



RESEARCH PAPER**Aquatic Exercises as Medicine for Older Individuals with Dementia:
Evidence by an Analytical Approach**

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ABSTRACT

The intent of this systematic review was to decide whether or not there is a relationship between aquatic exercise and dementia in older people. This review included eight experimental studies, one longitudinal study, and one qualitative study. The majority of the interventions focused on water-based exercises designed specifically for dementia patients. The results showed that aquatic exercise interventions in Dementia sufferers had a variety of beneficial effects. Improvements in cognitive function, mental health, and behavioral and psychological dementia symptoms were all included in these effects. These results are also in favor of including aquatic exercises in dementia care programs as aquatic exercise interventions have the potential to enhance a number of dementia-related results, including cognitive performance, psychological happiness and ultimate quality of life. To better understand and implement aquatic exercise interventions for people with dementia, research gaps have been identified, including the need for larger-scale studies and comparative investigations.

KEYWORDS Aquatic Exercises, Cognitive Function, Dementia, Mental Health, Older People, Systematic Review

Introduction

Dementia is a neurodegenerative condition that worsens over time and causes changes in behavior as well as a reduction of cognitive function (Geldmacher & Whitehouse, 1996). Future dementia prevalence is predicted to rise significantly as the world's population ages, initially posing significant problems for people, families, and healthcare systems (Babulal et al., 2019). As a result, it was vital to spot efficient interventions that can improve the well-being of dementia patients. The results of numerous studies investigating possible advantages of aquatic exercise for dementia patients have been encouraging.

Swimming, water aerobics, and hydrotherapy are examples of physical exercises that can be done in a water-based environment and are referred to as aquatic exercises (Bhushan et al., 2018). This type of exercise might have several unique advantages for senior citizens, including reduced joint stress, improved buoyancy, and increased safety. Two more characteristics of water (hydrostatic pressure and resistance) also have therapeutic benefits (Lee, Jackson, & Richardson, 2017).

Recent years have seen a rise in the amount of research on the benefits of aquatic exercise for those who have dementia. This population has been benefited by aquatic exercises in terms of behavior, psychological health, and quality of life, according to numerous studies (Usmani, Sharath, & Mehendale, 2022). A qualitative study was conducted to look at the benefits and drawbacks of dementia-affected older adults exercising in the water in residential care facilities. The outcomes demonstrated that the participants' physical functioning, social interaction, and all-around wellbeing had all improved (Aggarwal, Chaware, & Aggarwal, 2022).

Numerous other studies have examined how aquatic exercise affects dementia patients. For instance, a study on people with dementia examined water-based exercise routines' effects on the mental clarity and their general wellbeing. Improvements in assessment of cognitive performance and standard of life were seen in people with dementia (Ayán, Carvalho, Varela, & Cancela, 2017). Similar outcomes were observed in a study carried out in 2021, in which the researchers examined the influence of water behavioral training & emotional health in persons suffering from mild to severe dementia (Campos et al., 2021). The consequences of aquatic exercise on bodily function in dementia sufferers are a further area of study. Another study looked into how a thorough aquatic training program affected mobility and physical function in dementia-affected older adults. They found that those who exercised in the water had significantly greater gains in strength, mobility, and balance (Andrade, Siqueira, D'Oliveira, & Dominski, 2021).

According to the mixed-methods approach employed in the study, aquatic exercise has several benefits such as improved mood, less agitation, and increased participation in worthwhile activities (Campos et al., 2021). In spite of having these promising findings, a lot of study is required in this regard to completely apprehend the link between dementia patients and aquatic exercises.

The utmost intent of this systematic review was to decide whether or not there is a relationship between aquatic exercise and dementia in older people. Hence, by yielding an evidence-based evaluation of the probable benefits of aquatic exercise for dementia patients this systematic review may turn out to be useful for future studies as well. These outcomes will also help psychiatrists and physical educationists in altering their way of treatment towards patients of dementia.

