ISSN (Print): 0972-4397
ISSN (Online): 0974-0805
Journal of Ecophysiology and Occupational Health, *Vol 20(1&2), DOI: 10.18311/jeoh/2020/25201, 82– 94, January–June 2020*

Effect of Hydrokinesia in Elderly Subjects with Backward Disequilibrium: A Systematic Review

Radhika Chintamani*, Amrutkuvar Rayjade and Trupti Yadav

Faculty of Physiotherapy, Department of Musculoskeletal Sciences,
Krishna Institute of Medical Sciences Deemed to be University, Malkapur, Karad – 415539,
Maharshatra, India; radds2009@gmail.com

Abstract

Background: Water based exercise are significant in improving both static as well as dynamic balance. Elderly subjects already are known to have decreased balance. Changes in the musculoskeletal system are one of the major causes of decreased balance. Physiotherapy regimen is important in improving both static and dynamic balance in elderly. Aquatic therapy is painless and easy way to improve balance in geriatric. However, despite its widespread knowledge of importance of aquatic therapy in improvement of balance, the efficacy of aquatic therapy in elderly is limited. **Purpose:** The aim of this systematic review is to analyze the importance of aquatic therapy on fall perspective in elderly population. **Methods:** The authors searched Google Scholar and PubMed from 1996 to 2017. Only downloadable randomized controlled trials (15), randomized clinical trials (14) and experimental studies (3) were included in the study. **Results:** The duration of treatment varied significantly in comparison to various studies. Subgroup analysis was performed on factors considered for measuring of fall risk parameters in elderly subjects. **Conclusion:** The result of the present study shows strong evidence to support the water based exercises in which Hydrokineitic therapy showed significant reduction in kinesiophobia and fall risk rate. Hence the therapy can be considered effective for geriatric population.

Keywords: Backward Disequilibrium, Elderly, Systematic Review, Water Based Exercises

1. Introduction

Falls are one of the major risks in geriatric population causing mortality and morbidity. People aged 65 years and older fall each year and this ratio increases with age. The cause of fall can be various like; history of previous fall, disturbed gait due to neurological and balance problems, poor vision and chronic diseases such as arthritis[1].

Backward Disequilibrium (BD) is a postural disorder observed in elderly subjects who have distortion in their perception of vertical posture. It is commonly seen as the age increases, as the distortion in their perception of vertical posture is reduced. BD commonly may be due to musculoskeletal changes as well as psychological changes. BD may lead to fall of the individual which has many consequences as mentioned above[2].

Reduction of fall has become one of the major focuses on research nowadays. Some of those interventions are; land based exercises, home safety ergonomic advices, multifactorial interventions and others have shown to be effective. Unfortunately, aquatic therapy is understudied with perspective of fall risk in geriatric population, thus limiting the ability to use traditional systematic review to examine the comparative effectiveness of all published interventions of water based exercise therapy in geriatric population. Hence this study is been undertaken[3].

2. Methods

2.1 Ethical Clearance

Ethical clearance was obtained from Institutional ethical committee KIMS Deemed to be University Karad, Maharashtra.

2.2 Search Strategy

The author underwent searches of Google scholar, PubMed, Embase (Excerpta Medica Database), Cochrane Library, Web of Science and CINAHL (Cumulative Index to Nursing and Allied Health Literature) with English database being strictly followed in the study.

2.3 Study Selection

Reviewer independently selected the articles and downloaded the articles from Google scholar and PubMed. Inclusion criteria: RCTs, Randomized Clinical Trials and Experimental studies

*Author for correspondence

on Aquatic therapy in geriatric subjects with perspective of fall, age greater than 60 years. At least one fall related outcome measure, both genders, all forms of Hydrokinetic exercises, studies or articles which can be downloaded. Exclusion Criteria: Studies with known neurological disorders like stroke, head injury, spinal cord injury, significant musculoskeletal disorders, Passive physiotherapeutic regimen, discontinued physiotherapeutic regimen, Chronic illness like osteoarthritis of greater than grade 3 of Kellegren Lawrence Classification, cardiovascular diseases etc and subjects who were unable to walk due to chronic pain anywhere in body[4].

