



Impact of Regular Physical Activity on Mental Health and Well-Being of Dementia Patients in Australia – A Systematic-Scoping Review

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Background

Background: Dementia is a term used to describe a group of symptoms impacting memory, thinking and social abilities, however, studies have shown positive effects of physical activity on dementia patients. The purpose of this systematic-scoping review is to summarise and analyse the impact of physical activity on mental health and well-being of dementia patients.

Methods: The frameworks of Joanna Briggs Institute (JBI) for scoping review and the Preferred Reporting Items for Systematic reviews and Meta-analysis- extension for Scoping reviews (PRISMA-ScR) were followed throughout this work. Four electronic databases were searched, including Google Scholar, PubMed, ProQuest and Scopus using keywords such as 'dementia' 'physical activity' 'cognition' 'mental health' 'well-being' and 'Australia'. The relevant studies were gathered based on the inclusion and exclusion criteria of the review. PRISMA chart was used to describe the search and the identification and screening of studies. Data extraction and analysis was performed based on standardized criteria of systematic - scoping review following JBI guidelines.

Results: A total of 10 studies including 518 patients with dementia were included in the review. The majority of studies (8) reported significant positive relationship between the level of physical activity, and particularly regular physical activity, and improvement in cognition of dementia patients. The studies also reported decreased depression score, increased independence and fewer falls.

Conclusion: The findings of this systematic-scoping review provide a relatively more reliable evidence that physical activity can improve the mental health status and well-being of dementia patients. Systematic reviews and meta-analysis may be required to confirm these findings.

Keywords: Dementia; Physical Activity; Mental Health; Well-Being; Falls; Cognition

Introduction

Dementia, a syndrome that is usually of a chronic and progressive nature is characterized by deterioration in cognitive function beyond what might be expected from the usual consequences of biological ageing (WHO, [1]). Worldwide, around 55 million people have been diagnosed with dementia and there are nearly 10 million new cases every year (WHO, [2]). Dementia has had a similar

impact on the Australian population, being ranked the second leading cause of death (Australian institute of Health and welfare, [3]). It is estimated that more than 400,000 Australian people are living with dementia and it is expected those numbers will increase in the coming years (Dementia Australia, [4]). Dementia is considered to be one of the leading causes of disease burden on the

Australian economy as it is estimated to cost more than \$15 billion per year (Brown L. et al., [5]). By 2050, it is estimated there could be 900,000 Australians living with dementia, which will make it the third leading cause of disability-based burden for people age of 65 years or older (Miskovski K.,[6]). It is considered vital, for a person suffering with dementia, to maintain their physical wellbeing in order to minimize the deterioration of their overall health.

Physical activity is any bodily movement produced by skeletal muscles that requires energy expenditure (WHO, [1]). Various studies have identified the association of exercise with reduced risk of dementia among people aged 65 and older (Larson B. et al., [7]) and increased cognition activity (Heyn P. et al., [8]). Some studies showed that physical exercises improved cognition (Groot C. et al., [9]), balance and reduced the risk of falls (Hernandez S. et al., [10]). Likewise, older people who are more physically active demonstrate less cognitive decline (Dementia Australia, [11]). Hence, it can be assumed that participating in a physical activity program can impact mental health status and overall independence of adults with dementia. However, further research is required to better understand the relationship between exercise and mental health and well-being of dementia patients. This systematic-scoping review focuses on understanding the impact of regular physical activity on the mental health status and overall well-being of dementia patients in Australia.