Literature review

Previous research articles focusing on the objective of exploring the relation between dementia and aquatic exercises highlighted a positive outcome. An experimental study conducted on elder/senior care facility stated that positive effects on behavioral and psychological signs of dementia were identified (Timothy Henwood, Neville, Baguley, & Beattie, 2017a). Similarly, some other research studies including Ayán et al. (2017), Timothy Henwood et al. (2017a), Hobden, Swallow, Beer, and Dening (2019), Tim Henwood, Neville, Baguley, Clifton, and Beattie (2015), Maeshima, Okumura, Tatsumi, Tomokane, and Ikeshima (2017), Merom et al. (2014), Neville, Henwood, Beattie, and Fielding (2014), Schilling, Coles, Simons, and Frost (2018), Turnbull, Salwan, and Pattman (2018a) and (van de Rakt & Mccarthy-Grunwald, 2020) focusing on the subject of relation between aquatic exercises and dementia in older people also demonstrated that therapeutic aquatic exercise when consistently attended were effective in mitigating some of the symptoms of dementia.

Material and Methods

Research Approach

Some reputable academic databases such as The Wiley Library, MEDLINE, Pub Med, Springer etc. were exercised to carry out this organized search. The keywords or search terms used were “Dementia and Older people” “Dementia and Aquatic exercises”, “Aquatic Exercises and Older people”, “Swimming and Dementia”, and “Water based exercises and Older people”. Moreover, references of articles that aimed on finding a relationship between aquatic exercises, dementia and older people were also investigated to associate any new research article.

Inclusion’s Criteria

The procedure of inclusion consisted of studies that fulfilled the subsequent criteria: - 1) Articles having relation between dementia and aquatic exercises in older people either as the primary objective or a secondary area of concern 2) Cohort, Qualitative, Cross-sectional, and Experimental type of studies 3) Studies of which full texts are obtainable 4) Articles having population above the age of 45 regardless of any gender 5) Studies incorporating terms related to dementia and aquatic exercise, such as water-based sports, athletes versus non-athletes, cognitive disorders, etc.

Selection of study

Two independent experts conducted a thorough review to select the best articles according to the predetermined criterion for inclusion and exclusion for this systematic review. Two steps made up the study selection process. The specialists started by looking through the titles and abstracts of the retrieved articles to find relevant information and data that matched the goals of this review. The full texts of the articles, that were identified, were then meticulously examined to determine their potential relevance. Three meetings were held by the experts to discuss and settle any disagreements that arose during the study selection process in order to maintain consistency and reach consensus. If there was still a difference of opinion, a third expert was asked for their opinion. Figure 1. presents a thorough explanation of the study selection process, outlining all the specs of the procedure.

Methodology’s Rigor

For the experimental and longitudinal studies that met the criterion for inclusion and exclusion, two reviewers independently assessed any risk of biasness. The Critical Appraisal Skills Program (CASP) (Barker et al., 2023) for RCT and longitudinal studies was employed to gauge the methodological rigor of these research studies respectively. A qualitative study was evaluated using the COREQ tool (Booth et al., 2014), which is renowned for determining the reliability and validity of qualitative research.

On the other hand, the quantitative longitudinal study utilized the CASP tool, which is recognized as valid and reliable tool for assessing the methodological rigor of such studies. The use of these appropriate tools, allowed for an in-depth analysis of the included studies, considering the unique requirements and characteristics of each study design. We were able to assess the possibility of prejudice present in the chosen studies and ensure the credibility and robustness of the evidence synthesized in this systematic review by using this stringent quality appraisal process.

