

Dance Interventions as Non-Pharmacological Strategies for the Treatment of Dementia and Mild Cognitive Impairment

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Abstract

The percentage of people suffering from dementia has been rising constantly in recent decades. The fact that no effective treatments have been developed to date places particular value on prevention strategies and non-pharmacological interventions. With this in mind, the present study seeks to investigate the effects of dance on cognitive decline in older adults, and its use as a non-pharmacological strategy in efforts to combat dementia. A review of the relevant literature led to the consideration of peer-reviewed papers published between 2007 and 2020, selected on the basis of their research design, target population, intervention programmes, and assessment tools. The findings indicate that dance has a beneficial effect on cognitive function and mobility, reduces neuropsychiatric symptoms, and improves quality of life for individuals with dementia or mild cognitive impairment. In summary, there are clear indications that dance constitutes a highly promising alternative approach for the non-pharmacological treatment of dementia.

Keywords: dementia, mild cognitive impairment, neurocognitive disorders, dance, psychosocial interventions

1. Introduction

In recent decades, a steep rise in life expectancy has changed demographic structures across the globe, bringing dementia to the fore as a major 21st-century health issue. There are an estimated 50 million dementia sufferers worldwide, a number projected to rise to 82 million by 2030, and 152 million by 2050 (World Health Organisation, 2019). This rapid increase is expected to bring about major social and economic repercussions for individuals, families, and the health care systems around the world (Winblad et al., 2016).

Given that no effective means for combatting dementia have been found to date and existing treatments are symptomatic, the search for prevention strategies and non-pharmacological approaches to the disease has intensified (Cummings, Lee, Ritter, Sabbagh, & Zhong, 2019; Yiannopoulou & Papageorgiou, 2020). Within the category of alternative non-pharmacological approaches, interventions involving physical activity are increasingly gaining ground. Numerous studies have shown that factors relating to lifestyle, such as physical activity and exercise, can make an important contribution to the prevention of dementia and Alzheimer's disease (DeFina et al., 2013; Du et al., 2018; Fondell et al., 2018; Gaitán et al., 2021; Soni et al., 2019; Tan et al., 2017). Furthermore, it has been found that physical exercise, and a more active lifestyle in general are linked to an attenuation of harmful age-related alterations in key dementia pathophysiology biomarkers (Okonkwo et al., 2014), while achieving or maintaining a high level of aerobic capacity offers a level of protection with regard to the performance of cognitive function (CF) (Frith & Loprinzi, 2018).

As arises from the literature, physical exercise presents significant benefits for dementia sufferers, though the relationship between exercise and dementia varies according to the particular characteristics of the applied exercise intervention (Kouloutbani, Karteroliotis, & Politis, 2019).

As a form of aerobic exercise that involves a complex combination of processes (patterning of bipedal motion and metric entrainment to musical rhythms) (Brown, Martinez, & Parson, 2006), dance could have a positive effect on cognition (Doi et al., 2017) leading to a delay in the transition from mild cognitive impairment (MCI) (a precursor of dementia) to dementia. It has been established that the repetition of movements and memorization of choreographed

steps generates specific demands on both short- and long-term memory, and can help improve CF (Van de Winckel, Feys, De Weerd, & Dom, 2004). Furthermore, a combination of physical exercise and environmental enrichment (such as sensory stimulation and social interaction) seems to have a greater effect on hippocampal neurogenesis (which is important for spatial learning and memory) as compared to programmes that exclusively involve either physical exercise or environmental enrichment (Kempermann et al., 2010).

The frame of reference laid out above underpins the research concerns of this present study, which seeks to investigate the effect of dance on dementia patients, and to examine the possibility of its use as an effective non-pharmacological strategy in efforts to combat this particular disease.

2. Methods

Taking a review of the literature as its data collection method, this study examines peer-reviewed papers published in English and Greek between 2007 and 2020 that meet specific criteria for their inclusion. The studies, drawn from three online databases (PubMed, ScienceDirect, and Scopus), were selected on the basis of their research design, target population, intervention programmes, and assessment tools. More specifically, studies were sought that: (a) applied dance interventions to individuals with dementia or MCI; (b) made reference to specific characteristics of the interventions (type, frequency, and duration); and (c) investigated the effects of dance using valid and reliable assessment tools.

