

Aquatic physical therapy as a treatment modality in healthcare for non-institutionalized elderly persons: a systematic review

Fisioterapia aquática como modalidade de tratamento em idosos não institucionalizados: uma revisão sistemática

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ABSTRACT

Objective: To review scientific literature pertaining to aquatic physical therapy in the elderly and institutionalized population. **Methods:** A qualitative systematic review of electronic databases MEDLINE and LILACS, with the topic index terms: “hydrotherapy”, “homes for the aged or residential facilities”, and “aged. In light of the lack of studies carried out on the institutionalized population, we opted for reviewing literature on the effectiveness of this modality of physical therapy treatment on the non-institutionalized elderly population in order to produce knowledge that can be critically analyzed according to its potential applicability for the institutionalized population. The methodological quality of the studies was assessed using the Delphi listing. **Results:** Of the 27 studies analyzed by their abstracts, 10 studies were excluded since they did not correspond to the eligibility criteria. We analyzed the subject characteristics of each study, as well as the quality of the methods (good methodological quality in 47% of the studies), the result measurements considered, the intervention strategies, the sites where they took place, and the professionals involved (76% by physical therapists). **Conclusion:** Although a large part of the studies demonstrated good results with aquatic physical therapy practice, none of them had been applied on long-stay institution for the elderly. Therefore, more studies are needed in this area for a model of assistance to long-stay institution for the elderly to be proposed.

Keywords: Hydrotherapy; Homes for the aged; Treatment outcome

RESUMO

Objetivo: Revisar a literatura científica acerca da efetividade da fisioterapia aquática na população idosa e institucionalizada. **Métodos:** Revisão sistemática qualitativa nas bases de dados eletrônicas MEDLINE

e LILACS, com os descritores de assunto: “hidroterapia” (“*hydrotherapy*”), “instituição de longa permanência para idoso” (“*homes for the aged, residential facilities*”) e “idoso” (“*aged*”). Diante da inexistência de estudos realizados na população institucionalizada, optou-se por revisar a literatura acerca da efetividade dessa modalidade de tratamento fisioterapêutico na população idosa não institucionalizada, a fim de se produzirem conhecimentos que pudessem ser analisados criticamente conforme sua aplicabilidade potencial na população institucionalizada. A qualidade metodológica dos estudos foi avaliada por meio da lista Delphi. **Resultados:** Foram excluídos 10 estudos dos 27 analisados a partir do resumo, por não corresponderem aos critérios de elegibilidade. Foram analisadas as características dos sujeitos de cada estudo, bem como a qualidade metodológica (boa qualidade metodológica em 47% dos estudos), as medidas de resultado consideradas, as estratégias de intervenção, os locais onde ocorreram e os profissionais envolvidos (76% por fisioterapeutas). **Conclusão:** Embora, grande parte dos estudos tenha demonstrado bons resultados com a prática da fisioterapia aquática, nenhum deles foi aplicado em instituição de longa permanência para idoso. Sendo assim, são necessários mais estudos nessa área para que seja proposto um modelo assistencial em instituição de longa permanência para idoso.

Descritores: Hidroterapia; Instituição de longa permanência para idosos; Resultado de tratamento

INTRODUCTION

With the progressive demand on the part of a population in constant growth – the population of elderly people – an increase is expected in the offer of beds in hospitals and long-stay institutions for the elderly (LSIEs) over the next few years⁽¹⁾.

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These LSIEs may be governmental or non-governmental, with a residential atmosphere, destined to be the collective residence for persons aged 60 years or more, with or without family support, under conditions of freedom, dignity, and citizenship⁽²⁾.

The elderly citizens who live in these institutions or at geriatric homes and clinics have unique characteristics, such as mean age of about 80 years, sedentarism, low autonomy, and absence of family members. These factors contribute towards the increase in prevalence of morbidities and comorbidities related to autonomy⁽¹⁾.

One of the most important complications in this age group is the occurrence of falls, a public health problem due to its frequency, associated morbidities, and high social and economic costs, especially when it causes increased dependency and the beginning of life in an institution⁽³⁾.