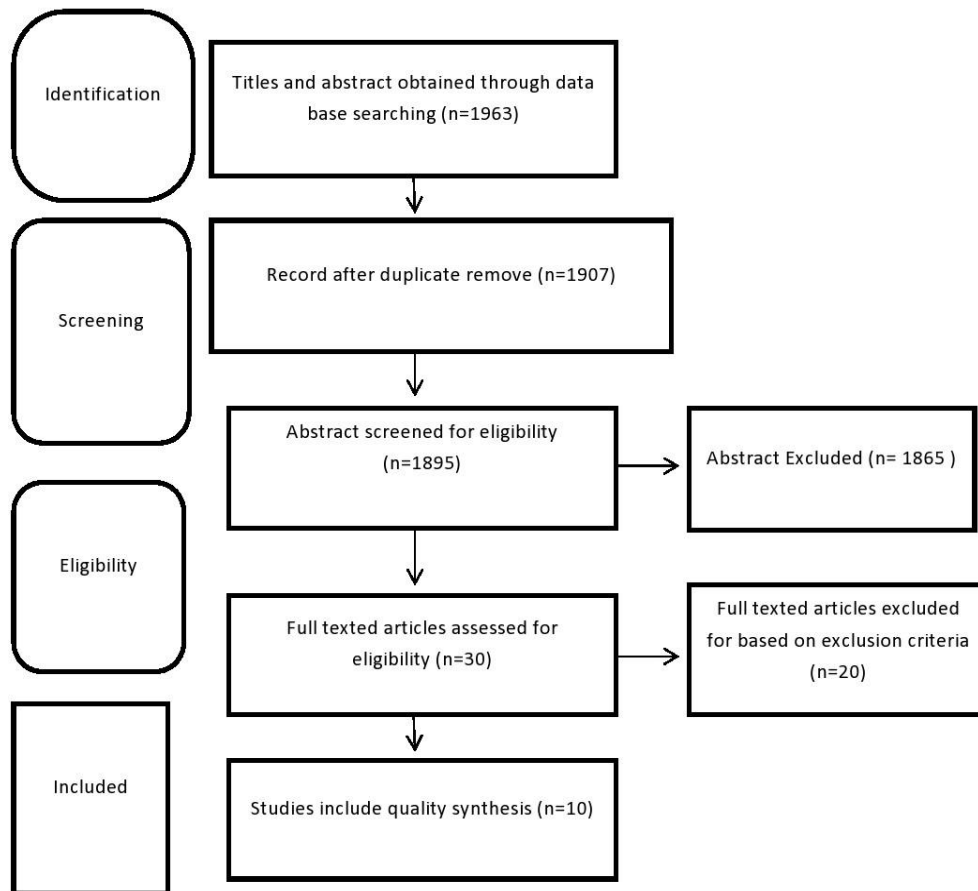


Figure 1. Process chart depicting the advancement of studies during the systematic review, adhering to the “PRISMA guidelines (Moher, Liberati, Tetzlaff, Altman, & Group*, 2009).”

Results and Discussion

Study selection

To determine eligibility, a thorough screening procedure was performed on a total of 1963 abstracts & titles. Thirty complete articles were retrieved and further assessed after excluding titles and abstracts that did not adhere to the predetermined inclusion criteria. This review's inclusion criterion was not met by 20 of these studies, so they were excluded. After carefully reviewing their full texts, 10 articles were chosen for a thorough quality evaluation. Eight of the experimental studies in these 10 articles met the criteria for very good, good, or satisfactory quality. In addition, 1 longitudinal study and 1 qualitative study were added for qualitative synthesis that ranged from low to moderate in the final analysis.

Study traits

Ten studies that investigated the characteristics and outcomes of aquatic exercise interventions on people with dementia were thoroughly analyzed as part of the systematic review. Eight of the 10 studies are experimental, one was longitudinal, and one was

qualitative. With sample sizes ranging from 9 to 51 participants, the studies included a variety of populations. The participants' average ages ranged from 46.3 to 88.4 years, reflecting a wide range of age groups among people with dementia. The gender distribution varied between studies, with a predominance of female participation relative to male participation.