2.4 Quality Assessment

Quality of the studies recruited in this study was assessed by quality list from Cochrane Collaboration recommendations. Data were extracted independently and checked for accuracy for the purpose of methodological quality.

2.5 Data Analysis

Information was extracted from each included trial on: 1. Descriptive characteristics of study (first author, Journal name, published year, Title, sample size); 2. Sample characteristics (average age, >65); 3. Type of intervention; 4. Fall-related outcome measure (length of follow-up, effect of the intervention).

2.6 Data Extraction

Following data was extracted from the study: 1. Trial design (sample size and inclusion and exclusion criteria); demographic data of subjects (age, gender, risk of falls); type of intervention (experimental and control components, duration); and outcomes measured as (rate of fall, risk of fall, kinesiophobia, health related quality of life, risk of fracture).

2.7 Data Synthesis and Statistical Methods

Statistical heterogeneity of treatment effects between trials was assessed with a significance level at $p<0.05$, and the I^2 statistic, as per the Cochrane handbook guidance.

Table 1. The detailed elaboration of the studies recruited in this systematic review. Given at the last page**.**

3. Results

Electronic searches identified 100 records, after removal of duplicates, screening the titles and abstracts of 75 records was done. Full-text articles were assessed for 65 records and resulted in 32 eligible studies were taken into consideration. 18 RCTs studies involved a total of 693 subjects, among which 363 were in water based exercises group and 330 were in control group/non-water based exercise group. 12 Randomized Clinical Trials consisted of 459 subjects among whom 233 subjects were given with water therapy and 226 various other therapies. And 2 experimental studies in which; 53 sample size was considered.

4. Conclusion

Hydrotherapy uses S.W.E.A.T method, Aquatic aerobics and Deep water running form of water based exercises, showed significant effect in reducing the rate of fall in elderly subjects. S.W.E.A.T method principle are; change in surface area and speed, working positions like rebound, neutral, suspended and extended, enlargement of movement, working around the body, travelling through water forward, backward or diagonal. The results indicate a mean difference of 12.59 (95% CI 0.10 to 40.5).

5. Funding

Self funding.

6. Conflicts of Interest

No conflicts of interest.

7. References

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Table 1. The detailed elaboration of the studies recruited in this systematic review

Sr. No	Author, Year, Title	Journal	Title	Outcome measure	Period of intervention	Sample size	p value
1	Takeshima N et al 2001 (RCT)[5]	American College of Sports Medicine	Water-based exercise improves health related aspects of fitness in older women	Agility, Flexibility, Muscular strength for knee extension, knee flexion, chest press and pull , shoulder press and pull, and back extension. Vertical jump, side-stepping agility, trunk extension	WEX: 12-wk supervised WEX program, 70 min·day_1, 3 d·wk_1.	WEX: 15 Control: 15	Between group p value: Vertical jump and side stepping agility test: $p<0.05$
2	Lord S. et al 2006 (RCT)[6]	American Journal on Aging	The effects of water exercise on physical functioning in older people	The maximal balance range and coordinated stability tests, Quadriceps strength, simple reaction time and flexibility	WAVES: 1hr exercise sessions/week for two 10 week terms	Water exercise program: 85 + Control group: 44	Maximal balance $p<0.01$, Coordinated stability: $p<0.05$, Shoulder ROM: $p<0.05$, Quadriceps strength and reaction time: Not significant
3	Tsourlou et T al 2006 (RCT)[7]	Journal of Strength and Conditioning Research	The effects of a twenty-four-week aquatic training program on muscular strength performance in healthy elderly women	Muscle strength (isometric and dynamic) flexibility, and functional mobility, Jumping performance was evaluated using the Squat Jump (SJ), functional mobility with the timed up-and-go (TUG I test, and trunk flexion with the sit-and-reach test.	AT= Supervised shallow-water exercise program for 60 minutes/day, 3 days a week;	Aquatic training program: 12 + Control group: 10	TUG and strength both improved $p<0.0125$

