K. Dance interventions for people with dementia: systematic review and practice recommendations. Int Psychogeriatrics 2018;31:1-11.
18. Guzmán-García A, Hughes JC, James IA, Rochester L. Dancing as a psychosocial intervention in care homes: a systematic review of the literature. Int J Geriatr Psychiatry 2013;28:914-924.
19. Moher D, Liberati A, Tetzlaff J, Altman DG; PRISMA Group. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. Int J Surg 2010;8:336-341.
20. Folstein MF, Folstein SE, McHugh PR. "Mini-mental state": A practical method for grading the cognitive state of patients for the clinician. J Psychiatr Res 1975;12:189-198.
21. de Vet HCW, De Bie RA, Van Der Heijden GJMG, Verhagen AP, Sijpkes P, Knipschild PG. Systematic reviews on the basis of methodological criteria. Physiotherapy 1997;83:284-289.
22. Hokkanen L, Rantala L, Remes AM, Härkönen B, Viramo P, Winblad I. Dance and movement therapeutic methods in management of dementia: a randomized, controlled study. J Am Geriatr Soc 2008;56:771-772.
23. Borges EG da S, Vale RG da S, Pernambuco CS, Cader SA, Sa SPC, Pinto FM, Regazzi ICR, Knupp VMAO, Dantas EHM. Effects of dance on the postural balance, cognition and functional autonomy of older adults. Rev Bras Enferm 2018;71(Suppl 5):2302-2309.
24. Low LF, Carroll S, Merom D, Baker JR, Kochan N, Moran F, Brodaty H. We think you can dance! A pilot randomised controlled trial of dance for nursing home residents with moderate to severe dementia. Complement Ther Med 2016;29:42-44.
25. Brami C, Trivalle C, Maillot P. Feasibility and interest of exergame training for Alzheimer patients in long-term care [Faisabilité et intérêt de l'entraînement en exergames pour des patients Alzheimer en SLD]. NPG Neurol - Psychiatr - Geriatr 2018;18:235-244.
26. Koh WLE, Low F, Kam JW, Rahim S, Ng WF, Ng LL. Person-centred creative dance intervention for persons with dementia living in the community in Singapore. Dementia (London) 2020;19:2430-2443.
27. Gomez Gallego M, Gomez Garcia J. Music therapy and Alzheimer's disease: cognitive, psychological, and behavioural effects [Musicoterapia en la enfermedad de Alzheimer: efectos cognitivos, psicológicos y conductuales]. Neurologia 2017;32:300-308.
28. Polgar S, Thomas S. Introduction to research in the Health Sciences. 7th ed. Elsevier; 2020.
29. Dominguez JC, Del Moral MCO, Chio JOA, de Guzman MFP, Natividad BP, Decena JM, Montalvo MJY, Reandelar M, Phung KTT. Improving Cognition through Dance in Older Filipinos with Mild Cognitive Impairment. Curr Alzheimer Res 2018;15:1136-1141.
30. Douka S, Zilidou VI, Lilou O, Tsolaki M. Greek Traditional Dances: A Way to Support Intellectual, Psychological, and Motor Functions in Senior Citizens at Risk of Neurodegeneration. Front Aging Neurosci 2019;11:6.
31. Esmail A, Vrinceanu T, Lussier M, Predovan D, Berryman N, Houle J, Karelis A, Grenier S, Minh Vu TT, Villalpando JM, Bherer L. Effects of Dance/Movement Training vs. Aerobic Exercise Training on cognition, physical fitness and quality of life in older adults: A randomized controlled trial. J Bodyw Mov Ther 2020;24:212-220.
32. Lazarou I, Parastatidis T, Tsolaki A, Gkioka M, Karakostas A, Douka S, Tsolaki M. International Ballroom Dancing Against Neurodegeneration: A Randomized Controlled Trial in Greek Community-Dwelling Elders With Mild Cognitive impairment. Am J Alzheimers Dis Other Demen 2017;32:489-499.
33. Meng X, Li G, Jia Y, Liu Y, Shang B, Liu P, Bao X, Chen L. Effects of dance intervention on global cognition, executive function and memory of older adults: a meta-analysis and systematic review. Aging Clin Exp Res 2020;32:7-19.
34. Wang S, Yin H, Meng X, Shang B, Meng Q, Zheng L, Wang L, Chen L. Effects of Chinese square dancing on older adults with mild cognitive impairment. Geriatr Nurs 2020;41:290-296.
35. Marquez DX, Wilson R, Aguiñaga S, Vásquez P, Fogg L, Yang Z, Wilbur J, Hughes S, Spanbauer C. Regular Latin Dancing and Health Education May Improve Cognition of Late Middle-Aged and Older Latinos. J Aging Phys Act 2017;25:482-489.
36. Hackney ME, Byers C, Butler G, Sweeney M, Rossbach L, Bozzorg A. Adapted Tango Improves Mobility, Motor-Cognitive Function, and Gait but Not Cognition in Older Adults in Independent Living. J Am Geriatr Soc 2015;63:2105-2113.
37. Delgado C, Araneda A, Behrens MI. Validation of the Spanish-language version of the Montreal Cognitive Assessment test in adults older than 60 years. Neurologia (Engl Ed) 2019;34:376-385.
38. Barnes DE, Mehling W, Wu E, Beristianos M, Yaffe K, Skultety K, Chesney MA. Preventing loss of independence through exercise (PLIÉ): a pilot clinical trial in older adults with dementia. PLoS One 2015;10:e0113367.
39. Krug MDR, Nascimento KB do, Garces SBB, Rosa CB, Brunelli ÂV, Hansen D. Autonomia em idosos com doença de alzheimer: contribuições do projeto estratégias de diagnóstico e reabilitação social de idosos dependentes e apoio psicossocial de cuidador domiciliar. Estud Interdiscip sobre o Envelhec 2015;20:833-848.
40. Kontos P, Miller KL, Colobong R, Palma Lazgare LI, Binns M, Low LF, Surr C, Naglie G. Elder-Clowning in Long-Term Dementia Care: Results of a Pilot Study. J Am Geriatr Soc 2016;64:347-353.
41. Guzmán-García A, Mukaetova-Ladinska E, James I. Introducing a Latin ballroom dance class to people with dementia living in care homes, benefits and concerns: a pilot study. Dementia [Internet]. 2013;12:523-535. Available from: https://www.scopus.com/inward/record.uri?eid=2-s2.0-84883196463&doi=10.1177%2F1471301211429753&partnerID=40&md5=5919fb3b58be9d8a7038e3629d783773
42. Nyström K, Lauritzen SO. Expressive bodies: demented persons' communication in a dance therapy context. Health (Irvine Calif) 2005;9:297-317.