The majority of the interventions, created especially for dementia patients, included aquatic or water-based activities. For a period of 6 to 12 weeks, there were two or three 40-to-60-minute exercise sessions per week, twice or three times per week. Some of the various exercise types used in the interventions included synchronized swimming, balance exercises, and aerobic exercises. The studies emphasized the benefits of water exercises in slowing the onset and progression of dementia.

The studies' findings revealed a number of positive effects connected to aquatic exercise interventions. Among these effects were improvements in mental health, behavioral and psychological dementia symptoms, and cognitive function. The studies also highlighted how satisfied and happy participants in aquatic exercises felt overall. The importance of aquatic exercises as a safer alternative to land-based exercises for dementia patients was also emphasized.

A variety of dementia-related results, including cognitive performance, psychological well-being, & general quality of life, may be improved by aquatic exercise interventions, according to the systematic review. The results suggest that aquatic exercises have the potential to be an effective intervention for dementia patients across a range of age groups.

Table 1
Summary Table

Study/Country	Population, Samples, Participants ages, Gender	Male/Female ratio	Study design	Intervention	Results/Findings
(Timothy Henwood, Neville, Baguley, & Beattie, 2017b) Australia	Final Participants: 46 Mean Age: 82.4 years	Male: 60.86% Female: 39.14%	Experimental	Swimming: Over a 12-week period, participants assigned to their normal facility activities. The program followed a planned schedule during each 45-minute workout session	Positive effects on behavioral and psychological signs of dementia were identified.
(Tim Henwood et al., 2015) Australia	Final Participants: 11 Mean Age: 88.4 years	Female: 90.9% Male: 9.1%	Experimental	Swimming: 45-minute group workout. The exercise classes were held bi-weekly over a span of 12 weeks.	An aquatic exercise has been shown to effectively decrease (BPSD)

(Ayán et al., 2017)	Final Participants: 51 Mean age: 46.3 years	Female: 100% Male: 0%	Experimental	Water-based Exercise Program: Over a 6-month period, the water-based program was conducted twice a week in non-consecutive 45-minute sessions.	Significant improvements in the patients' cognitive performance and mental health domains were reported.
(Schilling et al., 2018)	Final Participants: 10 Age range: 80-85 years	Female: 100% Male: 0%	Experimental	Water-based activities: A total of 19 observation days were undertaken throughout a 2-month period, equating to 60 days.	The experts highly advise for the use of water workouts for people with dementia
(Neville et al., 2014)	Final Participants: 24 Age: 65 years or above for all	Women: 92% Men: 8%	Experimental	Aquatic workouts with structure: The program was initially administered at a lesser intensity. However, as participants exhibited improved competency, the intensity of the exercises was gradually increased.	Aquatic exercise has been shown to benefit those suffering from dementia.
(Hobden et al., 2019)	Final Participants: 14 Age: 50 years or more for all	Participants gender was not mentioned.	Qualitative	Swimming: For seven weeks, semi-structured interviews were done in a dedicated quiet room by one of the researchers to get insights into the participants' experiences throughout these sessions.	Swimming's intrinsic worth as a form of healthful exercise was one of its most delightful qualities.
(Maeshima et al., 2017)	Final Participants: 23 Age range: 49-83 years	Female: 100% Male: 0%	Experimental	Aquatic Exercises: Within the control group, 16 participants engaged in exercise three or four times a week, while 17 participants exercised once or twice a week.	The outcomes of this study suggest that synchronized swimming has a favorable effect on cognitive function, in people with dementia.
(van de Rakt & Mccarthy - Grunwald, 2020)	Final Participants: 27 Age range: 50-60 years old	Participants gender was not mentioned.	Experimental	Structured Aquatic Exercises: 40-50 minutes twice a week.	The study's outcome indicates that the aquatic environment, delivers an aerobic boost, which is important for decreasing the course of dementia.
(Turnbul, Salwan, & Pattman, 2018b)	Final Participants: 9 Mean Age: 81.63 years	Female: 33% Male: 67%	Experimental	Aquatic Therapy: Mild aquatic therapy with very low intensity.	The findings indicate that water treatment is both safe and beneficial for patients with dementia, with favorable benefits found.
(Merom et al., 2014)	1,667 older Australian males with an average age of 76.8 years.	Female: 0% Male: 100%	Longitudinal	Moderate intensity level swimming.	Results suggests that swimming help in slowing the speed of dementia in older people