Sr. No	Author, Year, Title	Journal	Title	Outcome measure	Period of intervention	Sample size	p value
4	Barela A et al 2008 (RCT)[8]	Journal of Electro-myography and Kinesiology	Biomechanical characteristics of elderly individuals walking on land and in water	Spatio-temporal parameters of gait, joint angles, ground reaction force, muscle activation pattern	10 participants walked bare feet at self selected, comfortable speeds on both a walkway on land and in swimming pool (till xiphisternum).	In water: 10 + On land: 10	Elderly group presented significantly shorter stride duration (p = 0.02 between group) than younger adults in water.
5	Candeloro JM et al 2007 (RCT)[9]	Rev. bras. fisioter	Effects of a hydrotherapy program on flexibility and muscular strength in elderly women	Flexibility: toe touch, anterior flexion of the trunk in seated position, modified trunk inclination, muscle strength of quadriceps, hamstring, medial gluteus and iliopsoas.	The participants were 31 healthy sedentary elderly women aged between 65 and 70 years (16 in the experimental group and 15 in the control group).	Hydrotherapy program: 16 + Control group: 15	p value is not mentioned.
6	Melzer I et al 2008 (RCT)[10]	BMC Geriatrics	A water-based training program that include perturbation exercises to improve stepping responses in older adults: study protocol for a randomized controlled cross-over trial	Voluntary step reaction time, postural stabilogram diffusion analysis, Berg Balance Scale, get up and go test, fall efficacy scale, Folstein Mini Mental State Examination, Late Life Function and Disability Index	Future aspect study	--------	Future aspect study
7	Kastura Y et al 2010 (RCT)[11]	European Journal of Applied Physiology	Effects of aquatic exercise training using water-resistance equipment in elderly	Anthropometric measurements, physical performance test, profile of mood states, muscle strength of plantarflexors, timed up and go test, obstacle walking, walking speed, walking length.	Aquatic exercise: using water-resistance equipment: The aquatic exercise training was 90 min, three times per week for 8 weeks, and mostly consisted of walking.	Water resistant equipment: 12 + Control group: 8	Improvements were observed in muscle strength in plantarflexor, and the timed up and go test (TUG) in both groups. Additionally, 10-m obstacle walking and 5-m maximum walking speed and length with eye-open were significantly improved in the resistance group

Sr. No	Author, Year, Title	Journal	Title	Outcome measure	Period of intervention	Sample size	p value
8	Bocalini et al 2010 (RCT)[12]	Clinical Science	Repercussions of training and detraining by water based exercise on functional fitness and quality of life: a short-term follow-up in healthy older women	Aerobic power, neuromuscular fitness (Arm curl, chair stand test and 8-foot up and go test) and quality of life	Healthy older women (trained (TR) group) were submitted to 12 weeks WE (three 45 min sessions per week) followed by a 6-week detraining period. A group of aged-matched women without any exercise training (UN group) were evaluated during the same period	Water exercise: 30 + Control: 20	Balance was improved at 4^{th}, 6^{th} and even after 12^{th} week significantly with $p<0.05$
9	Avelar N. et al 2010 (RCT)[13]	Revista Brasileira de Fisioterapia	Effectiveness of aquatic and non-aquatic lower limb muscles endurance training in the static and dynamic balance of elderly people	the Berg Balance Scale, Dynamic Gait Index, gait speed and tandem gait	36 elderly people were evaluated using 4 tests: the Berg Balance Scale, Dynamic Gait Index, gait speed and tandem gait. The participants were allocated into 3 groups: aquatic exercise group, non-aquatic exercise group and control group. Aquatic group: lower-limb muscle endurance exercise: 40-minute/day twice a week for six weeks.	Aquatic group: 14 Non-aquatic group: 15 Control group: 17	The program for lower-limb muscle endurance significantly increased balance ($p<0.05$) in the evaluation tests after the training program.
10	Bento P et al 2012 (RCT)[14]	Journal of Aging and Physical Activity	The Effects of a Water-Based Exercise Program on Strength and Functionality of Older Adults	Peak Torque of extensor and flexor of lower extremities and rate of torque development of the ankle, knee and hip joints.	Thirty-seven elderly were randomly assigned to water-based training (3 d/wk for 12 wk) or a control group	Water based training: 24 Control group: 14	A peak-torque increase ($p < .05$) was detected for the hip flexors and extensors and for the plantar-flexor muscles; The rate of torque development increased ($p< .05$), Sit and Reach test, time in 8-ft up-and-go test, and 6-min test increased ($p < .05$)