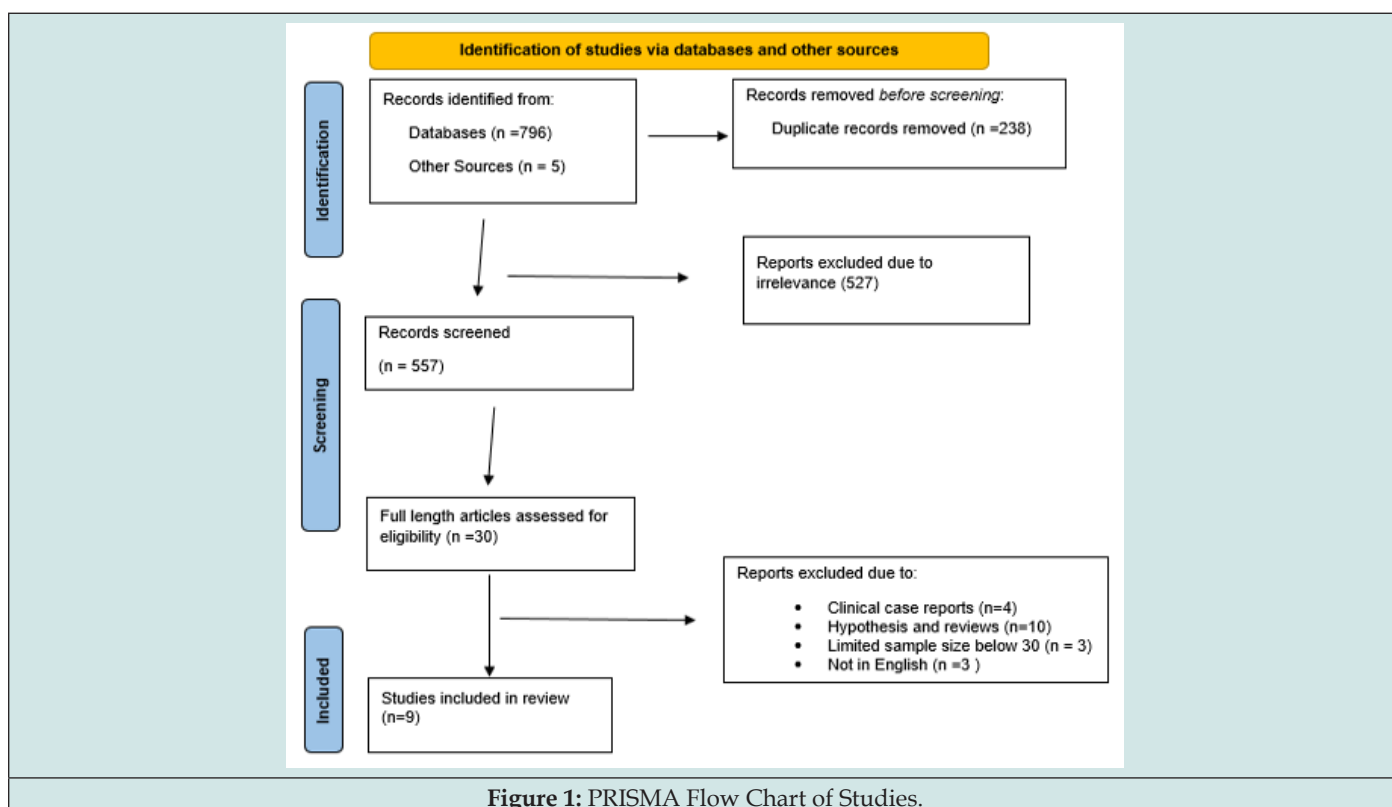
Methodology

This systematic-scoping review has been undertaken in order to gain insight into the impact of physical activity on the mental health of dementia patients; through utilization of a broad range of academic resources of various electronic databases. The review will

also include evidence in relation to regular exercise and prevention of falls that is directly linked to better cognitive function in elderly patients. This review will assist in understanding the results and gaps in the wide range of Australian-based population studies conducted specifically to comprehend the impact of physical training on dementia patients. This work focuses on the Australian concept as a model for western country settings because of its multicultural society. The findings of this review can be relevant to various cultures/ countries as the impact of physical activity on dementia and cognitive function is universal. Moreover, to our knowledge no systematic or scoping review has been conducted in Australia to understand the impact of physical activity on dementia patients. The framework of Jonna Briggs Institute (JBI) for scoping reviews and the Preferred Reporting Items for Systematic reviews and Meta-analysis- extension for Scoping reviews (PRISMA-ScR) were followed throughout this work (Peter M. et al., [12]).