43. Palo-Bengtsson L, Ekman SL. Emotional response to social dancing and walks in persons with dementia. Am J Alzheimers Dis Other Demen 2002;17:149-153.

44. Wu E, Barnes DE, Ackerman SL, Lee J, Chesney M, Mehling WE. Preventing Loss of Independence through Exercise (PLIÉ): qualitative analysis of a clinical trial in older adults with dementia. Aging Ment Heal 2015;19:353-362.

45. Teixeira-Machado L, Arida RM, de Jesus Mari J. Dance for neuroplasticity: A descriptive systematic review. Neurosci Biobehav Rev 2019;96:232-240.

46. Rösler A, Seifritz E, Kräuchi K, Spoerl D, Brokuslaus I, Proserpi SM, Gendre A, Savaskan E, Hofmann M. Skill learning in patients with moderate Alzheimer's disease: a prospective pilot-study of waltz-lessons. Int J Geriatr Psychiatry 2002;17:1155-1156.

47. Duignan D, Hedley L, Milverton R. Exploring dance as a therapy for symptoms and social interaction in a dementia care unit. Nurs Times 2009;105:19-22.

48. Hamill M, Smith L, Roehricht F, Ro F. "Dancing down memory lane": circle dancing as a psychotherapeutic intervention in dementia-a pilot study. Dementia 2012;11:709-724.

49. Ho RT, Cheung JK, Chan WC, Cheung IK, Lam LC. A 3-arm randomized controlled trial on the effects of dance movement intervention and exercises on elderly with early dementia. BMC Geriatr 2015;15:127.

50. Hokkanen L, Rantala L, Remes AM, Härkönen B, Viramo P, Winblad I. Dance/Movement Therapeutic methods in management of dementia. J Am Geriatr Soc 2003;51:576-577.

51. Xie H, Chen PW, Zhao L, Sun X, Jia XJ. Relationship between activities of daily living and depression among older adults and the quality of life of family caregivers. Front Nurs 2018;5:97-104.

52. Norton LE, Malloy PF, Salloway S. The impact of behavioral symptoms on activities of daily living in patients with dementia. Am J Geriatr Psychiatry 2001;9:41-48.

53. Abreu M, Hartley G. The effects of Salsa dance on balance, gait, and fall risk in a sedentary patient with Alzheimer's dementia, multiple comorbidities, and recurrent falls. J Geriatr Phys Ther 2013;36:100-108.

54. Bisbe M, Fuente-Vidal A, López E, Moreno M, Naya M, de Benetti C, Milà R, Bruna O, Boada M, Alegret M. Comparative Cognitive Effects of Choreographed Exercise and Multimodal Physical Therapy in Older Adults with Amnestic Mild Cognitive Impairment: Randomized Clinical Trial. J Alzheimers Dis 2020;73:769-783.

55. Hernandez SSS, Coelho FGM, Gobbi S, Stella F. Effects of physical activity on cognitive functions, balance and risk of falls in elderly patients with Alzheimer's dementia [Efeitos de um programa de atividade física nas funções cognitivas, equilíbrio e risco de quedas em idosos com demência de Alzheim. Rev Bras Fisioter 2010;14:68-74.

56. Ho RTH, Hon T, Chan WC, Kwan JSK, Chiu PKC, Lam LCW. Effects of dance movement intervention on elderly with early dementia: preliminary results of a randomized controlled trial. Ann Behav Med 2018;52:S525-S525.

57. Ho RTH, Fong TCT, Chan WC, Kwan JSK, Chiu PKC, Yau JCY, Lam LCW. Psychophysiological Effects of Dance Movement Therapy and Physical Exercise on Older Adults With Mild Dementia: A Randomized Controlled Trial. J Gerontol B Psychol Sci Soc Sci 2020;75:560-570.

58. Merom D, Grunseit A, Eramudugolla R, Jefferis B, Mcneill J, Anstey KJ. Cognitive Benefits of Social Dancing and Walking in Old Age: The Dancing Mind Randomized Controlled Trial. Front Aging Neurosci 2016;8:26.

59. Merom D, Mathieu E, Cerin E, Morton RL, Simpson JM, Rissel C, Anstey KJ, Sherrington C, Lord SR, Cumming RG. Social Dancing and Incidence of Falls in Older Adults: A Cluster Randomised Controlled Trial. PLoS Med 2016;13:e1002112.

60. Qi M, Zhu Y, Zhang L, Wu T, Wang J. The effect of aerobic dance intervention on brain spontaneous activity in older adults with mild cognitive impairment: A resting-state functional MRI study. Exp Ther Med 2019;17:715-722.