Physical activity for the elderly person is able to provide beneficial organic effects, including general well-being, preservation of independence, prevention of diseases, control of special situations (stress and obesity, for example), and a decrease in chronic pain⁽⁴⁾.

Aquatic physical therapy programs have frequently been indicated for the elderly population since they are carried out in a safe environment, with less susceptibility to falls, and with good acceptance of and compliance with treatment⁽⁵⁾. This resource is applied in a thermal-heated pool by means of techniques developed especially with objectives of preventing diseases, promoting and maintaining, treating, curing and rehabilitating health⁽⁶⁾.

The present study aimed to search scientific literature regarding effectiveness of aquatic physical therapy in the elderly and institutionalized population.

METHODS

Type of study

Systematic narrative review was carried out.

Data collection procedures

Bibliographic search was carried out using LILACS and MEDLINE databases in reference to publications of clinical trials in the last 10 years. The following index terms were used: “hydrotherapy”, “homes for the aged”, “residential facilities”, and “aged”.

No studies were found on hydrotherapy in this specific population. In light of this fact, we decided to review the literature on effectiveness of this modality of physical therapy treatment in the non-institutionalized aged population in order to produce knowledge that may be critically analyzed concerning its potential applicability in the institutionalized population.

The intersection of sets was used (index terms, type of publication, and 10-year period). The terms used for this new search were “hydrotherapy” and “aged”.

Twenty-seven articles resulted from the search with the mentioned criteria. All of them underwent analysis of the abstract by a single evaluator, and only those with the following inclusion criteria were selected:

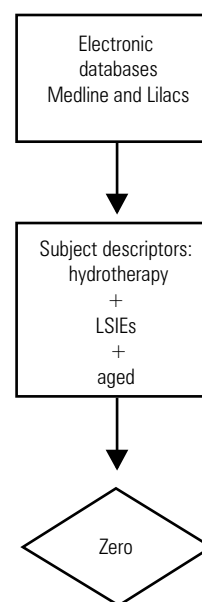
- clinical controlled/randomized trials;
- treatment with any type of intervention protocol, as long as with complete immersion in a therapeutic pool.

The articles meeting these criteria had their entire content reviewed and underwent critical analysis, being confronted with other publications on the topic.

For evaluation of the methodological quality, Delphi's Listing, comprising eight items, was used. The answers are presented in the form of “yes/no/I don't know”, in which one of the alternatives must be chosen for each item; the greater the quantity of affirmative answers, the better the quality of the study⁽⁷⁾ (Figures 1 and 2).

RESULTS AND DISCUSSION

Ten of the 27 studies analyzed by their abstracts were excluded since they did not present the desired association between aquatic physical therapy and the elderly. These studies addressed local application techniques (without immersion in the pool) and they were not experimental, besides using a population under 60 years of age.



LSIEs = long stay institutions for the elderlies

Figure 1. Flowchart of the first review.