Search Strategy

A systematic search of various databases was conducted using topic-specific keywords such as “physical activity”, “fitness”, “dementia”, “Alzheimer’s disease”, “elder*”, “adult*”, “improv*”, “mental health”, “improve”, “outdoor activities”, “Alzheimer”, “cognitive impairment”, “cognition”, “exercise”, “activity program”, “effects”, “benefits”, “old age” and “Australia” was conducted. Boolean operators “OR”, “AND” were used within the terms as required. PRISMA chart was used to identify and select final studies included in this review (Figure 1). In order to ensure rigor and reliability of the analysis, PRISMA-ScR guidelines was followed throughout the initial stages of this review, including search and identification of final study list, extraction of data and approach to analysis (Peter M. et al., [12]).



Database Search

A comprehensive search of relevant full text, peer-reviewed published articles, was undertaken on the public health database from Torrens University Australia library. Various electronic

databases such as Google Scholar, PubMed, ProQuest and Scopus were utilized to search for articles relevant to the proposed systematic scoping review and the research question. These databases were searched for all types of quantitative studies (Table 1).

Table 1: Characteristics of Included Studies.

Author, year	Study title	Study Design	Study Size	Female (%)	Intervention/ Exposure	Locality/ State
D’Cunha M. et al., [20]	Psychophysiological Responses in People Living with Dementia after an Art Gallery Intervention: An Exploratory Study	Quasi-experimental design	25	68%	Art gallery outings	ACT
Edwards C. et al., [22]	An evaluation of a therapeutic garden’s influence on the quality of life of aged care residents with dementia	Longitudinal Study	34	90%	Gardening as a physical activity	NSW
Ellis M. et al., [21]	Laughter yoga activities for older people living in residential aged care homes: A feasibility study	Quasi- experimental	28	82.10%	Laughter yoga program	Victoria
Hills D. et al., [13]	Effectiveness of balance training exercise in people with mild to moderate severity Alzheimer’s disease: Randomized trial	Randomized Control Trial	214	50%	Home based balance exercise	Victoria
Neville C. et., [19]	Exploring the effect of aquatic exercise on behavior and psychological well-being in people with moderate to severe dementia: A pilot study of the Water memories Swimming Club	Quasi- experi- mental	24	90%	Aquatic exer- cise	Queensland
Stevens J. and Killeen M., [14]	A randomised controlled trial testing the impact of exercise on cognitive symptoms and disability of residents with dementia	Randomized Control Trial	75	74.70%	Exercise pro- gram	NSW
Suttanon P. et al.,[16]	Feasibility, safety and preliminary evidence of the effectiveness of a home-based exercise program for older people with Alzheimer’s disease: a pilot randomized controlled trial	Randomized Control Trial	40	62.50%	Exercise supervised by physiotherapist	Victoria
Vreugdenhi A. et al., [15]	A community-based exercise program to improve functional ability in people with Alzheimer’s disease: a randomized controlled trial	Randomized Control Trial	40	60%	Outdoor exer- cise	Tasmania
Wesson J. et al., [18]	A feasibility study and pilot randomized trial of a tailored prevention program to reduce falls in older people with mild dementia	Randomized Control Trial	38	36.40%	Balance and strength enhancing exercises	NSW

Inclusion Criteria

The articles for the literature review were selected from various databases with known credible sources.

All the included studies have participants with diagnosed dementia, with no constraints on type of dementia or gender. The

study samples are from community settings, residential care and hospitals. Studies with any intervention based on physical activity, with no restriction on the type of activity, were included. Moreover, studies that reported any type of physical and/or psychological outcome measure were incorporated. All the studies included in this review were undertaken/conducted in Australia (Table 2).

Table 2: Results of association between physical activity and mental health of dementia patients.