3. Results

Out of the papers brought to light by a review of the literature, the present study includes fourteen that fulfilled the set criteria. A total of 1,037 individuals with dementia or MCI (344 with dementia and 693 with MCI) took part in these studies, which examined the effect of dance on the cognitive and brain function, physical and mental health, and quality of life of the participants. Table 1 presents the main features of the reviewed studies.

Table 1. Main characteristics of included studies (in alphabetical order)

Authors and year	Study groups and sample size	Type(s) of intervention(s)	Frequency (sessions/ week)	Duration per session	Total duration	Results
Abreu & Hartley, 2013	1 patient, 84 years old, with AD	Salsa Dance Therapy	2	60 min	12 weeks	-Improvements in range of motion strength, balance, functional mobility, gait distance and speed -One fall during the course of therapy and no falls 6 months post-intervention
Borges et al. 2018	60 patients with dementia EG: (n=30, mean age: 66 years) CG: (n=30, mean age: 67 years)	Ballroom dance programme	3	50 min	12 weeks	Improvement in balance, functional autonomy for the ADLs and improvement in mental state
Charras et al. 2020	23 patients with dementia Mean age: 83.47 years (Crossover explorative study)	Co-ordination and dance exercises (tango, waltz, and classical dance movements)	1	50 min	12 weeks	-No results concerning gait, balance, confidence or quality of life -Dance interventions are feasible in day care centres and contribute to patients' well-being
Doi et al. 2017	201 older adults with MCI Mean age: 76.0 years EG ₁ : (n=67) EG ₂ : (n=67) CG:(n=67)	EG ₁ : Ballroom dance programme EG ₂ : Music programme (playing percussion instruments)	1	60 min	40 weeks	-Dance group: improvements in memory and general cognitive function -Music group: improvements in general cognitive function
Dominquez et al. 2018	207 older adults with MCI EG: (n=101, mean age: 68.8 years) CG:(n=106, mean age: 69.4 years)	Structured modular ballroom dance intervention(INDAK)	2	60 min	48 weeks	Effective intervention in improving cognition and reducing depression symptoms
Douka et al. 2019	60 older adults EG ₁ : (n=30 healthy, median age: 65.5 years) EG ₂ : (n=30 with MCI, median age: 67.5 years)	Greek traditional dance programme	2	60 min	24 weeks	Dancing improves the cognitive and physical condition of the elderly and contributes to a better quality of life
Duignan et al. 2019	6 patients with dementia Mean age: 85.1 years	Wu Tao dance therapy –“The Dancing Way”	1	–	4 weeks	-Reduction in agitation scores -Wu Tao is a pleasurable and enjoyable therapy
Hamill et al. 2012	11 patients with moderate to advanced dementia (mean age: 83.09 years) +7 family carers	Therapeutic circle dance	1	45 min	10 weeks	-Positive impact on participants' general well-being and mood - Improvement in concentration and communication with others
Ho et al. 2020	204 patients with mild dementia (mean age: 79.0 years) EG ₁ : (n=69) EG ₂ : (n=67)	EG ₁ : Modified dance/movement therapy programme EG ₂ :Stretching, joint movements, and	2	60 min	12 weeks	-The dance group showed significant decrease in depression, loneliness, negative

	CG:(n=68)	exercising with towels				mood and improved daily functioning and diurnal cortisol slope -The exercise group showed no significant effects on the above outcomes - Long-term dance therapy effects on total retrieval and delayed recall
Hokkanen et al. 2008	29 patients with dementia EG: (n=19, mean age: 79.9 years) CG:(n=10, mean age: 84.5 years)	Dance and movement therapy	1	30-45 min	9 weeks	-Improvement in visuospatial ability and planning -Relative stability of behaviour -Slight improvement in self-care ability and IADLs -No effect on memory
Guzman et al. 2016	10 patients with dementia Mean age: 84.4 years (Multiple-baseline single-case study with three phases)	Psychomotor dance therapy intervention (DANCIN)	2	30 min	12 weeks	The DANCIN model has the potential to decrease irritability or depression and increase self-esteem in dementia
Lazarou et al. 2017	129 older adults with MCI Mean age: 66.8 years EG: (n=66) CG:(n=63)	International ballroom dancing	2	60 min	10 months	Positive impact on the maintenance of cognitive functions, mood and behaviour
Wang et al. 2020	66 older adults with MCI EG: (n=33, mean age: 81.06 years) CG: (n=33, mean age: 81.09 years)	Chinese square dancing programme	3	40 min	12 weeks	Positive effects on global cognition, depressive symptoms, balance and quality of life
Zhu et al. 2018	60 older adults with MCI Mean age: 69.6 years EG: (n=29) CG: (n=31)	Aerobic dance routine	3	35 min	3 months	Improvement in cognitive function, especially episodic memory and processing speed

