Aquatic Therapy

Author, Year PEDro Score, Country	Sample size	Intervention	Outcome and significance: (+) significant (-) not significant
Aidar et al., 2013 PEDro: 4/10 Country: Brazil	N=31 individuals with chronic stroke	Aquatic exercise program (n=16) Vs. No treatment (n=15) <u>*Treatment details:*</u> 45-60 minutes/session, 2 sessions/week for 12 weeks *Aquatic exercise program*: comprised dry land warm-up activities (5-10 mins) followed by exercises in the pool – walking (5-10mins), pedalling (5-10 mins), climbing/descending (5-10 mins), upper/lower limb exercises (5-10 mins), swimming (10 mins), low-intensity cool-down exercise (5 mins) and breathing exercises; participants were also provided educational materials. Water depth 1.5m; water temperature not specified. The control group received the aquatic program after the intervention phase.	**At post-treatment (12 weeks):** • (+) Beck Depression Inventory • (+) State Trait Anxiety Inventory (IDATE) – I Anxiety trait • (+) IDATE – II Anxiety state
Aidar et al., 2018 PEDro: 4/10 Country: Brazil	N=43 individuals with chronic stroke	Aquatic exercise program (n=22) Vs. No treatment (n=21) <u>*Treatment details:*</u> 45-60 minutes/session, 2 sessions/week for 12 weeks	**At post-treatment (12 weeks):** • (+) Beck Depression Inventory • (+) State Trait Anxiety Inventory (IDATE) – I Anxiety state • (+) IDATE – II Anxiety trait • (+) Timed Up and Go test • (+) Berg Balance Scale • (+) Timed 7.62 Meters Walk test • (+) Getting up from a sitting position test

Author, Year PEDro Score, Country	Sample size	Intervention	Outcome and significance: (+) significant (-) not significant
		Aquatic exercise program: comprised dry land warm-up activities (5-10 mins) followed by exercises in the pool – walking (5-10mins), pedalling (5-10 mins), climbing/descending (5-10 mins), upper/lower limb exercises (5-10 mins), swimming (10 mins), low-intensity cool-down exercise (5 mins) and breathing exercises; participants were also provided educational materials. Water depth 1.5m; water temperature 27 °C. The control group received the aquatic exercise program after the intervention phase.	
Cha, Shin & Kim, 2017 PEDro: 8/10 Country: Republic of Korea	N=22 individuals with chronic stroke	Bad Ragaz Ring method aquatic therapy (n=11) Vs. Conventional physical therapy (n=11) *Treatment details:* 30 minutes/session, 3 sessions/week for 6 weeks *Bad Ragaz Ring method aquatic therapy*: participants wore body ring floats between L5 and S2, neck ring floats, and wrist and ankle ring floats; participants lay supine to perform leg Pattern 1 and 2 (10 mins), Diagonal 1 and 2 flexion patterns (10 mins) and Diagonal 1 and 2 extension patterns (10 mins). Water depth 1.3m; water temperature at 33.33-36.67 °C. *Conventional physical therapy*: time-matched rehabilitation comprised proprioceptive neuromuscular	**At post-treatment (6 weeks):** • (+) Muscle activity – Tibialis anterior • (+) Muscle activity – Gastrocnemius • (+) Balance Index • (-) Timed Up and Go test

Author, Year PEDro Score, Country	Sample size	Intervention	Outcome and significance: (+) significant (-) not significant
		facilitation upper/lower extremity patterns to the affected side. Both groups received additional conventional physical therapy for 30 mins/session, 3 sessions/week.	
Chan et al., 2017 PEDro: 5/10 Country: Canada	N=32 participants with subacute stroke	Aquatic therapy (n=17) Vs. Conventional rehabilitation (n=15) <u>*Treatment details:*</u> 30 mins/session, 2 sessions/week for 6 weeks *Aquatic therapy*: balance, stretching, and strengthening and endurance training. Water depth not reported; water temperature 34.5°C. *Conventional rehabilitation*: time-matched on-land balance, strength, transfer, gait and stair training. Both groups received additional on-ground conventional rehabilitation for 30 mins/session, 2 sessions/week.	**At post-treatment (6 weeks):** • (-) Berg Balance Scale • (-) Community Balance and Mobility Test • (-) Timed Up and Go test • (-) Two-Minute Walk Test
Chu et al., 2004 PEDro: 6/10 Country: Canada	N=12 individuals with chronic stroke	Aquatic lower extremity program (n=7) Vs.	**At post-treatment (8 weeks):** • (+) VO2 max • (+) Maximal workload • (+) Gait speed (m/sec)