Quality of Studies

Eight experimental studies were evaluated using the CASP for RCT, and the results revealed interesting details about each study's characteristics. One of these studies was

deemed to be a "Very Good study," exhibiting a high level of methodological rigor and credibility. Five studies received the grade "Good," signifying that they met the criteria and displayed excellent qualities. As shown in Table 4, one study also received the rating "Satisfactory," which indicates a level of quality that is acceptable but could be improved.

The assessment also comprised a longitudinal study, which was rated as "Good" quality by CASP for longitudinal studies, confirming the assessment's dependability and robustness as shown in Table 3. Additionally, a qualitative study that was evaluated using the COREQ (Consolidated Criteria for Reporting Qualitative Research) tool received "Good" rating, indicating that it was thorough and adhered to the standards of qualitative research. Table 2 provides additional information. Overall, these findings highlight the merits and strengths of the evaluated studies, highlighting their adherence to ethical research procedures and boosting the reliability of their findings.

Table 2
Quality assessment of Qualitative Study using COREQ tool

Study	Quality rating	Score	Clear and concise conclusion	Address the potential biases	Provide sufficient data	Findings clearly presented	Ensuring participants confidentiality	Credibility of finding	Data analysis method describes in detail	Data collection described in detail	Adequate sampling strategy	Clear description of research design	Clear and concise introduction
(Hobden et al., 2019)	Good	7	Yes	No	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes

Table 3
Quality assessment for Longitudinal Study using CASP tool

Study	Quality rating	Score	Results clearly explained	Appropriate statistical methods	Intervention	Reliable measurements and assessments	Data collection adequately defined	Outcomes clearly defined	Sufficient follow up period	Inclusion/Exclusion criteria clearly defined	Population clearly defined	Appropriate study design	Research question clearly stated
(Merom et al., 2014)	Good	8	Yes	Yes	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes

Table 4.
Quality assessment table for experimental studies

Study	Validity of Study design			Methodology					Results				Quality Rating	
	1	2	3	4	5	6	7	8	9	10				
	Clearly focused Research question	Randomized intervention	All participants accounted for conclusion	Participants blind to intervention	Investigators blind to intervention	Analyzer blinded	Similarity of study groups	Identical care for all study groups	Precision of estimate of intervention reported	Benefits Outweighs the harms and cost	Application of results to local population	experimental intervention that offers increased benefits to individuals	Quality score out of 10	
(Timothy Henwood et al., 2017a)	Yes	No	Yes	Yes	Yes	Yes	No	Yes	No	Yes	Yes	Yes	7	Good
(Tim Henwood et al., 2015)	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	8	Good
(Ayán et al., 2017)	Yes	Yes	No	Yes	Yes	Yes	No	Yes	No	Yes	Yes	Yes	7	Good
(Schilling et al., 2018)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	9	Very Good
(Neville et al., 2014)	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	8	Good
(Maeshima et al., 2017)	Yes	No	No	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	7	Good
(van de Rakt & McCarthy-Grunwald, 2020)	Yes	No	No	Yes	Yes	Yes	No	Yes	No	Yes	Yes	Yes	7	Satisfactory
(Turnbull et al., 2018b)	yes	No	No	Yes	Yes	Yes	No	Yes	No	Yes	Yes	Yes	6	Satisfactory

"Procedure for Quality Ranking, Very Good articles: 9-10 score, Good articles: 7-8 score. Satisfactory studies: 5-6 score and 0 to 4 score for Unsatisfactory studies"

Discussion

The association between aquatic exercise and dementia in older people was examined in ten studies in the current systematic review. The study design, population, interventions, and outcomes assessed varied among the included studies. One longitudinal study and one qualitative study were also included, with the majority of the studies being experimental in nature. The wide age range of the participants reflected the variety of age groups within the dementia population. The findings of this comprehensive review, on the other hand, suggest that aquatic exercise therapies may be helpful in improving a range of dementia-related outcomes, such as cognitive function, overall quality of life etc. Future research should investigate conceivable physiological and psychological mechanisms to improve our comprehension of the impacts of aquatic workouts on individuals experiencing cognitive decline.