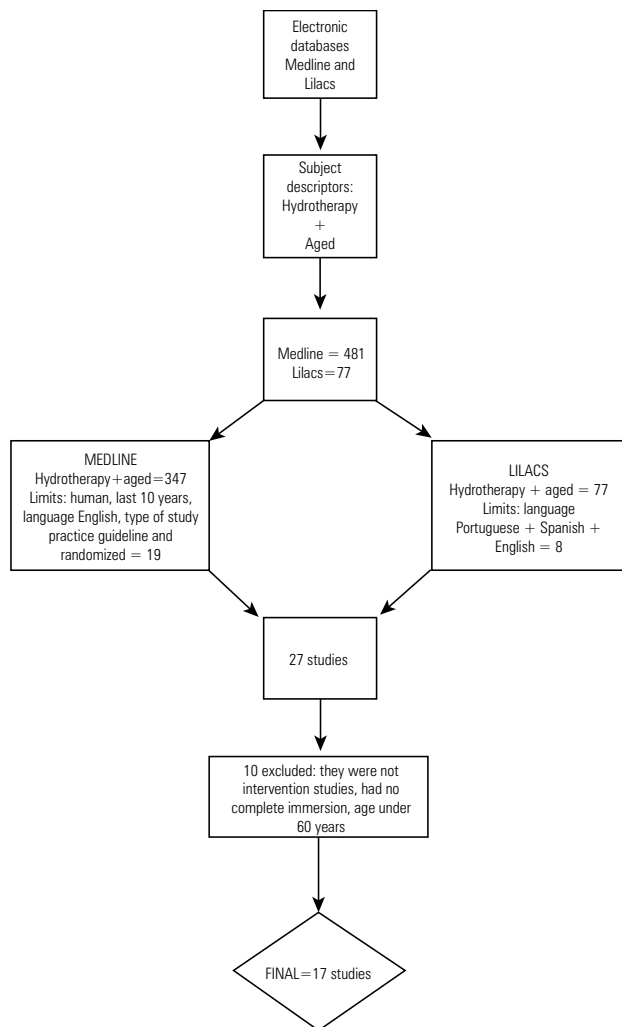


Figure 2. Flowchart of the second review.

The remaining 17 articles were comprehensively analyzed. The classifications and characteristics of these articles are included in this review and presented in chart 1.

All studies presented specified eligibility criteria, intention to treat, and most reported primary outcome measurements, thus providing better quality studies.

With this discussion, we intended to describe the findings of the articles searched and to associate them to the dynamics of institutionalized aged persons.

Subject characteristics

As to subject characteristics of the articles analyzed, 29% of the articles had as inclusion criterion patients diagnosed with osteoarthritis of the hip and/or knee^(13,14,17,23-24). As to gender, 23% of the studies involved aged women^(10,12,18,21), and the mean age of all study subjects was 68 years. However, it is important to point

out that the study conducted by Silva et al.⁽²³⁾ was the only one that had sample with a mean age of 59 years.

Regarding exclusion criteria, 41% of the articles excluded those individuals who had pathologies that limited exercise^(4,10,11,13,17,23,25), those dependent on help for daily activities, and those who engaged in other exercises besides what was proposed in the given study.

As to the sample, 23% had fewer than 25 participants^(4,10,19,21).

Methodological quality

Of the 17 studies, 47% were randomized and with a control group, i.e., with good methodological quality^(11-14,17,22,24,25).

On the other hand, 29% were merely intervention studies, with no randomization or control groups^(4,10,18,19,21), while 23% of the studies were controlled trials with randomization, but with no control group^(15,16,20,23).

In 47% of the studies, the outcome evaluators were blinded^(4,13-17,20,23). This methodological decision is very important, because when this is not the case, the results may be biased.

Applegate and Curb⁽⁸⁾ stated that many studies do not allow a true double-blind characteristic, but even so, it is possible to carry out successful randomized trials without complete blinding if the outcome evaluators are blind to the proposed treatment.

Result measurements

As to measurements of results, 35% of the articles^(13-16,20,23) applied the Western Ontario McMaster Universities (WOMAC) quality of life questionnaire specific for osteoarthritis, which is capable of assessing intensity of pain, joint stiffness, and functional difficulties resulting from hip or knee osteoarthritis⁽⁹⁾.

In 23% of the studies^(11,12,14,25), the questionnaire used to evaluate quality of life was the Short Form Health Survey (SF-36).

Another prevalent fact was pain assessment, also performed in 23% of the studies by means of the Visual Analog Scale (VAS)^(16,17,23-24).

Blood pressure (BP) was mentioned as an outcome measurement by Candeloro and Caromano et al.⁽¹⁰⁾ along with heart rate. On the other hand, for Gimenes et al.⁽⁴⁾, only BP was used as a result.

In order to avoid biases, it is important to identify all resulting variables and to report hypotheses before beginning the study. Nevertheless, investigators conduct trials with aged individuals, many times confronted with the problem of various results. For example, quality of life or physical function may have more important

Chart 1. List of articles resulting from bibliographic search on effectiveness of aquatic physical therapy in the elderly.