Author, Year PEDro Score, Country	Sample size	Intervention	Outcome and significance: (+) significant (-) not significant
		Upper extremity function program (n=5) *Treatment details:* 60 minutes/session, 3 sessions/week for 8 weeks *Aquatic lower extremity program*: intensive water-based exercises; participants wore a heart rate monitor and flotation belt or lifejacket; land-based stretching (10 mins), aerobic warm-up exercises (5 mins), moderate-high aerobic activities at target heart rate(30 mins), light cool-down exercises (5 mins), gentle stretching (10 mins). Water depth at chest-level; water temperature 26-28°C. *Upper extremity function program*: time-matched circuit training that comprised warm-up (5 mins), six 7-minute stations addressing gross upper limb movements, fine motor movements and muscle strengthening of the shoulder, elbow, wrist and fingers, and cool-down (5 mins).	• (-) Berg Balance Scale • (+) Muscle strength (composite) – more affected side • (-) Muscle strength (composite) – less affected side
Eyvaz, Dundar & Yesil, 2018 PEDro: 5/10 Country: Turkey	N=60 participants with chronic stroke	Water-based exercise group (n=30) Vs. Land-based exercise program (n=30) *Treatment details:* 60 mins/session, 3sessions/week for 6 weeks	**At post-treatment (6 weeks):** • (-) Functional Independence Measure • (-) Berg Balance Scale* • (-) Timed Up and Go test • (-) Isokinetic strength (maximum peak torque) – knee flexor (affected, non-affected) – 90-degree/second • (-) Isokinetic strength (maximum peak torque) – knee extensor (affected, non-affected) -90-degree/second

Author, Year PEDro Score, Country	Sample size	Intervention	Outcome and significance: (+) significant (-) not significant
		Water-based exercise group: strengthening (hip flexion and extension, hip abduction and adduction, knee flexion and extension, cycling), balance and coordination activities. Water depth not repoorted; water temperature 33°C. *Land-based exercise program*: stretching, strengthening (isometric, isotonic), trunk mobility (trunk flexion-extension, trunk lateral flexion, bridging, crawling, upright kneeling, half upright kneeling), balance (eyes open, eyes closed) and walking exercises. Both programs comprised 10 minutes warm-up/stretching, 40 minutes exercise, 10 minutes cool-down/stretching Both groups received additional land-based exercise sessions 2 times/week.	• (-) Isokinetic strength (maximum peak torque) – knee flexor (affected, non-affected) – 120-degree/second • (-) Isokinetic strength (maximum peak torque) – knee extensor (affected, non-affected) – 120-degree/second • (-) Sportak Balance Device – Statik balance index • (-) Sportak Balance Device – Dynamik balance index • (+) Short Form 36 (SF-36) – Vitality • (-) SF-36 – Physical functioning • (-) SF-36 – Role physical • (-) SF-36 – Pain • (-) SF-36 – General health • (-) SF-36 – Social functioning • (-) SF-36 – Role emotional • (-) SF-36 – Mental health * Significant between-group difference in favour of land-based exercise program
Furnari et al., 2014 PEDro: 5/10 Country: Italy	N=40 participants with chronic stroke	Hydrokinesytherapy (n=20) Vs. Conventional physical therapy (n=20) <u>*Treatment details:*</u> 60 mins/session, 3 sessions/week for 8 weeks	**At post-treatment (8 weeks):** • (-) Static postural stability – Plantar surface (paretic) • (-) Static postural stability – Plantar surface (non-paretic) • (-) Static postural stability – Plantar load (paretic)

Author, Year PEDro Score, Country	Sample size	Intervention	Outcome and significance: (+) significant (-) not significant
		Hydrokinesytherapy: comprised warm-up walking/marching (10 mins), Halliwick method exercises for trunk rotation and balance (15 mins), Ai Chi method exercises (15 mins) for rounding and balance, lower-limb strength exercises (10 mins) and cool-down walking (10 mins). Water depth 115cm (waist level); water temperature 33-34°C. *Conventional physical therapy*: time-matched rehabilitation comprised passive range of motion warm-ups (10 mins), lower- and upper-extremity strengthening (20 mins), postural control exercise (20 mins) and gait training (10 mins). Both groups received additional conventional physical therapy 60 mins/session, 3 sessions/week.	• (-) Static postural stability – Plantar load (non-paretic) • (+) Length of the ball – eyes open • (+) Length of the ball – eyes closed • (+) Gait speed (electric baropedometer) • (+) Cadence • (+) Stance phase • (+) Swing phase • (+) Double support phase • (-) Semistep length
Han, Kim & An, 2013 PEDro: n/a (quasi-experimental study) Country: Republic of Korea	N=62 participants with chronic stroke	Aquatic proprioceptive exercise program (n=31) Vs. Land-based proprioceptive exercise program (n=31) <u>*Treatment details:*</u> 40 mins/session, 3 sessions/week for 6 weeks *Aquatic proprioceptive exercise program*: participants used wonder boards to perform warm-up exercises (5	**At post-treatment (6 weeks):** • (+) Proprioception • (+) Sway area – eyes open • (+) Sway area – eyes closed • (+) Berg Balance Scale