Themes	References	Outcome
Unsupervised Exercise Programs	Hills D. et al., [13]	Reduced falls and fall injuries Exercise is considered to be an effective and essential part of fall prevention program
	Stevens J. and Killeen M., [14]	Increased function and independence. Improvement in self helping skills. Level of significance: p = .019
	V reugdenhi A. et al., [15]	Improved cognitive, physical function and independence in activities of daily life Level of significance: p = 0.001
Supervised Exercise Programs	Suttanon P. et al., [16]	Increased balance and performance. Reduced fall risk Reduced n behavioral and psychological symptoms in people with dementia (BPSD) Level of significance: p < 0.05
	Wesson J. et al., [18]	No psychological difference noticed between control and intervention group Fewer falls in control group with 95% CI. All participants demonstrated cognitive impairment in the mild range

Recreational activities as a form of exercise	D'Cunha M. et al., [20]	Improved hypothalamic- pituitary adrenal axis function The level of significance was defined at $\alpha=0.05$ Lower symptoms of depression post intervention ($p = 0.002$)
	Edwards C. et al., [22]	Mean depression and agitation scores decreased by almost half Mean quality of life score increased (level of significance: $p < .0001$)
	Ellis M. et al., [21]	Lower mean negative mood score Measurable improvements in happiness scores Level of significance: $p = 0.001$
	Neville C. et., [19]	Decreased Behavioral and psychological symptoms with dementia (BPSD) and improved psychological well being

Exclusion Criteria

Articles were excluded from the study for various reasons. These reasons included duplication; articles that did not reveal any relationship or closeness to the research question or topic. Moreover, studies conducted before 2005 were excluded from this analysis. Through reading the abstracts, it became clear whether or not to include an article in the study, therefore, the articles which did not reveal any relevance were excluded.

Unsupervised Exercise Programs

Three randomized controlled trials were included (total of 329 participants) that investigated the impact of unsupervised exercise programs on dementia patients. Hill et al., conducted a randomized controlled trial amongst mild to moderate severity Alzheimer's disease patients. The intervention group used home balance training exercise programs provided initially by physical therapists, whilst the control group received information, education, and other support-based program from the occupational therapist. The cognitive exercise primarily focused on various functional movements that have shown to be effective on reducing fall risk and cognitive impairments in elderly people (Hills et al., [13]). The result has shown that balance training at an early stage of Alzheimer's disease could prevent balance dysfunction and high fall risk in later stages of dementia. A 2nd study by Stevens & Killeen performed measured the progression of dementia symptoms by using the Clock Drawing Test, and disability level, by using the Revised Elderly Persons Disability Scale (REPDS). Out of the 120 study population, seventy-five participants completed the twelve-week exercise program. The Clock Drawing Test results showed a higher score for the intervention group. The above group post-test score also declined, which indicates improvement in cognitive function. The control and intervention group REPDS score reduced in 7 of 9 categories which shows function regression. The Self-help skill ($p \leq 0.0001$) and Sociability ($p=0.013$) score were statistically significantly reduced. On the other hand, there were significant improvements for the experimental group in Self-help skill ($p=0.019$), Confusion ($p=0.028$) and Behavior ($p=0.031$) categories (Stevens & Killeen [14]). These results demonstrate that regular exercise programs are effective in improving dementia patients' behavior and quality of life.

Vreugdenhil et al., have undertaken their research on Alzheimer's disease with a focus on improving functional ability through community-based exercise. This study used home based exercise program, and walking as an additional treatment,

for the experiment group over a period of 4 months. A total of 40 individuals, with a median age of 74.1 years, from the 64 participants agreed to be involved. The exercise program consisted of 10 exercises including lower and upper body movements, and a minimum 30 minutes of walking. The outcome measurements included cognitive and physical function, activity of daily living (ADLs), depression and global change in function. The experiment group showed improvements in physical activities (better balance $p=0.032$), lower body strengths ($p<0.001$) and reduction in Alzheimer's disease scale ($p=0.001$) (Vreugdenhil et al., [15]). The regular walking and exercise results showed positive changes to ADLs, mental health and physical health of these patients.