Sr. No	Author, Year, Title	Journal	Title	Outcome measure	Period of intervention	Sample size	p value
11	Elbar O et al 2012 (RCT)[15]	Archives of Gerontology and Geriatrics	A water-based training program that includes perturbation exercises improves speed of voluntary stepping in older adults: A randomized controlled cross-over trial	Step execution, postural stability parameters in eyes open and eyes closed condition	thirty-six independent old adults (64–88 years old) were divided into two groups. Group A received WEP for the first 12 weeks, followed by no intervention for the second 12 weeks. Group B did not receive intervention for the first 12 weeks and received WEP for the second 12 weeks.	Initially group A (18) received water based intervention with Perturbation training for 12 weeks and group B (18) received no treatment. Vice versa was done for next 12 weeks.	Between group analysis; foot contact time ($p = 0.003$), step initiation ($p = 0.05$) and swing-phases ($p = 0.002$). An interaction effect between group and time reached significance for sway area and ML sway range in eyes open condition ($p = 0.04$ and $p = 0.05$, respectively. No significant for between group and time w.r.t Berg Balance scale.
12	Sanders. M. 2013 (RCT)[16]	Journal of Sports Science and Medicine	Impact of the S.W.E.A.T. Water-Exercise Method on Activities of Daily Living for Older Women	Static balance, dynamic balance, sit and reach, sit to stand, walking speed, agility, stair climb and biceps curl	Sixty-six women (60-89 yr of age) self-selected to a Water Exercise (WEX) group (n = 48) or control (C) group (n = 18). The training consisted of a 16-week (45 min.day-1, 3 d·wk-1) supervised WEX program that included 10 min of warm-up and warm down/stretching and 35 min training using the S.W.E.A.T method in shallow water 1.0-1.2 m, with water temperature approximately 28-29°C.	Water exercise (48) + Control group (18)	Sit and reach ($p<0.05$), Sit to stand ($p<0.0001$), Walk speed ($p<0.0001$), walk steps ($p<0.0001$), agility ($p<0.000$), arm curls ($p<0.0001$), static balance ($p<0.05$) and dynamic balance ($p<0.0001$)
13	Kim S et al (RCT)[17]	Journal of Physical Therapy	Effects of Aqua Aerobic Therapy Exercise for Older Adults on Muscular Strength, Agility and Balance to Prevent Falling during Gait	Muscle strength, muscle power, flexibility, agility and balance.	A total of 15 subjects participated in this study and they were randomly divided into the experimental and the control group	Aqua aerobics: 8 Control group: 7	<0.05

Sr. No	Author, Year, Title	Journal	Title	Outcome measure	Period of intervention	Sample size	p value
14	Kovách et al Randomized clinical trial[18]	Biomedical Human Kinetics	Effects of Pilates and aqua fitness training on older adults' physical functioning and quality of life	Fullerton Functional Fitness Test, WHO's Quality of Life Questionnaire.	A total of 54 participants (M = 66.4 ± 6.2 years) from a club for retired people in Eger, Hungary.	Aquatic fitness training: 17 Pilates: 22 Control group: 15	FITT: Pilates: strength, flexibility, dynamic balance and aerobic endurance: p<0.0001. Aqua group: body flexibility: <0.05 Control group, body strength:<0.01. WHOQOL-OLD: Pilates: Autonomy: <0.01, perception: <0.001 Aqua group: sociability, <0.001
15	Oliveria M et al 2014 (RCT)[19]	Archives of Gerontology and Geriatrics	Effect of different types of exercise on postural balance in elderly women: A randomized controlled trial	Five postural balance task were performed on a force platform (COP sway), two legged stand with eyes open, two legged stand with eyes closed, semi-tandem stand with eyes open, semi-tendon stand with eyes close, one legged stand.	Seventy-four physically independent elderly women, mean age 69+/-4 years, were randomly assigned to three intervention groups. Each group performed physical training, including cardiorespiratory, muscular strength and endurance, flexibility and sensory-motor exercises for 12 weeks	Aquatic gymnastics: 28 Mini trampoline: 23 Control group: 23	p<0.05
16	Khanjari Y. et al 2015 (RCT)[20]	International Letters of Social and Humanistic Sciences	The effect of a period of aquatic therapy exercise on the quality of life and depression in aged males suffering from chronic physical pains	SF-36 and Depression questionnaire	30 aged males who voluntarily referred to Niyayesh health center of Shiraz were selected. They were randomly divided in to two groups; experimental (n = 15) and control (n = 15). Subjects of aquatic therapy exercise were involved in an 8-week-activity in water; 3 sessions per week each lasting approximately 50 to 70 minutes	Aquatic therapy: 15 Control group: 15	p<0.05 in both