Author, Year PEDro Score, Country	Sample size	Intervention	Outcome and significance: (+) significant (-) not significant
		mins), 3 sets of 10 repetitions of unstable surface exercises (one-legged knee flexion, toe stands, one-legged stance, knee flexion of both legs, weight-shift) (30 mins) and cool-down exercises (5 mins). Water depth 1.1m, water temperature 33.5°C. *Land-based proprioceptive exercise program*: participants used balance mats to perform the same proprioceptive exercise program.	
Han & Im, 2018 PEDro: 6/10 Country: Republic of Korea	N=20 participants with subacute stroke	Aquatic treadmill training (n=10) Vs. Land-based aerobic exercise (n=10) <u>*Treatment details:*</u> 50 mins/session, 5 sessions/week for 6 weeks *Aquatic treadmill training*: comprised stretching and light aerobic warm-up exercises, aerobic exercises at a target heart rate of 50-85% of heart rate reserve on a motorized aquatic treadmill (shallow-water running with a combination of buoyancy, hydrostatic pressure, turbulence and resistance), and stretching/cool-down exercises. Water depth began at waist height; water temperature 30-33°C.	**At post-treatment (6 weeks):** • (-) Korean modified Barthel Index • (-) Six Minute Walk Test • (+) Oxygen uptake (VO2peak) • (-) Peak rate pressure product • (-) Heart rate – resting • (+) Heart rate – peak • (+) Age-predicted maximum heart rate • (+) Exercise tolerance test duration • (-) Respiratory exchange ratio

Author, Year PEDro Score, Country	Sample size	Intervention	Outcome and significance: (+) significant (-) not significant
		Land-based aerobic exercise program: comprised stretching and light aerobic warm-up exercises, aerobic exercises at a target heart rate of 50-85% of heart rate reserve using upper- and lower-body ergometers, and stretching/cool-down exercises. Both groups also performed aerobic exercise for 50 mins/session, 5 sessions/week.	
Jung et al., 2014 PEDro: 5/10 Country: Republic of Korea	N=30 participants with chronic stroke	Aquatic obstacle training (n=15) Vs. Land-based obstacle training (n=15) <u>*Treatment details*</u>: 40 minute/session, 3 sessions/week for 12 weeks *Aquatic obstacle training*: participants repeated a three-stage obstacle course that comprised stepping over an obstacle at a height of 10cm, going up/down stairs at a height of 19cm, and crossing over a step at a height of 14cm (30 mins total), and cool-down stretching exercises (5mins) Water depth 1.1m; water temperature 33-35°C. *Land-based obstacle training*: intensity-matched intervention using similar obstacles and movement demands as the aquatic obstacle course.	**At post-treatment (12 weeks):** • (+) Mediolateral sway velocity – eyes closed • (+) Anteroposterior sway velocity – eyes closed • (+) Sway area

Author, Year PEDro Score, Country	Sample size	Intervention	Outcome and significance: (+) significant (-) not significant
Kim, Lee & Jung, 2015 PEDro: 4/10 Country: Republic of Korea	N=20 participants with chronic stroke	Aquatic coordination movement using Proprioceptive Neuromuscular Facilitation (n=10) Vs. No treatment (n=10) *Treatment details:* 30 mins/session, 5 sessions/week for 6 weeks *Aquatic coordination movement using Proprioceptive Neuromuscular Facilitation (PNF)*: comprised five sets of 10 movements using the PNF sprinter and skate patterns for 10secs each from a standing position in left and right alternation. Water depth 100cm; water temperature 34-34°C Both groups received neurodevelopmental therapy for 30 mins/session, 5 sessions/week that comprised mat exercises, resistance exercises, postural control exercises and functional activity exercises.	**At post-treatment (6 weeks):** • (+) Berg Balance Scale • (+) Functional Reach Test • (+) 10 meter Walk Test • (+) Timed Up and Go Test
Kim, Lee & Kim, 2015 PEDro: 4/10 Country: Republic of Korea	N=20 participants with chronic stroke	Aquatic proprioceptive neuromuscular facilitation (PNF) lower extremity exercises (n=10) Vs. On-ground PNF lower extremity exercises (n=10) *Treatment details:*	**At post-treatment (6 weeks):** • (+) Berg Balance Scale • (+) Timed Up and Go test • (+) Functional Reach Test • (+) One Leg Stand Test • (+) Functional Independence Measure

Author, Year PEDro Score, Country	Sample size	Intervention	Outcome and significance: (+) significant (-) not significant
		30 mins/session, 5 sessions/week for 6 weeks *Aquatic PNF*: lower extremity PNF patterns D1 and D2 were performed using the rhythmic initiation method in supine position; participants wore a neck collar and a body ring between L5 and S1. Water depth 110cm, water temperature 31-33°C. *On-ground PNF*: time-matched exercises performed on the ground in a supine position.	
Kim, Lee & Kim, 2016 PEDro: 4/10 Country: Republic of Korea	N= 20 participants with chronic stroke	Aquatic dual-task training (n=10) Vs. No treatment (n=10) <u>*Treatment details:*</u> 30 mins/session, 5 sessions/week for 6 weeks *Aquatic dual-task training*: comprised a stability exercise (standing with eyes closed then standing with eyes closed while catching a ball) and a movement exercise (walking 10m then walking 10m while holding a cup of water). Water depth 100cm; water temperature 32-3°C. Both groups performed neurodevelopmental treatment for 30 mins/session, 5 sessions/week.	**At post-treatment (6 weeks):** • (+) Berg Balance Scale • (+) Five Times Sit-to-Stand Test • (+) Functional Reach Test • (+) 10 Meter Walk Test • (+) Timed Up and Go test • (+) Functional Gait Assessment