Author	Subject number	Frequency of therapy	Mean age	Inclusion criteria	Exclusion criteria	Delphi list	Intervention	Follow up	Measurements result	Significance
Candeloro et al., 2007 ⁽⁸⁾	16	Twice a week, for 60 minutes, during 14 weeks	66.9	Medical indication, women, aged, no use of medication, sedentary	Disease that would limit hydrotherapy (HT), such as, arterial hypertension, cardiac, respiratory, musculoskeletal or neurological diseases	3	Activities in pairs, warming up, physical activities for flexibility, muscle strength (MS) and relaxation, with increasing difficulty	No	BP = blood pressure and HR = heart rate	The mean rest HR was not statistically significant. There was a decrease by 5.6 mm Hg in mean SBP and by 9.7 mm Hg in mean DBP
Cider et al., 2003 ⁽⁹⁾	25 (HT = 15) and (Control = 10)	3 times/week, for 45 minutes, during 8 weeks	HT = 70.2 Control = 75	Patients with stable congestive heart failure (CHF), functional class II-III, ejection fraction of 45%, ≥ 60 years, stable medication in the previous 3 months	Diabetes, peripheral arterial disease, chronic pulmonary disease, after stroke or other diseases that limit exercise	4	Moderate exercises, 40-70% of maximum HR, resistance exercises and MS	No	Tolerance to exercise, muscular function, QoL = quality of life	Physical training in water was well tolerated and it seems to improve exercise capacity as well as MS in CHF patients
Devereux et al., 2005 ⁽¹⁰⁾	50 (HT = 25 and Control = 25)	Twice a week, for 60 minutes, during 10 weeks	73.3	Elderly women ≥ 60 years, diagnosis of osteopenia or osteoporosis, residing in a metropolitan region in Australia	Do not reside close to the study area, age < 65 years, unable to read, write or understand English, impaired cognition (MEEN < 23), with no hearing or visual aid, had Meniere disease, benign paroxysmal positional vertigo, Parkinson or neurological dysfunction	5	Warming up, stretching, aerobic exercises and based on Tai Chi, strength, posture, gait, vestibular, proprioception and balance. The control group received no intervention	No	Balance, fear of falling down and QoL	Water exercise produced significant changes in equilibrium and QoL, but not in fear of falling down
Fransen et al., 2007 ⁽¹¹⁾	152 (HT = 55, Tai Chi = 56 and control = 41)	Twice a week, for 60 minutes, during 12 weeks	70	Age 59 – 85 years, diagnosis of osteoarthritis (OA) in the hip or knee, according to the American College of Rheumatology, chronic pain > 1 year	Physical activity for leisure more than twice a week, incapacity to walk at home, instability of severe heart and lung conditions, incontinence, fear of water, epilepsy, low back pain and lower limb pain, joint replacement surgery	6	HT: warming up, MS, flexibility and resistance exercises. Tai Chi classes: given by trained instructors throughout the study	12 and 24 weeks	Pain, physical function, general health status (WOMAC)	The HT and Tai Chi group demonstrated clinical benefits for over 12 weeks
Foley et al., 2003 ⁽¹²⁾	105 (HT = 35, gymnastics = 35 and Control = 35)	3 times/week, during 6 weeks	70.9	Age ≥ 50 years, with radiological diagnosis of OA of the hip or knee, able to read, write and speak English, to give consent, to have his/her own transportation means	Patients who received physical therapy or HT in the last 6 weeks, had group gymnastics class, joint replacement in the last 12 months or cognitive deficit	6	HT: walks, active hip and knee exercises and bicycle. Gymnastics: 4 minutes of stationary bicycle, MS exercises, sitting down and getting up, knee exercises and double leg press. Control: no intervention	No	MS of quadriceps, A0 index (WOMAC), walking for 6', DoL	The functional gains were observed in both exercise programs as compared to the control group
Gill et al., 2009 ⁽¹³⁾	86 (Floor = 40 and HT = 42)	Twice a week, during 6 weeks	Floor = 71.6 HT = 69.2	Patients waiting for elective hip or knee arthroplasty	If undergoing only tibia osteotomy, if surgery was scheduled before conclusion of supervised program of 6 weeks, if they were not able to complete exercises or if they were not able to understand English	6	Floor: warming up, stationary bicycle and muscle resistance of calf and hamstring muscles, and quadriceps stretching. HT: walks and active exercises of calf and hamstring muscles, and quadriceps stretching	6 and 8 weeks	Pain and self-reported function and global evaluation (WOMAC)	There were not major differences in effects after intervention. However exercises in swimming pool seemed to have a more favorable effect on pain immediately after treatment