Sr. No	Author, Year, Title	Journal	Title	Outcome measure	Period of intervention	Sample size	p value
17	Alberti D. et al 2017 (RCT)[21]	Motriz, Rio Claro	Water running: effects on muscle function and functionality	Dynamic isokinetic strength, lower limb functionality.	Older women (n = 19) were randomly assigned to one of the two groups: deep-water running (DWR: n = 09, 64.33 ± 4.24 years, 75.15 ± 12.53 kg, 160.45 ± 7.52 cm; or control group CG: n = 10, 64.40 ± 4.22 years, 74.46 ± 12.39 kg, 158.88 ± 5.48 cm). The DWR group carried out 18 weeks of deep-water running, twice/week 50 min sessions	Deep water running: 9 Control group: 10	P value not mentioned
18	Neiva H. et al 2018 (RCT)[22]	Water-aerobics, health status and physical fitness	The effect of 12 weeks of water-aerobics on health status and physical fitness: An ecological approach	Strength of upper limb Body fat mass SBP Triglycerides	Fifteen volunteers (58.80 ± 14.32 years old) were part of an experimental group (Exercise), and eight volunteers (59.00 ± 12.26 years old) were part of the control group (Control). The Exercise performed 45 min of water aerobics twice a week for 12 weeks; no physical exercise was permitted for the Control during the same period	Water aerobics: 15 Control group: 8	The results suggest that 12 weeks of water aerobics performed twice a week in a real-life context seem to benefit the explosive strength
19	Alikhajeh et al 2012 (RCT)[23]	Procedia Social and Behavioural Sciences	Effects of hydrotherapy in static and dynamic balance among elderly men	Sharpened Romberg test (static balance with eyes open and close) and Timed Up and Go.	The participants were 28 healthy sedentary elderly men aged between 64 and 79 years	14 in the experimental group and 14 in the control group	Hydrotherapy program group: Sharpened Romberg test ($p < 0.001$) and the Timed Up and Go test ($p < 0.001$).
20	Simmons V. et al 1996 Ranomized clinical trial[24]	Journal of Gerontology: MEDICAL SCIENCES	Effectiveness of Water Exercise on Postural Mobility in the Well Elderly: An Experimental Study on Balance Enhancement	Functional reach	Four groups of elderly subjects (80 ± 5.8 years old) were placed into four groups. Each group met twice per week for 45 minutes for 5 weeks of simple exercises or socializing in the designated medium.	Water Exercisers: 13 Land Exercisers: 13 Water Sitters: 13 Land Sitters: 13	Only water exercise was significant over 5 weeks

