

**Supplementary Table S1.** Characteristics of excluded studies [ordered by study ID]

Study	Reason for exclusion
Abreu-Corrales et al., 2023 [1]	Study protocol
Ayache et al., 2020 [2]	Study protocol
Barclay et al., 2019 [3]	Not RCT
Backus et al., 2016 [4]	Not RCT
Baroni et al., 2024 [5]	Study protocol
Berriozabalgoitia et al., [6]	Study protocol
Castro-Sanchez et al., 2012 [7]	Spasticity not used as a specific outcome measure
Cattaneo et al., 2018 [8]	Spasticity not used as a specific outcome measure
Chioobaz et al., 2024 [9]	Not RCT
Criado et al., 2017 [10]	Spasticity not used as a specific outcome measure
Englund et al., 2022 [11]	Spasticity not used as a specific outcome measure
Eyssen et al., 2013 [12]	Spasticity not used as a specific outcome measure
Fernandez et al., 2014 [13]	Not RCT
Fernandez et al., 2021 [14]	Not RCT
Flachenecker et al., 2014 [15]	Not RCT
Finkelstein and Liu, 2018 [16]	Not RCT
Gaede et al., 2018 [17]	Not RCT
Greco et al., 2024 [18]	Not RCT
Gurpinar et al., 2020 [19]	Spasticity not used as a specific outcome measure
Hofstoetter et al., 2021 [20]	Not RCT
Hughes et al., 2013 [21]	Not RCT
Hugos et al., 2019 [22]	Study protocol
Kovari et al., 2018 [23]	Not RCT
Kremer et al., 2014 [24]	Not RCT
Lam et al., 2019 [25]	Not RCT
Luque-Moreno et al., 2020 [26]	Study protocol
Manca et al., 2020 [27]	Not RCT
Mazzei et al., 2014 [28]	Spasticity not used as a specific outcome measure
Moss-Morris et al., 2012 [29]	Spasticity not used as a specific outcome measure
Motamedzadeh et al., 2021 [30]	Study protocol
Munoz-Lasa et al., 2019 [31]	Not RCT
Norbye et al., 2020 [32]	Not RCT
Ozkan et al., 2023 [33]	Not RCT
Pau et al., 2015 [34]	Not RCT
Pompa et al., 2017 [35]	Spasticity not used as a specific outcome measure
Salbas et al., 2022 [36]	Spasticity not used as a specific outcome measure
Sakel et al., 2022 [37]	Not RCT
Schatz et al., 2014 [38]	Spasticity not used as a specific outcome measure
Seebacher et al., 2017 [39]	Spasticity not used as a specific outcome measure
Smith et al., 2023 [40]	Not RCT
Solaro et al., 2020 [41]	Spasticity not used as a specific outcome measure
Spina et al., 2016 [42]	Spasticity not used as a specific outcome measure
Uszynski et al., 2016 [43]	Spasticity not used as a specific outcome measure
Ventura et al., 2022 [44]	Not RCT
Vermersch, 2014 [45]	Not RCT
Wens et al., 2015 [46]	Spasticity not used as a specific outcome measure
Williams et al., 2021 [47]	Spasticity not used as a specific outcome measure
Wollenwerber et al., 2016 [48]	Spasticity not used as a specific outcome measure
Yamaguchi et al., 2018 [49]	Not RCT

RCT, randomised controlled trial.