Jimenes et al., 2008 ⁽⁴⁾	20	Twice a week, for 45', during 12 weeks	68.05	Age ≥ 60 years, both sexes, with no cognitive impairment and were not exercising regularly for one year	Dependent on hearing/visual aid use of walking aid and no medical permission for activity in the swimming pool	4	10 minutes warming up (walking), 20 minutes of aerobic exercises (MS of upper and lower limbs and abdominal muscles, jumping, dancing and cycling, besides respiratory work and playful activities of balance and coordination) and 15 minutes of relaxation	No	BP before and after immersion in the swimming pool	The mean SBP after protocol in the first and last day showed statistically significant decrease
Harmer et al., 2009 ⁽¹⁴⁾	102 (floor = 49 and HT = 53)	Twice a week, for 60 minutes, during 6 weeks	Floor = 67.8 HT = 68.7	Patients who went to the clinic in the preoperative period of total knee arthroplasty	Deep infection in the preoperative period, documented dementia or other neurological condition and with no informed consent	5	Floor: stationary bicycle, climbing stairs, range of motion (ROM) of knee, balance and sit on chairs of different heights. HT: walk in several directions, run, jump, kick, exercises with the knee, squatting and combined exercises with upper limbs	6 and 26 weeks	6-minute walk, climbing stairs, WOMAC (A0 index), VAS for pain in operated knee, passive movements of knee and edema	Both floor and water exercises had evident improvement in nearly all measures of result up to 6 months in the postoperative period of total knee arthroplasty
Lund et al., 2008 ⁽¹⁵⁾	79 (HT = 27, Floor = 25 and Control = 27)	Twice a week, for 50 minutes, during 8 weeks	68	Diagnosis of OA of knee, according to the American College of Rheumatology	Hydrophobia, urinary incontinence, wounds, language or intellectual problem, history of knee fracture, total knee replacement, inflammatory joint disease, lung or heart disease, or other diseases, contraindication for exercises and participation in other studies	6	Both water and floor exercises comprised warming up, MS, resistance, balance and stretching	8 weeks and 3 months	Pain, OA questionnaire (KOOS), balance and strength	Floor exercise showed discreet relief in pain and improvement in strength as compared to control. No alteration was detected after water exercise in comparison with the control group. However, there were less adverse events in water
Madureira et al., 1998 ⁽¹⁶⁾	25	3 times/week, 50 minutes, during 4 months	65	Elderly women, aged 57-77, with no contraindication for water exercises	They could not participate in other training programs	3	Activities of stretching, calisthenics exercises and displacement	No	Anthropometric data, cardiorespiratory function, flexibility of the spine and hip, strength, localized muscle resistance, abdominal and strength of palmar prehension	Significant improvement in abdominal muscle strength and resistance and in cardiorespiratory capacity
Medeiros et al., 2008 ⁽¹⁷⁾	9	10 sessions, 45 minutes each	74.1	Age over 65 years, walking with no assistance, preserved cognitive functions, no history of falls with trauma	Age under 65 years, not participating in the Programa Gostar de Viver [Enjoy Life Program], neurological disorders with stroke, head trauma, Parkinson, neoplasm, cardiac arrhythmias, water-borne diseases, high fever, heart failure, infectious diseases, fecal and urinary incontinence, open wounds, epilepsy and low vital lung capacity	3	All exercises proposed in the swimming pool were performed as 3 series of 15 repetitions each, with 30 seconds intervals	No	Static and dynamic balance	Significant improvement in balance, gait and Tinetti evaluation
Rahmann et al., 2009 ⁽¹⁸⁾	65 (HT = 24, water exercise = 21 and exercises in the inpatients unit = 20)	40 minutes, during 6 months, daily	69.6	Patients who would undergo the first hip or knee arthroplasty were selected	Neurological disorders, musculoskeletal problem with altered mobility, cognitive dysfunction, those who were not willing to be randomized, if residing outside the metropolitan region	6	Inpatients unit: exercises of active flexion of the hip and knee, exercises for circulation, respiratory exercises, active exercises of lower limbs, transfers, gait training, stretching and step. HT (fast rhythm): active exercises of hip, mini squatting, walking with and without floats in the lower limbs, combined exercises with upper limbs. Water exercises (slow rhythm): active exercises of hip and knee with and without floats, lateral trunk exercises, relaxation	14, 90 and 180 days	Strength, gait speed and functional ability (WOMAC)	After 14 days, abducting strength of the hip was significantly greater after HT as compared to hospital physical therapy and water exercises