Supervised Exercise Program

This section explores the 2 studies that used tailored and supervised exercise programs for dementia patients. One of the studies conducted by Suttanon et al. [16], aimed at improving stability and decreasing falls risk in Alzheimer's disease patients. The study participants (mean age 81.9) received tailored home-based exercise programs from a physiotherapist for a period of 6 months. The participants were encouraged to train five times a week following the proposed program. The above study found functional reach to be more than doubled in the experimental group (2.28, $p=0.002$). Falls risk also improved significantly ($p=0.008$) (Suttanon et al., [16]). The home-based exercise program results suggest that mild to moderate Alzheimer's disease patients may gain advantage from this type of program.

The 2nd study conducted by Wesson et al. aimed at reducing fall risk among mild dementia patients by using individually prescribed interventions that include occupational therapy, physiotherapy, home visits and three phone calls for twelve weeks. The clinical measurements were falls, physical performance and everyday ability measures. Additionally, cognition functions were measured by the ACE (Addenbrooke's Cognitive Examination) following the proper guidelines across the varied timepoints during the intervention. ACE-III is a brief cognitive test that assesses five cognitive domains: attention, memory, verbal fluency, language and visuospatial abilities (So M. et al., [17]) and these scores for all these domains were moderately but not significantly improved between baseline and post-intervention (Wesson J. et al., [18]). The above findings indicate that physical activity may have a positive effect on the cognitive function of dementia patients.

Recreational Activity as A Form of Exercise

This section analyzes four studies that used different

recreational activities to understand the impact of physical activity on the cognition function of dementia patients. Neville et al., [19] utilized various aquatic exercises to understand the same impact on twenty-four selected participants. The study used Friedman test that indicated reduction in the number of behavioral and psychological symptoms of people with dementia (BPSD) from a median of 2.0 at start to reducing to 0.0 by the end of intervention. Also, the residential aged care facilities (RACFs) noticed a decline in the BPSD from 4.0 at time 1 to 0.0 at both time 3 and time 4 (Neville et al., [19]).

Additionally, D'Cunha et al. used art gallery outing as an intervention and the cognitive performances were measured utilizing Mini-Addenbrooke's Cognitive Examine (M-ACE). It showed significant variation in different timeframes such as improving between baseline and post-intervention, and decreasing between post-intervention and follow-up. In terms of memory (immediate recall) and verbal fluency score there was an increase from baseline to post-intervention, and decrease from post intervention to follow-up. However, no significant difference had been marked between attention or visuospatial ability. Moreover, participants were administered the six-item General Wellbeing Questionnaire (GWQ) from the Museum Wellbeing Measures Toolkit and scored 30 following each visit to the National Gallery of Australia (NGA) program during weeks 1, 3, and 6. The GWQ score increased from week 1 to week 3 and remained the same at week 6. However, there was an increase of expressions of happiness and laughter between week 1 and week 2 and a decrease in week 5 of intervention (D'Cunha et al., [20]).

Similarly, study conducted in 2017 by Ellis et al. [21], suggested that laughter yoga activities played an important role in improving the physical and psychological health of the residents. The mean score for positive mood and happiness significantly increased after taking the yoga session compared with the pre-session score in week 1, 3 and 6. In contrast, the negative mood score was significantly lower than pre-session scores in weeks 3 and 6. Moreover, the yoga activities also played a vital role in controlling the systolic blood pressure; it was lower during the post-session period compared with the pre-session period in weeks 1 and 6 (Ellis et al., [21]). Edwards et al., evaluated the influence of "therapeutic garden" that consists of a quite area with water feature, walking platform overlooking bushes, raised growing beds and more on dementia patients in aged care residents. The above study showed remarkable improvements across all sectors including quality of life, depression and agitation. Further to this, the residents social interaction level also increased due to spending more time socializing whilst engaging in the recreational and physical activities. In conclusion, the results showed significant improvements in the quality of life for residents (Edwards et al., [22]).