More specifically, the study by Lazarou et al. (2017) showed that dance has a positive effect on the maintenance of CF, short- and long-term memory, attention, learning ability, visuospatial ability, executive function, verbal fluency, and mood of older adults with amnesic MCI. Taking part in the study were 129 people aged 55 to 75, divided into an experimental group (n=66) and a control group (n=63). The intervention, lasting ten months in total, included international ballroom dances such as tango, waltz, foxtrot, rumba, cha-cha-chá, swing, salsa, merengue, and disco hustle alongside Greek traditional dances. Sessions lasting 60 minutes were held twice a week. The control group continued with their customary lifestyles and the results of the study revealed that these particular individuals saw a significant decline in the areas of interest set out above.

Similarly, in a study by Doi et al. (2017), long-term participation in a dance intervention programme was associated with an improvement in the general CF and memory of people with MCI. The study, lasting 40 weeks, saw the participation of 201 people divided into three groups: (a) a dance group taking part in weekly 60-minute sessions that involved ballroom dances such as salsa, rumba, waltz, cha-cha-chá, blues, jitterbug, and tango; (b) a music group where participants played musical instruments (drums) in weekly 60-minute sessions; and (c) a control group that attended three 90-minute health education classes. The dance group achieved better results in memory recall as compared to the control group, while the music group showed no significant improvement. In addition, both experimental groups demonstrated greater improvement in general CF as compared to the control group.

The research team Zhu et al. (2018) also reported positive results regarding the effect of a moderate-intensity aerobic dance routine on the CF of people with MCI. The 60 patients who took part in the study were divided into an experimental group (n=29) and a control group (n=31). In addition to its usual treatment regimen, the experimental

group attended three dance classes a week lasting 35 minutes each. The intervention consisted of a specially designed dance routine of moderate intensity that demanded cognitive effort on the part of the participants through the memorization of complex movements. Once the intervention was complete, the participants of the experimental group were encouraged to continue practising their dance routine at home. During the course of the study, the control group received only their customary treatment. At the end of the intervention programme's third month, the experimental group demonstrated significantly greater improvement in episodic memory and processing speed as compared to the control group. However, in the three months that followed, the improvements in memory seen in the experimental group attenuated, while processing speed returned to initial, pre-intervention levels. Furthermore, it was noted that processing speed in the control group underwent significant decline over the course of the six months. According to the researchers, these findings underline the value of regular and systematic engagement with this specific type of dance in order to maintain its beneficial effects.

Also of interest is a study that examined the effects of Greek traditional dances on the CF of older adults, and on delaying the onset of cognitive impairment or dementia (Douka, Zilidou, Lilou, & Tsolaki, 2019). This particular study saw the participation of 60 older adults (aged over 60) divided into two groups in accordance with a medical assessment of their CF to create a group of individuals with MCI ($n_1=30$) and a group of healthy individuals ($n_2=30$). The intervention, which involved traditional dances from across Greece, lasted 24 weeks, with two 60-minute sessions a week.

The dances were of a moderate (progressively increasing) intensity considered suitable for the ages and physical abilities of the participants. Improvements were noted in physical and mental health, CF, and quality of life among both the healthy older adults and those with MCI. Specifically, it was established that the intervention helped bolster attention, verbal fluency, executive function, physical fitness, and quality of life among the participants. Results also showed a reduction in stress levels among the patients with MCI, and an increase in stress levels among the healthy participants. Furthermore, physical fitness improvements were noted in both groups with regard to maintaining proper body posture and stimulating the muscular system. According to the researchers, the repetition of steps and the combinatory movement of upper and lower limbs boosted CF among the trial population. The intervention seemed to have a positive effect on healthy participants with regard to memory, a fact deemed particularly important given that in Alzheimer's disease – the most common form of dementia – the hippocampus in patients shrinks, leading to memory problems. On the basis of the above, the researchers contend that dance can play an important role in both combatting the onset of dementia and slowing its development.

Similar findings were made by another group of researchers (Dominguez et al., 2018), who undertook a study showing that a structured modular ballroom dance intervention (INDAK) is effective with regard to improving CF and limiting symptoms of depression in older adults with MCI. This study saw the participation of 207 individuals (aged over 60) divided into an experimental group ($n=101$) and a control group ($n=106$). The INDAK intervention involved steps taken from eight types of dance (reggae, cha-cha-chá, samba, merengue, bachata, swing, tango, and salsa) in increasing levels of complexity, adapted to the abilities of older adults. Sessions lasting one hour were held twice a week over a total of 48 weeks.