Chart 1. Continuation

Author	Subject number	Frequency of therapy	Mean age	Inclusion criteria	Exclusion criteria	Delphi list	Intervention	Follow up	Measurements result	Significance
Ramos et al., 2007(19)	13	3 times/week, for 50 minutes, during 8 weeks	64	Elderly women aged \geq 60 years, Caucasian, with no other physical activity	Over 6% absences, recent fractures, joint replacement (femur), use of calcium supplement or hormone replacement	3	Warm-up exercises during 5 minutes, increased global MS without floats for upper and lower limbs, relaxation and stretching	No	Densitometry values before and 8 months after HT	No significant increase in values
Ritomy Ide et al., 2005(20)	59 (HT=19, Floor = 19 and Control=21)	3 times/week, for 50 minutes, during 10 weeks	62.1	Socially active, but not practicing any type of physical activity more than once a week	Having not smoked for the past 10 years, no respiratory and muscular-skeletal dysfunctions	4	The intervention program was similar and followed the sequence: warm-up, conditioning, MS and cooling down	No	Anterior flexibility of trunk/pelvis	A respiratory physical therapy program to practice range of motion of the rib cage has no effect in anterior flexibility of trunk/pelvis of healthy elderly
Silva et al., 2008(21)	64 (HT and floor)	3 times/week, for 50 minutes, during 18 weeks	59	Clinical and radiological criteria of OA of knee according to American College of Rheumatology, and knee pain ranging from 30 to 90 millimeters in VAS	Neurological disease, symptomatic heart disease and severe pulmonary condition, systemic disease or psychiatric disorder that could interfere with evaluations, epilepsy, skin disease or inability to walk. Patients who received intra-articular injections of steroids in the last 3 months and those who performed physical activity 6 months before	5	Both groups performed similar exercises of MS, stretching of lower limbs and gait training	9 and 18 weeks	Pain, WOMAC, 6-minute walk test	Pain reduced in both groups throughout time, but water exercises significantly decreased pain as compared to floor exercises, before and after walk at week 18
Victorin et al., 2004(22)	45 (HT and education = 15, Electroacupuncture (EA) and education=15 and only education=15)	Twice a week, for 30 minutes, during 5 weeks	EA = 65.7 HT = 70.3 Control=65.5	All patients were in a waiting list for hip arthroplasty, with radiological alterations compatible with OA of hip, pain associated to movement and/or load and/or rest	Hepatitis B, epilepsy or rheumatoid diseases	5	EA: acupuncture needles in sites of pain in the hip and attached to an electrical stimulator, not causing painful muscle contractions. HT: small groups, with warm-up, mobility, MS for hip and stretching. Lecture: meetings about anatomy, disease process and pain relief	10 sessions, 1 month and 6 months	Disability rating Index (DRI), Global severity index (GSI) and Visual analogic scale (VAS)	EA and HT, combined with education of patients, led to last-longing effects, and demonstrated reduced pain, functional pain and reducing QoL. In the EA group, pain relief lasted longed, up to 6 months. The group receiving only education did not improve in any variable
Wadell et al., 2003(23)	30 (Floor = 15, HT= 15 and Control= 13)	3 times/week, for 45 minutes, during 12 weeks	65	Outpatients, moderate to severe COPD, FEV1 < 80% of predict, FEV1/Vc < 70%, stable medication and no infection in the last month	Heart diseases, orthopedic, neurological, psychological disorders or conditions that may interfere in performance of exercise	4	In both groups: aerobic training during 45 minutes with same intensity (warm up, flexibility, resistance, strength of upper limbs, trunk and lower limbs) and stretching	No	Physical capacity and health; QoL related to health	Both groups of high-intensity training showed benefits in COPD patients, but water exercises had additional benefits in physical capacity as compared to floor