Author, Year PEDro Score, Country	Sample size	Intervention	Outcome and significance: (+) significant (-) not significant
Kum & Shin, 2017 PEDro: 5/10 Country: Republic of Korea	N=30 participants with chronic stroke	Underwater backward treadmill training (n=15) Vs. On-ground backward treadmill training (n=15) <u>*Treatment details:*</u> 40 mins/session, 2 sessions/week for 6 weeks *Underwater backward treadmill training*: participants performed on-ground forward treadmill training for 20 mins/session at 1.0m/sec, then underwater backward treadmill training for 20 mins/session at 1.0km/hr; speed increased at a rate of 0.1km/hr each week Water height was 1.0m; water temperature not reported *On-ground backward treadmill training*: participants performed on-ground forward treadmill training then on-ground backward treadmill training while wearing a harness to promote non-weight-bearing; training was performed at a rate an intensity to match the experimental group.	**At post-treatment (6 weeks):** • (-) Muscle strength – paretic hip flexion • (-) Muscle strength – paretic hip extension • (-) Muscle strength – paretic knee flexion • (-) Muscle strength – paretic knee extension • (+) Proprioception – paretic hip flexion • (+) Proprioception – paretic hip extension • (+) Proprioception – paretic knee flexion • (+) Proprioception – paretic knee extension • (-) Figure-of-Eight Walk test • (-) Functional Gait Assessment
Lee, Ko & Cho, 2010 PEDro: 5/10 Country: South Korea	N=34 participants with chronic stroke	Aquatic task-oriented training (n=17) Vs. On-ground task-oriented training (n=17) <u>*Treatment details:*</u>	**At post-treatment (12 weeks):** • (-) Anteroposterior sway velocity – eyes open • (-) Anteroposterior sway velocity – eyes closed • (-) Mediolateral sway velocity – eyes open • (-) Mediolateral sway velocity – eyes closed

Author, Year PEDro Score, Country	Sample size	Intervention	Outcome and significance: (+) significant (-) not significant
		50 mins/session, 3 sessions/week for 12 weeks *Aquatic task-oriented training*: comprised 10 tasks performed at intensity to match the Rate of Perceived Exertion level 11-13 – warm-ups, balance task, heel lifts, coordination/muscular strength task, balance/muscular strength task, balance/ability to move task, endurance/ability to move task, ability to move task, mobility/balance in turning task, and cool-down tasks performed for 4 mins/task. Pool depth 1.25-1.5m; water temperature 33-34°C. *On-land task-oriented training* comprised time- and intensity-matched exercises.	• (+) Dynamic balance – time • (+) Dynamic balance – distance
Lee et al., 2018 PEDro: 7/10 Country: Republic of Korea	N=37 participants with subacute stroke	Aquatic treadmill training (n=19) Vs. On-land aerobic exercise (n=18) <u>*Treatment details:*</u> 30 mins/session, 5 sessions/week for 4 weeks *Aquatic treadmill training*: comprised warm-up (5mins), aerobic exercise on a motorized aquatic treadmill including shallow-water running at different combinations of buoyancy, hydrostatic pressure, turbulence and resistance (20 mins), and cool-down (5mins); initial speed at comfortable walking velocity and increased in	**At post-treatment (4 weeks):** • (+) Isometric strength – paretic knee flexion • (+) Isometric strength – paretic knee extension • (-) Isometric strength – non-paretic knee flexion • (-) Isometric strength – non-paretic knee extension • (-) Fugl-Meyer Assessment (FMA) • (-) FMA – Lower Limb • (-) Berg Balance Scale • (-) Modified Barthel Index (Korean version) • (-) EQ-5D-3L

Author, Year PEDro Score, Country	Sample size	Intervention	Outcome and significance: (+) significant (-) not significant
		increments of 0.1m/sec to maximum ability of the participant Water depth at chest height down to popliteal height; water temperature 30-33°C; no external buoyancy devices. *On-land aerobic exercise*: aerobic exercise performed using upper- and lower-extremity ergometers; training load was gradually increased from 30-50% of maximal effort to the highest level achievable by the participant. Both groups also received conventional rehabilitation.	• (-) Resting heart rate (beats/min) • (-) Resting systolic blood pressure (mm Hg) • (-) Resting diastolic blood pressure (mm Hg) • (-) Maximal heart rate (beat/min) • (-) Maximal systolic blood pressure (mm Hg) • (-) Maximal diastolic blood pressure (mm Hg) • (-) Maximal rate pressure product (mm Hg/min) • (-) Respiratory exchange ratio • (-) VO2 peak (ml/kg/min) • (-) Arterial stiffness – paretic • (-) Arterial stiffness – non-paretic
Matsumoto et al., 2016 PEDro: 6/10 Country: Japan	N=120 participants with chronic stroke	Aquatic therapy (n=60) Vs. No aquatic therapy (n=60) *Treatment details:* 30 mins/session, 2 days/week for 12 weeks Both groups received conventional rehabilitation 6 times/week.	**At post-treatment (12 weeks):** • (+) 10 Meter Walk Test: Speed • (+) 10 Meter Walk Test: Cadence • (+) Modified Ashworth Scale • (+) 36-Item Short Form Health Survey (SF-36): Physical functioning • (+) SF-36: Role physical • (+) SF-36: Bodily pain • (+) SF-36: General health • (+) SF-36: Vitality • (+) SF-36: Social functioning • (+) SF-36: Role-emotional