Ten years earlier, Hokkanen et al. (2008) conducted a randomized, controlled trial with the aim of investigating the effect of dance and movement therapeutic methods on the CF and behaviour of patients with dementia. Participating in the study were 29 people suffering from various forms of dementia (14 had Alzheimer's disease, 8 had vascular dementia, and 7 had undefined types of dementia) divided into an experimental group ($n=19$) and a control group ($n=10$). Nine weekly sessions lasting between 30 and 45 minutes were held. The analysis of the results showed that while the experimental group improved when it came to a task of visuospatial ability and planning (Clock Drawing Test), the control group remained stable or declined slightly. As regards memory (Word List Delayed Recall) and behaviour, the experimental group remained relatively stable after the end of the intervention, while self-care ability and instrumental activities of daily living saw a slight improvement.

More recently, Wang et al. (2020) studied the effect of a Chinese square dancing programme on global cognition, symptoms of depression, balance, and quality of life in older adults with MCI. This study saw the participation of 66 individuals divided equally into an experimental group ($n=33$) and a control group ($n=33$). The programme involved three 40-minute sessions per week and lasted a total of 12 weeks. The results showed a positive effect across all assessed outcomes and, according to the researchers, long-term adherence to this dance intervention could lead to even better results.

Similar conclusions were drawn by Borges et al. (2018) regarding the efficacy of dance for improving the balance, and boosting the functional autonomy and mental state of patients with dementia. Taking part in this study, which assessed the effects of ballroom dances such as foxtrot, waltz, rumba, swing, samba, and bolero, were 60 individuals randomly

and equally divided into experimental and control groups. The intervention involved three 50-minute sessions a week for a period of 12 weeks, and the dances were adapted to the abilities of the participants. The results of this study showed that the experimental group presented an improvement in functional autonomy for the activities of daily living and an improvement in their mental state as compared to the control group. As such, the researchers recommend the use of this particular form of dance, asserting that it contributes to the prevention and management of complications arising from dementia, and other diseases that affect movement and usually afflict older adults.

Also worthy of note were the findings of the study by Abreu and Hartley (2013) concerning the effects of a therapeutic salsa dance intervention on balance, gait, and fall risk in an 84-year-old woman with Alzheimer's dementia and multiple comorbidities.

Before the start of the study, the participant followed a sedentary lifestyle but was fairly familiar with this particular dance form due to her cultural background. The intervention lasted a total of 12 weeks, during which time 24 sessions were held that mainly involved salsa dance moves. By the end of the programme, the patient showed improvement in range of motion, strength, balance, functional mobility, and gait distance and speed.

Contrary results arose in a study by Charras et al. (2020), which observed no statistically significant changes in balance, self-confidence, and quality of life in people with dementia following the implementation of a dance programme.

The study saw the participation of 23 individuals. In order that all involved might benefit from the dance sessions, and to counteract the lack of a control group, a crossover experimental design was implemented, according to which groups were alternately designated experimental or control. The study included 12 weekly sessions involving co-ordination and dance exercises (tango, waltz, and classical dance movements) followed by 12 weeks without any dance activity, and vice versa. Both quantitative and qualitative data were collected showing that dance interventions are feasible at day care centres and contribute to the well-being of patients with dementia. According to the researchers, the non-significant outcomes that arose with regard to balance, gait, self-confidence, and quality of life are perhaps due to methodological issues of the study (experimental design and outcome measures among them).

That same year, a randomized controlled trial by Ho et al. (2020) compared the psychophysiological effects of dance movement therapy and physical exercise on dementia. Taking part in the study were 204 older adults with mild dementia, divided into dance, exercise, and control groups. The dance intervention consisted of a modified dance/movement therapy programme with a focus on easy steps, simple rhythms, and movements that can be performed in both standing and sitting positions. The physical exercise sessions involved stretching, joint movements, and exercising with towels. For the two experimental groups, 24 one-hour sessions were held (two times a week), each of mild to moderate intensity, over a total of 12 weeks. The results showed that the dance group presented improvement in total retrieval and delayed recall three months after the completion of the intervention, which indicates the potential existence of mediating factors that might explain this delayed effect. Furthermore, significant reductions in depression, loneliness, and negative mood were noted, as were improvements in functionality and diurnal cortisol slope, improvements which were maintained at the one-year follow up. In contrast, no major beneficial effects on the aforementioned study outcomes were noted in the group that undertook the physical exercise programme.