Sr. No	Author, Year, Title	Journal	Title	Outcome measure	Period of intervention	Sample size	p value
21	Roth A. et al 2006 Randomized clinical trial[25]	Journal of Sports Rehabilitation	Comparisons of Static and Dynamic Balance Following Training in Aquatic and Land Environments	Balance: single leg stance, single leg tandem stance, single leg stance on medium density foam and tandem stance on medium density foam. Centre Of Pressure angle	24 healthy subjects randomly assigned to aquatic (n = 8), land (n = 10), or control (n = 6) groups. Intervention: Four weeks of balance training	Aquatic exercise: 8 Land exercise: 10 Control group: 6	Results of this study show that balance training can effectively be performed in both land and aquatic environments.
22	Bocalini D. et al 2008 Randomized clinical trial[26]	Japan Geriatric Society	Water- versus land-based exercise effects on physical fitness in older women	bodyweight, HR at rest, maximum aerobic power and neuromuscular performance (upper and lower body strength; agility; upper and lower body flexibility)	Fifty healthy sedentary women were randomly assigned to sedentary (S), WE and WL groups. The two groups were exercised for 12 weeks at 70% of the age-predicted maximum Heart Rate (HR).	Water exercise: 27 Walking on land: 25	VO2max and neuromuscular performance p<0.05
23	Booth C. et al 2008 Randomized Clinical Trial[27]	Activities, Adaptation and Aging	Water Exercise and Its Effect on Balance and Gait to Reduce the Risk of Falling in Older Adults	Gait and balance was assessed with the Tinetti Gait and Balance Assessment. The Health Survey SF36v2 and a demographic/health survey were used to collect information concerning overall health and to identify other factors influencing the risk to fall.	Forty-three women were recruited, 20 from land-based and 23 from water-based exercise programs	Water based exercise: 23 Land based exercise: 20	Water exercise may contribute a positive benefit on balance and gait for women 65 years and older
24	Kaneda K. et al 2008 Randomized clinical trial[28]	Journal of Aging and Physical Activity	A Comparison of the Effects of Different Water Exercise Programs on Balance Ability in Elderly People	Postural sway test Tandem walking test Reaction time Normal and maximum walking test	The participants completed a twice-weekly water exercise intervention for 12 wk. Exercise sessions comprised a 10-min warm-up on land, 20 min of water-walking exercise, 30 min of water exercise while separated into NWE and DWRE, a 10-min rest on land, and 10 min of recreation and relaxation in water.	Deep water running exercise: 15 Normal water exercise: 15	DWRE: Postural sway distance (<0.05), postural sway area (<0.05), tandem walking time (<0.05) and reaction time (<0.05) NWE: reaction time (<0.05)

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25	Sa to D. et al 2009 Randomized clinical trial[29]	Archives of Gerontology and Geriatrics	Comparison of 2-year effects of once and twice weekly water exercise on activities of daily living ability of community dwelling frail elderly	ADL ability and lower muscle strength were measured before the beginning of exercise and 6 months, 1 year, and 2 years after the program had started.	Group 1 participated in a 60-min exercise session once a week, for 2 years, while Group 2 attended the session twice a week. Exercise sessions were divided into a 10-min warm-up on land and 50 min of exercise in water. The 50-min water exercise program consisted of 20 min walking, 10 min ADL exercise, 10 min stretching and strength exercises, and 10 min relaxation in water.	Once a week session: 10 Twice a week session: 12	Significant group differences occurred for bathing transfer and stair climbing at the 2-year measurement. These results suggested that at least twice-weekly water exercise was necessary to maintain the ADL ability and KEX of the frail elderly
26	Abbasi A. et al 2011 Randomized Clinical trial[30]	World Applied Sciences Journal	Effect of Whole Body Vibration, Aquatic Balance and Combined Training on Neuromuscular Performance, Balance and Walking Ability in Male Elderly Able-Bodied Individual	Neuromuscular performance, balance (Timed Up and Go and 5-Chair stand tests) and walking ability	Sixty adult male subjects voluntarily participated in WBVT, aquatic balance- and combined training.	Aquatic balance: 15 Whole body vibration technique: 15 Combined training on neuromuscular performance: 15 Control: 15	Aquatic balance- and combined-training are more persistent than WBVT and reduce the risk for falling in male able-bodied elderly individuals.
27	Oh. S.et al 2015 Randomized clinical trial[31]	Archives of Gerontology and Geriatrics	Comparison of the effects of water- and land-based exercises on the physical function and quality of life in community-dwelling elderly people with history of falling: A single-blind, randomized controlled trial	Physical functions (muscle strength, flexibility, and mobility) And Quality of life (SF-36) Fear of falling (modified- fall efficacy scale)	Participants were randomly assigned to the water-based exercise group (n = 34) or land-based exercise groups (n = 32).	Water based: 34 Land based: 32	physical functioning: $p < 0.001$, role physical: $p < 0.001$, role emotional: $p = 0.002$, bodily pain: $p < 0.001$, vitality: $p < 0.001$, and mental health: $p < 0.001$). There was a significant difference in the M-FES in both groups ($p = 0.040$).