Author, Year PEDro Score, Country	Sample size	Intervention	Outcome and significance: (+) significant (-) not significant
		Aquatic therapy: comprised warm-up and flexibility exercises (5 mins), endurance and strength exercises based on walking to improve endurance, postural control, flexibility, mobility and walking (20 mins), and cool-down (5 mins) Water depth 150cm with participants emersed to chest height; water temperature 30-31°C. *Conventional rehabilitation*: ROM exercises, muscle strengthening and basic activity training using gait and ADL training and speech therapy	• (+) SF-36: Mental health
Montagna et al., 2014 PEDro: n/a (pre-post design study) Country: Brazil	N=15 participants with chronic stroke	Aquatic physiotherapy (n=15) *Treatment details:* 40 mins/session, 2 sessions per week, total 18 sessions *Aquatic physiotherapy*: facilitated using the Halliwick method.	**At post-treatment (18 sessions):** • (-) Baropodometry – Anteroposterior (eyes open) • (-) Baropodometry – Anteroposterior (eyes closed) • (-) Baropodometry – Anteroposterior (sit to stand) • (-) Baropodometry – Mediolateral (eyes open) • (-) Baropodometry – Mediolateral (eyes closed) • (-) Baropodometry – Mediolateral (sit to stand) • (+) Berg Balance Scale • (+) Timed Up and Go test • (-) Stroke-Specific Quality of Life questionnaire (SS-QoL) – Total score • (-) SS-QoL – Energy

Author, Year PEDro Score, Country	Sample size	Intervention	Outcome and significance: (+) significant (-) not significant
			• (-) SS-QoL – Family roles • (-) SS-QoL – Language • (+) SS-QoL – Mobility • (-) SS-QoL – Mood • (-) SS-QoL – Personality • (-) SS-QoL – Self-care • (-) SS-QoL – Social roles • (-) SS-QoL – Thinking • (-) SS-QoL – Upper extremity function • (-) SS-QoL – Vision • (-) SS-QoL – Work/Productivity
Morer et al., 2020 PEDro: n/a (quasi-experimental prospective study) Country: Spain	N=62 participants with chronic stroke	Aquatic therapy + Thalassotherapy (n=62) *Treatment details:* 45 mins/day aquatic therapy + 80 mins/day thalassotherapy, 5 sessions/week for 2 weeks *Aquatic therapy*: facilitated using the Halliwick method; sessions included mental adaptation (5 mins), rotational control exercises (10 mins), individualised therapy exercises (15 mins), stretching/relaxation (5 mins), and time to enter/exit the pool. Water depth 140cm (chest height); water temperature 32°C. *Thalassotherapy*: mud/seawater bath (20 mins) + walk (60 mins).	**At post-treatment (2 weeks):** • (+) Berg Balance Scale • (+) Timed Up and Go test • (+) Six Minute Walk Test • (-) Ten meter walk test • (+) Pain Visual Analogue Scale • (+) WHO 5-item Well-being Index • (+) EQ – Visual Analogue Scale • (+) EQ-5D – Mobility • (-) EQ-5D – Self-care • (-) EQ-5D – Usual activities • (-) EQ-5D – Pain/discomfort • (-) EQ-5D – Anxiety/depression

Author, Year PEDro Score, Country	Sample size	Intervention	Outcome and significance: (+) significant (-) not significant
Noh et al., 2008 PEDro: 5/10 Country: Korea	N=25 participants with chronic stroke	Aquatic therapy (n=13) Vs. Conventional rehabilitation (n=12) <u>*Treatment details:*</u> 60 mins/session, 3 sessions/week for 8 weeks *Aquatic therapy*: facilitated using the Ai Chi and Halliwick methods; warm-up exercises (10 mins), Halliwick method for balance – sagittal rotation control, transverse rotation control and combined rotation control (20 mins), Ai Chi method – rounding and balancing to facilitate weight bearing on the affected side (20 mins), cool-down exercises (10 mins) Water depth 115cm; water temperature 34°C. *Conventional rehabilitation*: time-matched gym exercise program that included warm-ups, lower- and upper-extremity strengthening and gait training.	**At post-treatment (8 weeks):** • (+) Berg Balance Scale • (-) Modified Motor Assessment Scale • (-) Rising from a chair (paretic) • (-) Rising from a chair (non-paretic) • (-) Weight-shift – lateral (paretic) • (-) Weight-shift – lateral (non-paretic) • (+) Weight-shift – forward (paretic) • (-) Weight-shift – forward (non-paretic) • (+) Weight-shift – backward (paretic) • (-) Weight-shift – backward (non-paretic) • (+) Muscle strength – knee flexor (paretic) • (-) Muscle strength – knee flexor (non-paretic) • (-) Muscle strength – knee extensor (paretic) • (-) Muscle strength – knee extensor (non-paretic) • (-) Muscle strength – lumbar flexors • (-) Muscle strength – lumbar extensors
Park et al., 2011(a) Pedro: 4/10 Country: Republic of Korea	N=44 participants with chronic stroke	Aquatic exercise (n=22) Vs. Land exercise (n=22) <u>*Treatment details:*</u> 35 mins/session, 6 sessions/week for 6 weeks	**At post-treatment (6 weeks):** • (+) Proprioception – Knee • (+) Performance-Oriented Mobility Assessment