The efficacy of a psychomotor dance therapy intervention (DANCIN) on the mood and behaviour of patients with mild to moderate dementia were investigated a few years earlier by Guzmán, Freeston, Rochester, Hughes, and James (2016). This particular approach examined three aspects: (a) motion, such as balance and fast/slow interpersonal co-ordination; (b) emotional-affective, such as the expression of feelings, as well as verbal and non-verbal communication; and (c) cognition, such as attention and the planning of movements within the space. The sessions, lasting 30 minutes, were held twice a week, while the total duration of the intervention was 12 weeks. The analysis of the data showed a small to moderate improvement in 21 of the 32 sub-categories of the Dementia Mood Assessment Scale (DMAS) which concern both mood and behaviour. More specifically, there was a reduction in irritability and depression, and a rise in self-esteem, important factors for the improvement of both behaviour and mood. Furthermore, it was noted that this specific dance therapy programme contributed to a reduction in the social isolation of patients who, prior to the implementation of the programme, were socially withdrawn.

According to Hamill, Smith, and Röhricht (2012), dementia patients seem to benefit emotionally, socially, and cognitively through their participation in a therapeutic circle dancing programme. A total of 18 people (11 patients and 7 caregivers/relatives) took part in the conducted study, undertaking 10 weekly sessions lasting 45 minutes each. The intervention had a positive effect on the mood and concentration of the participants, as well as on their interactions with other individuals. These researchers note the importance of similar interventions on a social level. When it comes to dementia, a decline in a patient's condition is to be expected, however their need for emotional connection remains.

Strategies oriented towards enhancing and maintaining social skills, emotional expression, connection, and trust between people with dementia and their caregivers is vitally important for improving their quality of life, regardless of the severity of their disease.

It is well known that one of the most complex and difficult to combat symptoms often displayed by dementia patients is agitation. Management of this particular symptom constitutes a priority in the care of dementia sufferers as it corresponds to high levels of caregiver burden, limited patient function, premature patient institutionalisation, and increased mortality (Porsteinsson et al., 2014).

In a pilot study, Duignan, Hedley, and Milverton (2009) attempted to assess Wu Tao dance therapy (otherwise known as “The Dancing Way”) as an intervention combatting dementia, and to investigate its effects on agitation symptoms. Taking part in the study were six patients with dementia who participated in dance sessions as part of a programme lasting four weeks. According to the results of the study, agitation symptoms saw a reduction in four out of the six individuals, while the overall average reduction in the Cohen-Mansfield Agitation Inventory (CMAI) score was 6.16 points. Furthermore, Wu Tao improved the mood of both patients and care unit personnel due to increased communication, giving them the opportunity to develop therapeutic bonds.

4. Discussion

The aim of the present study was to explore the effect of dance interventions on dementia sufferers and examine the possibility of it constituting a non-pharmaceutical approach for preventing and alleviating the symptoms of this disease. Included in the literature review were 14 studies that displayed significant variety with regard to sample size, outcomes, and dance interventions implemented. Specifically, the number of participants ranged from 1 to 207 individuals with dementia or MCI, though in a majority of the studies (57.1%) the sample size was larger than 60 participants. A variety of dance programmes were carried out (e.g., ballroom dance programmes, dance and movement therapy, Greek traditional dance programmes, and so on), with sessions held between one and three times a week. Sessions lasted between 30 and 60 minutes, and the programmes had a total duration of between 4 and 48 weeks. With regard to outcomes, the studies included here explored the effect of dance on cognitive and brain function, as well as on the physical and mental health and the quality of life of the participants.

Overall, the findings of this review show that dance, as a complex sensorimotor activity that combines aerobic exercise, total body co-ordination, and cognition, offers significant benefits for older adults with neurocognitive disorders. More specifically, it contributes to the enhancement and maintenance of CF (Doi et al. 2017; Dominguez et al. 2018; Douka et al. 2019; Ho et al. 2020; Lazarou et al. 2017; Wang et al. 2020), memory (Doi et al. 2017; Lazarou et al. 2017; Zhu et al. 2018), attention (Douka et al. 2019; Lazarou et al. 2017), learning ability (Lazarou et al. 2017), visuospatial ability (Hokkanen et al. 2008; Lazarou et al. 2017), executive function (Douka et al. 2019; Lazarou et al. 2017), verbal fluency (Douka et al. 2019; Lazarou et al. 2017), processing speed (Zhu et al. 2018), and planning ability (Hokkanen et al. 2008).