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28	Covill L. et al 2016 Randomized clinical trial[32]	Journal of Geriatric Physical Therapy	Comparison of Ai Chi and Impairment-Based Aquatic Therapy for Older Adults With Balance Problems: A Clinical Study	Physical balance measures, which included the Berg Balance Scale (BBS) and Timed Up and Go (TUG), the Activities-Specific Balance Confidence Scale (ABC) and Numerical Pain Rating Scale (NPRS),	Thirty-two community-dwelling adults, 65 to 85 years old, were referred to 2 different community pools for APT. 15 participants received Ai Chi-based aquatic interventions and 17 subjects received an IBAT program.	Impairment Based Aquatic Therapy: 15 Ai-Chi: 17	The Berg Balance Scale and Timed Up and Go test showed significant improvement (BBS, p = .00; TUG p = .03) after Aquatic Physical Therapy. The Activities-Specific Balance Confidence Scale and NPRS did not improve significantly (ABC, p = .27;NPRS, p = .77).
29	Reichert T. et al 2016 (randomized clinical trial)[33]	AGE	Continuous and interval training programs using deep water running improves functional fitness and blood pressure in the older adults	SBP, DBP, foot up-and-go test, Flexibility of upper and lower limbs, strength of upper extremity and lower extremities and 6-min walk test.	Thirty-six individuals were divided into continuous group (CONT) and interval group (INT). Both groups were trained for 28 weeks (twice weekly). Measures were performed before the training period, after 12 weeks and training period.	Intermittent therapy: 18 Continuous therapy: 18	Foot up-and-go: <0.0001, Flexibility of Lower limbs:0.007, strength factor:<0.0001 and 6-min test: 0.021 were significant and by group: alone flexibility of upper limb: 0.042 was significant.
30	Silva L. et al 2017 (randomizer clinical trial)[34]	Clinics	Effects of aquatic exercise on mental health, functional autonomy and oxidative stress in depressed elderly individuals: A randomized clinical trial	Depression, anxiety, Timed up and Go test, Berg Balance scale, Flexibility, and blood based parameters	92 elderly individuals were included in the study and were allocated into the depression group (n = 16) and non-depression group (n = 14). Both groups engaged in the aquatic exercise program for 12 weeks, including two weekly sessions (45 min/session) at a low intensity (between 50% and 60% of maximal heart rate or Borg scale scores of 13 to 14) throughout the intervention.	Based on depression subjects were divided into two groups: Depression group: 16 Non-depression group: 14	TUG: 0.05, BBS: 0.05 and Flexibility: 0.03

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31	Douris P et al ---- Randomized clinical trial[35]	Journal of Geriatric Physical Therapy	The Effect of Land and Aquatic Exercise on Balance Scores in Older Adults	Berg Balance Scale	11 subjects completed this study. Five subjects were from an assisted living facility (age 83.2 ± 8.1 years) and 6 subjects were from an outpatient facility (age 75.0 ± 3.6 years). Each group did a comparable set of lower body exercises (2 times per week for 6 weeks), but one group exercised in the pool, and the other exercised on land	Aquatic therapy: 6 Land therapy: 6	There was a significant main effect of time ($p < .001$) but not group on BBS scores
32	Resende SM. et al 2008 Experimental trial[36]	Rev Bras Fisioter	Effects of Hydrotherapy in balance and prevention of falls among elderly women	Berg Balance Scale and Timed-up and Go test	25 elderly women were evaluated using two scales: the Berg Balance Scale and Timed Up and Go. The subjects underwent, subsequently, a low to moderate intensity hydrotherapy program for balance, which consisted of three phases: a phase of adaptation to the aquatic environment, a stretching phase and a phase of static and dynamic balance exercises. The program was applied for 12 weeks, with two sessions per week, each session lasting 40 minutes.	25	Berg Balance Scale ($p < 0.001$) and the Timed Up and Go test ($p < 0.001$).