Author, Year PEDro Score, Country	Sample size	Intervention	Outcome and significance: (+) significant (-) not significant
		Aquatic exercise: 3 sets of 10 repetitions of exercises that included standing/bending on a balance board, walking, cycling and jumping; flotation devices included floating cuff, belt, balance ball and pool noodle Water depth 1.3m; water temperature 33-35°C. *Land exercise*: time-matched intervention included trunk stability strengthening exercises and balance training exercises.	
Park et al., 2012 PEDro: 4/10 Country: Republic of Korea	N=20 participants with chronic stroke	Aquatic treadmill training (n=10) Vs. On-ground treadmill training (n=10) <u>*Treatment details:*</u> 30 mins/session, 4 sessions/week for 6 weeks. *Aquatic treadmill training*: performed using the Aqua Track underwater treadmill; treadmill speed maximum velocity of 2-4m/s. Water depth at the level of thoracic vertebrae 11; water temperature 28-30°C. *On-ground treadmill training*: time- and intensity-matched treadmill training.	**At post-treatment (6 weeks):** • (+) Weight-bearing ability – Entire foot • (+) Weight-bearing ability – Hindfoot • (-) Weight-bearing ability – forefoot • (+) Joint angle – Hip flexion (heel contact) • (+) Joint angle – Hip flexion (toe off ground) • (+) Joint angle – Knee extension (heel contact) • (+) Joint angle – Knee extension (toe off ground) • (-) Joint angle – Ankle plantarflexion • (-) Joint angle – Ankle dorsiflexion • (-) Short Physical Performance Battery

Author, Year PEDro Score, Country	Sample size	Intervention	Outcome and significance: (+) significant (-) not significant
Park et al., 2014 PEDro: 5/10 Country: Republic of Korea	N=22 participants with chronic stroke	Aquatic treadmill training (n=11) Vs. No treatment (n=11) <u>*Treatment details:*</u> 30 mins/session, 2 sessions/week for 4 weeks. *Aquatic treadmill training*: performed on the Hydrophysio-Focus treadmill and comprised warm-ups (5 mins), exercises (30 mins), cool-down stretching (5 mins); initial speed was set at 36% of individuals' ground gait speed and increased in increments of 0.1m/s to the maximum ability of the individual Water depth at participants' xiphoid; water temperature 34°C. Both groups received conventional rehabilitation that comprised motor exercise (30 mins/session), functional electrical stimulation (15 mins/session) and occupational therapy (30 mins/session), 5 times/week.	**At post-treatment (4 weeks):** • (-) Balance System SD – Static balance (anteroposterior sway) • (-) Balance System SD – Static balance (mediolateral sway) • (-) Balance System SD – Static balance (total sway) • (-) Balance System SD – Dynamic balance
Park et al., 2016 PEDro: 4/10 Country: Republic of Korea	N=25 participants with chronic stroke	Aquatic trunk exercise program (n=13) Vs. Land-based trunk exercise program (n=15) <u>*Treatment details:*</u>	**At post-treatment (4 weeks):** • (-) Walking speed • (-) Walking cycle* • (-) Stance phase – paretic limb • (-) Stride length – paretic limb* • (-) Symmetry index – stance phase • (-) Symmetry index – stride length

Author, Year PEDro Score, Country	Sample size	Intervention	Outcome and significance: (+) significant (-) not significant
		30 mins/session, 3 sessions/week for 4 weeks *Aquatic trunk exercise program*: exercises were based on Halliwick, Watsu and trunk exercise programs, to comprise warm-ups (5 mins), trunk muscle activation exercises (20 mins) and cool down relaxation and stretching (5 mins). Water depth at xiphoid process; water temperature 30°C. *Land-based trunk exercise program*: trunk exercises included bridge exercises, curl-ups with arms crossed/arms reaching/diagonal reaching, abdominal hollowing and quadruped exercises, using a pressure biofeedback unit.	* Significant between-group difference, in favour of land-based trunk exercise program
Park & Roh, 2011(b) Pedro: 4/10 Country: Republic of Korea	N=46 participants with chronic stroke	Aquatic exercise (n=23) Vs. Land exercise (n=23) <u>*Treatment details:*</u> 35 mins/session, 6 sessions/week for 6 weeks *Aquatic exercise*: 3 sets of 10 repetitions of exercises that included standing/bending on a balance board, walking, cycling and jumping; flotation devices included floating cuff, belt, balance ball and pool noodle Water depth 1.3m; water temperature 33-35°C.	**At post-treatment (6 weeks):** • (+) Static balance – Mediolateral sway velocity (eyes open) • (-) Static balance – Mediolateral sway velocity (eyes closed) • (+) Static balance – Anteroposterior sway velocity (eyes open) • (-) Static balance – Anteroposterior sway velocity (eyes closed) • (+) Static balance – Velocity movement (eyes open) • (-) Static balance – Velocity movement (eyes closed)