With regard to mental health, a synthesis of the results drawn from the studies included in this review reveals that dance interventions have a positive effect on mood (Duignan et al. 2019; Guzmán et al. 2016; Hamill et al. 2012; Ho et al. 2020; Lazarou et al. 2017), boost self-esteem (Guzmán et al. 2016), and also reduce symptoms of depression (Dominguez et al. 2018; Guzmán et al. 2016; Ho et al. 2020; Wang et al. 2020), stress (Douka et al. 2019), irritability (Guzmán et al. 2016), and agitation (Duignan et al. 2019). They also contribute to enhancing quality of life (Douka et al., 2019; Wang et al., 2020) and improving the well-being of dementia sufferers (Charras et al. 2020; Hamill et al. 2012).

The findings of this review with regard to physical health are also of interest. More specifically, the reviewed studies suggest that dance has the potential to improve balance (Abreu & Hartley, 2013; Borges et al. 2018; Wang et al. 2020), gait distance and speed (Abreu & Hartley, 2013), physical fitness (Douka et al. 2019), functional mobility (Abreu & Hartley, 2013; Ho et al. 2020), and functional autonomy for the activities of daily living (Borges et al. 2018; Hokkanen et al. 2008). In contrast, the methodological limitations of the study conducted by Charras et al. (2020) did not allow for conclusions to be drawn with regard to balance and gait.

The majority of the studies reviewed here seem to concur that dance has the potential to be much more than just a recreational activity for specific parts of the population. Given its main advantage – that it can be adjusted to the physical limitations of older adults since it constitutes an activity that can be performed in a variety of contexts – dance provides major benefits in a safe and pleasing way (Brustio, Liubicich, Chiabrero, & Rabaglietti, 2018). It is an appealing, cost-effective, and multicomponent physical activity that offers older adults an enriched environment that provides them with increased sensory stimulation and challenging cognitive tasks within a pleasant social interaction

setting (Dominguez et al. 2018). Furthermore, the positive experiences of the participants constitute important facilitators for adherence that can lead to even better results in the long term (Wang et al. 2020).

Seen from this perspective, this particular type of intervention could perhaps be given greater priority in efforts to combat dementia and MCI.

However, the restricted number of pertinent studies and the differences apparent between them limit the ability to draw clear conclusions as to which type of intervention is most effective. It would thus be useful going forward for more randomized, controlled trials of high methodological quality to be conducted, trials that are thoroughly and strictly designed and involve large numbers of participants. More specifically, future studies will need to examine dose-response relationships more comprehensively so that public health recommendations for preventing and combatting the disease can be more targeted and effective. Furthermore, in order to bolster the potential contributions of dance interventions, it would be useful for their efficacy with regard to the type and severity of the disease to be studied in future. There is little doubt that both the obstacles thrown up by the disease itself and the individual characteristics of the participants need to be taken into careful account when designing physical exercise programmes (Kouloutbani, Venetsanou, Markati, Karteroliotis, & Politis, 2021).

The findings of the present study could be used to inform and raise awareness among interested parties regarding the value of dance interventions for this particular population group. With this in mind, it is expected that dance will play a larger role in efforts to combat the disease, and that it will be utilised going forward as either the treatment of choice, or as a means of supporting existing treatment regimens.

5. Conclusions

The findings of this review present clear indications that dance constitutes a highly promising alternative approach to the non-pharmaceutical treatment of dementia since it can have a favourable impact in various ways, such as enhancing cognitive and motor function, delaying the onset of behavioural and psychological symptoms, and improving the quality of life enjoyed by people with dementia or MCI. However, heightening the potential contributions of dance interventions to this particular disease requires the application of clear practical recommendations with regard to their specific characteristics (e.g. type, frequency, and duration). Moreover, if the benefits and therapeutic effects that spring from this particular type of physical exercise are to be maximised, it is vitally important that specially formulated and personalized interventions are applied, interventions adapted to meet the needs and desires of their participants. There is little doubt that an awareness and understanding of the specific factors operating in the relationship between dance and dementia can lead to the development of specially designed programmes, and to the emergence of dance as an alternative method for preventing and combatting dementia.