results than mortality, despite the latter being easier to measure⁽⁸⁾.

Since intervention in these studies had a curative character, large groups of diagnoses related to specific functional losses were selected. In institutionalized elderly persons, studies such as these, with intention to treat, could use more generic outcome measurements such as functional capacity and quality of life, since this population has a higher degree of functional fragility.

Intervention strategies

In general, the protocol of exercises performed in the therapeutic pool obeyed the following sequence: warm-up, strengthening of lower limbs, flexibility, resistance, and stretching, all with increasing degrees of difficulty and in groups.

In addition to these, Devereux et al.⁽¹²⁾ also proposed water exercises based on Tai Chi and demonstrated that exercises in the water produced significant changes in balance and quality of life, but not in the fear of falling.

Fransen et al.⁽¹³⁾ compared groups in hydrotherapy, Tai Chi exercises, and a control group and verified clinical benefits in both intervention groups.

In 23% of the articles, exactly the same intervention group was used^(14,17,22,25), which consisted of hydrotherapy, floor exercises, and a control group.

Stener-Victorin et al.⁽²⁴⁾ compared hydrotherapy, electroacupuncture, combined with educational talks and a group that received only the educational

talk. The authors were able to affirm that the two intervention groups produced lasting effects, and demonstrated reduced movement pain and quality of life. Only this latter study used combined therapy. In cases in which the objective was the recovery of functionality, elderly patients were benefited by combined therapy, e.g., by hydrotherapy and floor exercises.

The duration of intervention varied from only 10 sessions, in Medeiros et al.⁽¹⁹⁾, to a 6-month follow-up, in Rahmann et al.⁽²⁰⁾. Almost all studies applied their protocols with a frequency of 2 to 3 times a week, with 30 minutes to 1 hour duration of each session.

Of the 17 studies, 41% of them showed follow-up even after the end of the intervention^(13,15-17,20,23,24).

Intervention sites and professionals involved in application of the method

Of all articles reviewed, none of them had an LSIE as the site of the intervention. Of these, 52% were conducted in teaching clinics of universities^(4,10,15,16,19,21-24), while 23% were held in therapeutic pools within hospitals^(13,14,20,25). Only 11% made no mention as to where they were carried out^(11,17). There was also a study conducted in a community aquatic center and gym^(12,18).

The vast majority (76%) was applied by physical therapists^(4,12-17,19,20,22-25); only two were performed by physical education professionals^(18,21). In two articles, the professional involved was not mentioned^(4,11).

Lund et al.⁽¹⁷⁾ reported in their study that the professionals involved were, in reality, senior year Physical Therapy students, while Rahmann et al.⁽²⁰⁾ mentioned that the professional in their study had 5 years of experience in orthopedic postoperative care. Only 17% of the articles declared the experience of their professionals^(14,20,24).

CONCLUSION

Even though a large part of the studies demonstrated results with the practice of aquatic physical therapy, none of them was applied in an LSIE environment. Based on these studies in community elderly persons, a model of aquatic physical therapy assistance can be proposed, with well-defined inclusion and exclusion criteria. Thus, further studies are needed in this area to propose a model of assistance in LSIEs.

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