



REVIEW PAPER

Systematic review of published studies on aquatic exercise for balance in patients with multiple sclerosis, Parkinson's disease, and hemiplegia



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KEYWORDS

aquatic exercise;
balance;
hemiplegia;
multiple sclerosis;
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Abstract *Background:* Multiple sclerosis, Parkinson's disease, and hemiplegia are common disorders that directly cause impairment of balance and gait. Aquatic exercises are used for neurological rehabilitation. It is suggested that the contributing factors of the water setting such as buoyancy, viscosity, and hydrostatic pressure offer an ideal environment for rehabilitative programmes.

Objective: To conduct a systematic review of studies that assess the effect of aquatic exercises on balance in neurological patients (i.e., patients with multiple sclerosis, Parkinson's disease, and hemiplegia).

Methods: A systematic literature search of six databases (MEDLINE, PEDro, AMED, CINAHL, Embase, SPORTDiscus) for randomized controlled trials and quasi-experimental trials on aquatic exercises in three different neurological disorders, namely, multiple sclerosis, Parkinson's disease, and hemiplegia, was performed. Reference lists from identified studies were manually searched for additional studies. Methodological quality was assessed using the Downs and Black checklist. The data were analyzed and synthesized by two independent reviewers. Disagreements in extracted data were resolved by discussion among the reviewers.

Results: The methodological quality of eight studies included in this review ranged from fair to good. The findings illustrated that there were statistically significant improvements in static and dynamic balance in patients with multiple sclerosis and hemiplegia. The statistically

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significant improvements in gait ability were only found in the studies conducted on multiple sclerosis. No conclusions can be drawn in Parkinson's populations as only two trials conducted with a small sample size were available.

Conclusion: Aquatic exercises may be effective at improving balance impairment in patients with hemiplegia and multiple sclerosis. There is a need for further research investigating its effect on Parkinson's disease before encouraging the use of aquatic exercises.

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Introduction

Neurological disorders are recognized as a large source of disease burden globally [1]. In London, over 1,00,000 people suffer from neurological disorders [2]; however, the precise number of neurological patients worldwide is unavailable due to limited information. Nevertheless, in the British population, the prevalence of neurological diseases such as Parkinson's disease has been estimated to be 19/1,00,000 in 2000 [2], stroke 7.2/1000 in 2008 [3], and multiple sclerosis 1,27,000 in 2010 [4].

Impairments in neuromuscular function limit functional and physiological ability, thereby leading to a progressive decrease in everyday activities and a reduction in quality of life [1]. The personal and economic costs of neurological disorders pose a significant problem to public health [5]. Patients with multiple sclerosis, Parkinson's disease, and stroke may experience a loss of balance due to a reduction in muscle strength, exercise tolerance, co-ordination, and reaction time [6,7]. It is suggested that poor balance may contribute to falls and accidents. In addition, patients who have experienced a fall are at risk of developing a fear of falling and a restriction in physical activities [8].

Exercise is recognized as a mechanism to maintain health, prevent disease, and rehabilitate a broad range of conditions. Evidence suggests that participation in exercise programmes can strengthen muscle [9], increase walking velocity [10], and provide better results in response time and balance control [11]. Aquatic therapy is an exercise modality performed in a controlled water environment and is commonly used in neurological rehabilitation [12].

Water creates a low-impact environment allowing patients to perform therapeutic exercise with less fear of falling [13]. Buoyancy and hydrostatic pressure created by the water environment provide a supportive force on joints and a reduction in gravitational force, which may facilitate postural control [12]. In addition, hydrostatic pressure and viscous force provide a different proprioceptive and sensory feedback from that experienced on land [14], thus influencing the postural control system and balance competence [15].

It is suggested that aquatic exercise provides an optimum environment for rehabilitation programmes for patients with neurological conditions [13]. To date, there has not been a systematic review evaluating the effects of aquatic exercise on balance in patients with neurological conditions. The aim of this study is to systematically review the evidence from randomized controlled trials (RCTs) and

quasi-experimental studies to assess the effectiveness of aquatic exercises for balance improvement in patients with multiple sclerosis, Parkinson's disease, and stroke.

Methods

Literature search

An electronic literature search was conducted by two independent researchers in MEDLINE, PEDro, AMED, CINAHL, Embase, and SPORTDiscus using the following combination of various terms: (aquatic exercise OR aquatic therapy OR water-based exercises OR water exercises OR pool exercises OR pool therapy OR hydrotherapy) AND (balance OR postural control OR postural control) AND (stroke OR cerebrovascular OR cerebrovascular disorder OR hemiparesis OR hemiplegia OR parkinson disease OR parkinson OR demyelinating disease OR demyelinating OR demyelination OR multiple sclerosis OR neurodegeneration OR neurodegenerative). We limited our review to publications prior to December 31, 2014. The Cochrane Library and six databases (included in this review) were searched to ensure there were no other systematic reviews on this topic. Manual search of the reference lists of all relevant articles was conducted. Only articles written in English were included. Studies were included when (1) adult patients (18 years and above) were diagnosed with multiple sclerosis or Parkinson's disease or stroke; (2) trials included all types of aquatic exercises; (3) the outcome measure was balance and/or gait performance; and (4) the study was an RCT, a quasi-experimental study, or a pre–post study. Studies were excluded when (1) swimming was considered as an intervention; (2) the interventions failed to meet the recommendation of exercise for improving balance ability (the studies that delivered the intervention <4 weeks) [16]; and (3) studies appeared in previous relevant systematic reviews.

Data extraction and management

Independent reviewers (PM and CE) individually merged and screened all the titles and abstracts from the databases. Studies that failed to meet the selection criteria were excluded. Data extraction was analyzed and synthesized by two reviewers independently (PM and CE). The data extraction form was developed based on the PICO questions

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