Author, Year PEDro Score, Country	Sample size	Intervention	Outcome and significance: (+) significant (-) not significant
		Land exercise: time-matched intervention included trunk stability strengthening exercises and balance training exercises.	
Perez-de la Cruz, 2020 PEDro: 8/10 Country: Spain	N=40 participants with chronic stroke	Ai-Chi aquatic therapy (n=13) Vs. On-land exercises (n=14) Vs. Combined therapy (Ai-Chi aquatic therapy + on-land exercises, n=13) <u>*Treatment details:*</u> 45 mins/session, 2 sessions/week for 12 weeks *Ai Chi aquatic therapy:* comprised warm-up (10 mins) Ai-Chi exercises to promote balance, strength, relaxation, flexibility and breathing (20 mins), cool-down walking and stretching (15 mins). Water depth 1.4m, water temperature 34°C. *On-land exercises:* group training sessions comprising warm-ups (10 mins), strength training, aerobic, flexibility and coordination exercises (30-40 mins), cool-down stretching and relaxation exercises (10 mins).	**At post-treatment (12 weeks):** *Ai-Chi aquatic therapy vs. On-land exercises* • (+) Pain – Visual Analogue Scale (VAS) • (+) Tinetti test – Total score • (+) 360 degree turn test • (-) 30-s Chair Stand test (CS-30) • (-) Single leg stance balance test – Right • (-) Single leg stance balance test – Left *Combined therapy vs. On-land exercises* • (+) Pain – Visual Analogue Scale (VAS) • (+) Tinetti test – Total score • (+) 360 degree turn test • (+) 30-s Chair Stand test (CS-30) • (-) Single leg stance balance test – Right • (-) Single leg stance balance test – Left *Combined therapy vs. Ai-Chi aquatic therapy* • (-) Pain – Visual Analogue Scale (VAS) • (-) Tinetti test – Total score • (+) 360 degree turn test • (+) 30-s Chair Stand test (CS-30) • (-) Single leg stance balance test – Right • (-) Single leg stance balance test – Left

Author, Year PEDro Score, Country	Sample size	Intervention	Outcome and significance: (+) significant (-) not significant
		Combined therapy: comprised time-matched alternate aquatic therapy/dry land sessions under the same conditions.	**At 1-month follow-up:** *Ai-Chi aquatic therapy vs. On-land exercises* • (+) Pain – Visual Analogue Scale (VAS) • (+) Tinetti test – Total score • (+) 360 degree turn test • (-) 30-s Chair Stand test (CS-30) • (-) Single leg stance balance test – Right • (-) Single leg stance balance test – Left *Combined therapy vs. On-land exercises* • (+) Pain – Visual Analogue Scale (VAS) • (+) Tinetti test – Total score • (+) 360 degree turn test • (+) 30-s Chair Stand test (CS-30) • (-) Single leg stance balance test – Right • (-) Single leg stance balance test – Left *Combined therapy vs. Ai-Chi aquatic therapy* • (-) Pain – Visual Analogue Scale (VAS) • (-) Tinetti test – Total score • (+) 360 degree turn test • (+) 30-s Chair Stand test (CS-30) • (-) Single leg stance balance test – Right • (-) Single leg stance balance test – Left
Perez-de la Cruz, 2021 PEDro: 8/10 Country: Spain	N=45 participants with chronic stroke	Ai-Chi aquatic therapy (n=15) Vs.	**At post-treatment (12 weeks):** *Ai-Chi aquatic therapy vs. On-land exercises* • (+) Berg Balance Scale (BBS)

Author, Year PEDro Score, Country	Sample size	Intervention	Outcome and significance: (+) significant (-) not significant
		On-land exercises (n=17) Vs. Combined therapy (Ai-Chi aquatic therapy + on-land exercises, n=13) <u>*Treatment details:*</u> 45 mins/session, 2 sessions/week for 12 weeks *Ai Chi aquatic therapy:* comprised warm-up (10 mins) Ai-Chi exercises to promote balance, strength, relaxation, flexibility and breathing (20 mins), cool-down walking and stretching (15 mins). Water depth 1.1m, water temperature 30°C. *On-land exercises:* group training sessions comprising warm-ups (10 mins), strength training, aerobic and functional exercises (30-40 mins), cool-down stretching and relaxation exercises. *Combined therapy:* comprised time-matched alternate aquatic therapy/dry land sessions under the same conditions.	• (+) Tandem stance – eyes open • (+) Five Times Sit-to-Stand test (FTSTS) • (+) Timed Up and Go test (TUG) *Combined therapy vs. On-land exercises* • (-) Berg Balance Scale (BBS) • (+) Tandem stance – eyes open • (+) Five Times Sit-to-Stand test (FTSTS) • (+) Timed Up and Go test (TUG) *Combined therapy vs. Ai-Chi aquatic therapy* • (+) Berg Balance Scale (BBS)* • (-) Tandem stance – eyes open • (+) Five Times Sit-to-Stand test (FTSTS) • (-) Timed Up and Go test (TUG) **At 1-month follow-up:** *Ai-Chi aquatic therapy vs. On-land exercises* • (+) Berg Balance Scale (BBS) • (+) Tandem stance – eyes open • (+) Five Times Sit-to-Stand test (FTSTS) • (+) Timed Up and Go test (TUG) *Combined therapy vs. On-land exercises* • (-) Berg Balance Scale (BBS) • (+) Tandem stance – eyes open • (+) Five Times Sit-to-Stand test (FTSTS) • (+) Timed Up and Go test (TUG)