Discussion

The systematic scoping review found a significant decrease in cognition impairment in older adults with dementia when engaged in regular physical activity. The review also recorded lower

depression rates and lower falls due to regular exercise, which categorically contribute to better cognitive functioning and well-being. Supervised regular exercise showed the most significant improvement in cognitive functioning among dementia patients.

The results of this systematic-scoping review are consistent with previous world-wide studies, addressing the impact of physical activity on dementia patients' physical health and general wellbeing. A systematic review by Aarsland et al.[1], demonstrated that regular physical activity is likely to prevent the development of Vascular dementia (Aarsland D. et al., [23]), and, the study showed association with improved psychological well-being. There is a growing evidence suggesting that physical activity and exercise have tremendous positive effects on cognitive function of the elderly. The wonderful effects of physical activity and exercise on cognition has been quite evident in this review. These findings are consistent with findings from a Randomized Controlled Trial that showed that dementia sufferers in the intervention arm of a bodily hobby or exercising had an advanced cognitive performance compared to those in the control group (Neville et al., [19]). It is well established that exercise is useful for dementia patient's cognition, yet few studies proposed a particular style of exercise or physical activity that would improve symptoms of dementia (Anderiesen H. et al., [23]).

However, due to the multifaceted nature of physical activity it is difficult to pinpoint what may have been the most effective component (Wesson et al., [18]). Nevertheless, the connection between exercise and improved functioning in activities of daily living and reduced depression has been reported previously. A meta-analysis conducted to test this hypothesis reported positive effects on cognition (Colcombe S. & Kramer F., [24]) and the association between higher levels of physical activity and a reduced risk of cognitive decline in dementia (Blondell J., [25]). Still, the impact of additional intervention components such as socialization, rekindled positive memories, fun and relaxation are yet to be explored through controlled studies.

Although the summary of evidence provided by this systematic scoping review has added strength to the individual evidence provided by the included studies, the above analysis covered a relatively small number of studies pertinent to the research question. While all efforts were made to capture any Australian based study within the timeframe of the review, some studies may have been missed in this search, which may have potentially impacted the overall outcome. Moreover, the review being an Australian context specific means that the findings may not necessarily apply to dementia patients who do not reside in Australia, however, the evidence may somewhat relates to western country context.

Recommendations

Physical activity is generally highly recommended as it reduces the risk of developing various health conditions. World Health Organization recommends weekly minimum of 150 minutes of moderate-intensity aerobic exercise to reduce the risk of cognitive decline in people over 65 years of age (WHO, [26]). The findings

in this review highlight the importance of regular and organized physical activity in reducing and slowing the exacerbation of dementia and its complication. Health policy makers and health programs planners as well as healthcare providers are required to integrate physical activity routines into the care packages provided to dementia patients. This regulation and formalization of this will not only protect dementia patients against complications including falls, which can be dreadful, it will also assist in reducing the risk of further chronic illness and/or lowering the impact of any pre-existing chronic disorders [27,28].

Conclusion

The current systematic scoping review addressed the association between outdoor regular physical exercise and mental health status and well-being of dementia patients in Australia. one of the most evident findings was the decreased in cognition impairment when older adults with dementia engaged in regular physical activity. Moreover, lower depression rates and falls were also recorded. There was an overall evidence of the positive impact of outdoor physical activity programs on the mental health and well-being of dementia patients. Health policy makers and healthcare providers are highly encouraged to incorporate regular exercise into the care plan of dementia patients. A systematic review and meta-analysis may be required to confirm these findings.

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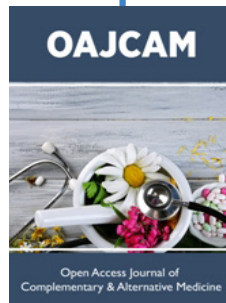
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