References

- Abreu, M., & Hartley, G. (2013). The effects of salsa dance on balance, gait, and fall risk in a sedentary patient with Alzheimer's dementia, multiple comorbidities, and recurrent falls. *Journal of Geriatric Physical Therapy*, 36(2), 100–108.
- Borges, E. G. D. S., Vale, R. G. D. S., Pernambuco, C. S., Cader, S. A., Sá, S. P. C., Pinto, F. M., ... Dantas, E. H. M. (2018). Effects of dance on the postural balance, cognition and functional autonomy of older adults. *Revista Brasileira de Enfermagem*, 71, 2302–2309.
- Brown, S., Martinez, M. J., & Parson, L. M. (2006). The neural basis of human dance. *Cerebral Cortex*, 16(8), 1157–1167.
- Brustio, P. R., Liubicich, M. E., Chiabrero, M., & Rabaglietti, E. (2018). Dancing in the golden age: A study on physical function, quality of life, and social engagement. *Geriatric Nursing*, 39(6), 635–639.
- Charras, K., Mabire, J. B., Bouaziz, N., Deschamps, P., Froget, B., de Malherbe, A., ... Aquino, J. P. (2020). Dance intervention for people with dementia: Lessons learned from a small-sample crossover explorative study. *The Arts in Psychotherapy*, 70, 101676.
- Cummings, J., Lee, G., Ritter, A., Sabbagh, M., & Zhong, K. (2019). Alzheimer's disease drug development pipeline: 2019. *Alzheimer's & Dementia: Translational Research & Clinical Interventions*, 5, 272–293.
- DeFina, L. F., Willis, B. L., Radford, N. B., Gao, A., Leonard, D., Haskell, W. L., ... Berry, J. D. (2013). The association between midlife cardiorespiratory fitness levels and later-life dementia: A cohort study. *Annals of Internal Medicine*, 158(3), 162–168.
- Doi, T., Verghese, J., Makizako, H., Tsutsumimoto, K., Hotta, R., Nakakubo, S., ... Shimada, H. (2017). Effects of cognitive leisure activity on cognition in mild cognitive impairment: Results of a randomized controlled trial. *Journal of the American Medical Directors Association*, 18(8), 686–691.