Author, Year PEDro Score, Country	Sample size	Intervention	Outcome and significance: (+) significant (-) not significant
			Combined therapy vs. Ai-Chi aquatic therapy • (+) Berg Balance Scale (BBS)* • (+) Tandem stance – eyes open • (+) Five Times Sit-to-Stand test (FTSTS) • (-) Timed Up and Go test (TUG) * in favour of aquatic therapy vs. combined therapy
Saleh, Rehab & Aly, 2019 PEDro: 6/10 Country: Egypt	N=50 participants with chronic stroke	Aquatic motor dual task training (n=25) Vs. Land-based motor dual task training (n=25) <u>*Treatment details:*</u> 45 mins/session, 3 sessions/week for 6 weeks *Aquatic motor dual task training*: sessions comprised warm-up exercises (5 mins), motor dual task training including various walking conditions and standing on a balance board (25 mins) and cool down exercises (5 mins) Devices included suspended chair and plinth, side bars and balance board Water depth 1.3m; water temperature 33-35°C. *Land-based motor dual task training*: comprised time- and intensity-matched sequence of exercises performed on land.	**At post-treatment (6 weeks):** • (+) Biodex Balance System – Overall Stability Index • (+) Biodex Balance System – Anteroposterior Stability index • (+) Biodex Balance System – Mediolateral Stability Index • (+) Biodex Gait Trainer – Walking speed • (+) Biodex Gait Trainer – Step length (paretic) • (+) Biodex Gait Trainer – Step length (non-paretic) • (+) Biodex Gait Trainer – Time of support on the paretic limb

Author, Year PEDro Score, Country	Sample size	Intervention	Outcome and significance: (+) significant (-) not significant
Tripp & Krakow, 2014 PEDro: 7/10 Country:	N=30 participants with acute/subacute stroke	Aquatic therapy using the Halliwick method (n=14) Vs. Conventional physiotherapy (n=16) *Treatment details:* 45 mins/session, 3 sessions/week for 2 weeks *Aquatic therapy*: performed using the Halliwick method Variable water depth; water temperature not reported *Physiotherapy*: ?? Both groups received additional conventional physiotherapy for 45 mins/session, 2 sessions/week	**At post-treatment (2 weeks):** • (+) Functional Ambulation Categories • (-) Functional Reach Test • (+) Berg Balance Scale • (-) Rivermead Mobility index
Zhang et al., 2016 PEDro: 8/10 Country: China	N=36 participants with subacute stroke	Aquatic training (n=18) Vs. Land-based physiotherapy (n=18) *Treatment details:* 40 mins/session, 5 sessions/week for 8 weeks *Aquatic training*: exercises were performed in a sitting position and included warm-ups (5 mins), exercises based	**At post-treatment (8 weeks):** • (-) Modified Ashworth Scale – knee flexion • (-) Modified Ashworth Scale – ankle dorsiflexion • (+) Functional Ambulation Categories • (+) Barthel Index • (+) Knee extension torque • (+) Knee extension cocontraction ratio • (-) Knee flexion torque • (-) Knee flexion cocontraction ratio • (-) Ankle dorsiflexion torque • (-) Ankle dorsiflexion cocontraction ratio

Author, Year PEDro Score, Country	Sample size	Intervention	Outcome and significance: (+) significant (-) not significant
		on the Halliwick method, underwater treadmill exercise and lower limb movements (35 mins). Water depth to xiphoid process; water temperature at 37-38°C. *Land-based physiotherapy*: comprised time-matched standard physiotherapy sessions that incorporated lower limb exercises, treadmill training and daily life activity training (e.g. cycling, stair climbing).	• (+) Ankle plantarflexion torque • (-) Ankle plantarflexion cocontraction ratio
Zhu et al., 2016 PEDro: 8/10 Country: China	N=28 participants with chronic stroke	Hydrotherapy exercises (n=14) Vs. Land-based exercises (n=14) *Treatment details:* 45 mins/session, 5 sessions/week for 4 weeks *Hydrotherapy*: comprised warm-up exercises (5 mins), strengthening/balance/coordination exercises and aquatic treadmill training (30 mins) and cool-down stretching (10 mins). Water depth 1.4m; water temperature 34-36°C. *Land-based exercises*: comprised warm-up stretching exercises (5 mins), strengthening and trunk mobility exercises and treadmill training (30 mins) and cool-down stretching (10 mins).	**At post-treatment (4 weeks):** • (-) Berg Balance Scale • (+) Functional Reach Test • (-) Timed Up and Go test • (+) Two Minute Walk Test