Swimming or water-based exercises adapted to the particular needs of dementia patients were the main components of the aquatic exercise interventions used in the studies. Over a period of 6 to 12 weeks, the exercise sessions took place twice or 3 times a week for a total of 40 to 60 min. Exercises of all kinds, such as synchronized swimming, aerobics, and balance drills, were used. These interventions looked at how aquatic exercises might help manage dementia symptoms and the disease's progression.

Aquatic exercises have a lot to offer elderly people with dementia, including a variety of special benefits that greatly enhance their general wellbeing (Harmer & Orrell, 2008). There is a possibility that the buoyancy offered by water plays a crucial role in ensuring a safe and risk-free form of physical exercise for dementia patients by minimizing the impact on joints and muscles (Becker, 2020). This aspect is especially important because it enhances mobility, balance, and coordination, which are frequently impaired in people with dementia (Saúde, Bouça-Machado, Leitão, Benedetti, & Ferreira). Additionally, the aquatic environment's sensory stimulation can have a significant impact on cognitive function and sensory integration, possibly resulting in noticeable improvements in memory, attention, and general cognitive performance (Dias, da Paixão, & Nobre, 2021). Additionally, the soothing and healing effects of water foster a tranquil setting that can successfully lessen the stress, anxiety, and agitation frequently felt by people with dementia (Detweiler et al., 2012). These elements possibly work together to make aquatic exercises a highly effective and compelling strategy for fostering physical, cognitive, and psychological well-being in seniors with dementia.

The results are encouraging, but some research areas still need to be addressed. The majority of the studies that made up the analysis had sample sizes that ranged from 9 to 51 subjects, which was a relatively small number. Larger-scale studies involving diverse populations are required to improve the findings' applicability. Additionally, the length of the interventions varied between studies, and it is still unknown whether longer or more frequent exercise sessions are more beneficial. Establishing the best intervention times and frequencies should be the focus of future research.

More comparative studies that directly contrast aquatic exercises with other types of physical exercise or non-exercise interventions for people with dementia are also needed. This would make it easier to assess the special advantages of aquatic exercises and whether they are superior to or equivalent to other interventions. Additionally, it is still unknown what mechanisms underlie the effects of aquatic exercises on dementia outcomes. Future research should investigate conceivable physiological and psychological mechanisms to improve our comprehension of the effects of aquatic exercise on people with dementia.

The majority of the studies showed good or very good quality, according to the quality evaluation of the studies conducted using recognized appraisal tools. This enhances the validity of the results and demonstrates the researchers' dedication to a strict methodology. However, some studies still found room for improvement, highlighting the necessity of paying closer attention to methodological rigor, including blinding, randomization, and reducing potential biases.

Conclusion

In sum, this review provides sufficient evidence in favor of therapeutic use of aquatic exercises to prevent and reduce dementia related symptoms among older people. As the quality of the studies was good or satisfactory and no study exhibited contradicting findings. Therefore, with the help of aquatic exercise interventions, the cognitive performance, psychological health, & life satisfaction of older people dealing with cognitive impairment may be enhanced, according to the evidence presented in this systematic review. The inclusion of aquatic exercises in dementia care programs was supported by the positive results, in addition to the safety and enjoyment mentioned by participants. Larger sample sizes, comparative studies, and mechanistic investigations are a few of the research gaps that should be addressed in future studies in order to better understand the advantages and ideal application of aquatic exercise interventions for people with dementia.

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