- Dominguez, J. C., Del Moral, M. C. O., Chio, J. O. A., de Guzman, M., Fe, P., Natividad, B. P., ... Phung, K. T. (2018). Improving cognition through dance in older Filipinos with mild cognitive impairment. *Current Alzheimer Research*, 15(12), 1136–1141.
- Douka, S., Zilidou, V. I., Lilou, O., & Tsolaki, M. (2019). Greek traditional dances: A way to support intellectual, psychological, and motor functions in senior citizens at risk of neurodegeneration. *Frontiers in Aging Neuroscience*, 11, 6.
- Du, Z., Li, Y., Li, J., Zhou, C., Li, F., & Yang, X. (2018). Physical activity can improve cognition in patients with Alzheimer's disease: A systematic review and meta-analysis of randomized controlled trials. *Clinical Interventions in Ageing*, 13, 1593–1603.
- Duignan, D., Hedley, L., & Milverton, R. (2009). Exploring dance as a therapy for symptoms and social interaction in a dementia care unit. *Nursing Times*, 105(30), 19–22.
- Fondell, E., Townsend, M. K., Unger, L. D., Okereke, O. I., Grodstein, F., Ascherio, A., & Willett, W. C. (2018). Physical activity across adulthood and subjective cognitive function in older men. *European Journal of Epidemiology*, 33(1), 79–87.
- Frith, E., & Loprinzi, P. D. (2018). Physical activity is associated with higher cognitive function among adults at risk for Alzheimer's disease. *Complementary Therapies in Medicine*, 36, 46–49.
- Gaitán, J. M., Moon, H. Y., Stremlau, M., Dubal, D. B., Cook, D. B., Okonkwo, O. C., & van Praag, H. (2021). Effects of aerobic exercise training on systemic biomarkers and cognition in late middle-aged adults at risk for Alzheimer's disease. *Frontiers in Endocrinology*, 12:660181.
- Guzmán, A., Freeston, M., Rochester, L., Hughes, J. C., & James, I. A. (2016). Psychomotor Dance Therapy Intervention (DANCIN) for people with dementia in care homes: A multiple-baseline single-case study. *International Psychogeriatrics*, 28(10), 1695–1715.
- Hamill, M., Smith, L., & Röhrich, F. (2012). 'Dancing down memory lane': Circle dancing as a psychotherapeutic intervention in dementia – a pilot study. *Dementia*, 11(6), 709–724.
- Ho, R. T., Fong, T. C., Chan, W. C., Kwan, J. S., Chiu, P. K., Yau, J. C., & Lam, L. C. (2020). Psychophysiological effects of dance movement therapy and physical exercise on older adults with mild dementia: A randomized controlled trial. *The Journals of Gerontology: Series B*, 75(3), 560–570.
- Hokkanen, L., Rantala, L., Remes, A. M., Härkönen, B., Viramo, P., & Winblad, I. (2008). Dance and movement therapeutic methods in management of dementia: A randomized, controlled study. *Journal of the American Geriatrics Society*, 56(4), 771–772.
- Kempermann, G., Fabel, K., Ehninger, D., Babu, H., Leal-Galicia, P., Garthe, A., & Wolf, S. (2010). Why and how physical activity promotes experience-induced brain plasticity. *Frontiers in Neuroscience*, 4, 189.
- Kouloutbani, K., Karteroliotis, K., & Politis, A. (2019). The effect of physical activity on dementia. *Psychiatriki*, 30(2), 142–155.
- Kouloutbani, K., Venetsanou, F., Markati, A., Karteroliotis, K. E., & Politis, A. (2021). The effectiveness of physical exercise interventions in the management of neuropsychiatric symptoms in dementia patients: A systematic review. *International Psychogeriatrics*, 1–14.
- Lazarou, I., Parastatidis, T., Tsolaki, A., Gkioka, M., Karakostas, A., Douka, S., & Tsolaki, M. (2017). International ballroom dancing against neurodegeneration: A randomized controlled trial in Greek community-dwelling elders with mild cognitive impairment. *American Journal of Alzheimer's Disease & Other Dementias®*, 32(8), 489–499.
- Okonkwo, O. C., Schultz, S. A., Oh, J. M., Larson, J., Edwards, D., Cook, D., ... Bendlin, B. B. (2014). Physical activity attenuates age-related biomarker alterations in preclinical AD. *Neurology*, 83(19), 1753–1760.
- Porsteinsson, A. P., Drye, L. T., Pollock, B. G., Devanand, D. P., Frangakis, C., Ismail, Z., ... Lyketsos, C. G. (2014). Effect of citalopram on agitation in Alzheimer disease: The CitAD randomized clinical trial. *JAMA*, 311(7), 682–691.
- Soni, M., Orrell, M., Bandelow, S., Steptoe, A., Rafnsson, S., d'Orsi, E., ... Hogervorst, E. (2019). Physical activity pre- and post-dementia: English longitudinal study of ageing. *Aging & Mental Health*, 23(1), 15–21.
- Tan, Z. S., Spartano, N. L., Beiser, A. S., DeCarli, C., Auerbach, S. H., Vasan, R. S., & Seshadri, S. (2017). Physical activity, brain volume, and dementia risk: The Framingham study. *Journals of Gerontology Series A: Biomedical Sciences and Medical Sciences*, 72(6), 789–795.
- Van de Winckel, A., Feys, H., De Weerd, W., & Dom, R. (2004). Cognitive and behavioural effects of music-based exercises in patients with dementia. *Clinical Rehabilitation*, 18(3), 253–260.
- Wang, S., Yin, H., Meng, X., Shang, B., Meng, Q., Zheng, L., ... Chen, L. (2020). Effects of Chinese square dancing on older adults with mild cognitive impairment. *Geriatric Nursing*, 41(3), 290–296.

- Winblad, B., Amouyel, P., Andrieu, S., Ballard, C., Brayne, C., Brodaty, H., ... Zetterberg, H. (2016). Defeating Alzheimer's disease and other dementias: A priority for European science and society. *The Lancet Neurology*, 15, 455–532.
- World Health Organization (2019). Dementia. [Online] Available: <https://www.who.int/news-room/fact-sheets/detail/dementia> (3 June 2021)
- Yiannopoulou, K. G., & Papageorgiou, S. G. (2020). Current and future treatments in Alzheimer's disease: An update. *Journal of Central Nervous System Disease*, 12, 1–12.
- Zhu, Y., Wu, H., Qi, M., Wang, S., Zhang, Q., Zhou, L., ... Wang, T. (2018). Effects of a specially designed aerobic dance routine on mild cognitive impairment. *Clinical Interventions in Aging*, 13, 1691–1700.