## REFERENCES (excluded studies)

- [1] Abreu-Corrales A, Velasco A, Cuesta-Gomez A, Sanchez-Gonzalez JL. Impact of reflex locomotion and the Bobath concept on clinical and biomolecular parameters in people with multiple sclerosis: study protocol for a randomized controlled trial. *Front Neurol* 2023; 14: 1209477.
- [2] Ayache SS, Riachi N, Ahdab R, Chalah MA. Effects of transcranial direct current stimulation on hand dexterity in multiple sclerosis: a design for a randomized controlled trial. *Brain Sci* 2020; 10.
- [3] Barclay A, Paul L, MacFarlane N, McFadyen AK. The effect of cycling using active-passive trainers on spasticity, cardiovascular fitness, function and quality of life in people with moderate to severe Multiple Sclerosis (MS); a feasibility study. *Mult Scler Related Disord* 2019; 34: 128-34.
- [4] Backus D, Manella C, Bender A, Sweatman M. Impact of massage therapy on fatigue, pain, and spasticity in people with multiple sclerosis: a pilot study. *Int J Therap Massage Bodywork* 2016; 9: 4-13.
- [5] Baroni A, Lamberti N, Gandolfi M, Rimondini M, Bertagnolo V, Grassilli S, et al. Traditional versus progressive robot-assisted gait training in people with multiple sclerosis and severe gait disability: study protocol for the PROGR-EX randomized controlled trial. *BMJ Open Sport Exerc Med* 2024; 10: e002039.
- [6] Berriozabalgoitia R, Sanz B, Fraile-Bermudez AB, Otxoa E, Yeregui I, Bidaurrazaga-Letona I, et al. An overground robotic gait training program for people with multiple sclerosis: a protocol for a randomized clinical trial. *Front Med (Lausanne)* 2020; 7: 238.
- [7] Castro-Sanchez AM, Mataran-Penarrocha GA, Lara-Palomo I, Saavedra-Hernandez M, Arroyo-Morales M, Moreno-Lorenzo C. Hydrotherapy for the treatment of pain in people with Multiple Sclerosis: a randomized controlled trial. *Evidence-Based Complement Altern Med* 2012; 2012: 2473963.
- [8] Cattaneo D, Rasova K, Gervasoni E, Dobrovodska G, Montesano A, Jonsdottir J. Falls prevention and balance rehabilitation in multiple sclerosis: a bi-centre randomized controlled trial. *Disabil Rehabil* 2018; 40: 522-26.
- [9] Choobsaz H, Ghotbi N, Ansari NN. Effects of dry needling on spasticity, cortical excitability, and range of motion in a patient with multiple sclerosis: a case report. *J Med Case Rep* 2024; 18: 125.
- [10] Criado MB, Santos MJ, Machado J, Goncalves AM, Greten HJ. Effects of Acupuncture on Gait of Patients with Multiple Sclerosis. *J Altern Complement Med* 2017; 23: 852-7.
- [11] Englund S, Piehl F, Kierkegaard M. High-intensity resistance training in people with multiple sclerosis experiencing fatigue: a randomized controlled trial. *Mult Scler Relat Disord* 2022; 68: 104106.
- [12] Eyssen I, Steultjens MPM, de Groot V, Steultjens EMJ, Knol DL, Polman CH. A cluster randomized controlled trial on the efficacy of client-centred occupational therapy in multiple sclerosis: good process, poor outcome. *Disabil Rehabil* 2013; 35: 1636-46.
- [13] Fernandez O. Advances in the management of multiple sclerosis spasticity: recent clinical trials. *Eur Neurol* 2014; 72 Suppl 1: 9-11.
- [14] Fernandez O, Costa-Frossard L, Martinez-Gines ML, Montero P, Prieto-Gonzalez JM, Ramio-Torrenta L. Integrated management of Multiple Sclerosis spasticity and associated symptoms using the Spasticity-Plus Syndrome Concept: results of a structured specialists' discussion using the Workmat((R)) methodology. *Front Neurol* 2021; 12: 722801.
- [15] Flachenecker P, Henze T, Zettl UK. Spasticity in patients with multiple sclerosis--clinical characteristics, treatment and quality of life. *Acta Neurologica Scandinavica* 2014; 129: 154-62.
- [16] Finkelstein J, Liu J. Usability of Telerehabilitation System Supporting Multipronged Exercise in Patients with Multiple Sclerosis. *Stud Health Technol Inform* 2018; 251: 281-4.
- [17] Gaede G, Tiede M, Lorenz I, Brandt AU, Pfueller C, Dörr J. Safety and preliminary efficacy of deep transcranial magnetic stimulation in MS-related fatigue. *Neurol Neuroimmunol Neuroinflamm* 2018; 5: e423.
- [18] Greco T, Poole EM, Young AC, Alexander JK. Application of the Bayesian network theory in clinical trial data: Severity shift in spasticity numeric rating scale in patients with multiple sclerosis. *Mult Scler Relat Disord* 2024; 83: 105466.
- [19] Gurpınar B, Kara B, Idiman E. Effects of aquatic exercises on postural control and hand function in multiple sclerosis: Halliwick versus aquatic plyometric exercises: a randomized trial. *J Musculoskel Neuron Interact* 2020; 20: 149-53.
- [20] Hofstoetter US, Freundl B, Lackner P, Binder H. Transcutaneous spinal cord stimulation enhances walking performance and reduces spasticity in individuals with Multiple Sclerosis. *Brain Sci* 2021; 11: 472.
- [21] Hughes C, Howard IM. Spasticity management in multiple sclerosis. *Physical Medicine and Rehabil Clinics North*

Am 2013; 24: 593-604.

- [22] Hugos C, Cameron M. Evaluation of a spasticity management program for people with multiple sclerosis: full-scale study protocol. *Mult Scler J* 2019; 25: 1032.
- [23] Kovari M, Pokorna A. Treatment of spasticity in patients with multiple sclerosis by using method of electrical stimulation according to Jantsch-a pilot study. *Mult Scler J* 2018; 24: 969-70.
- [24] Kremer TR, Van Dillen LR, Wagner JM. Dynamometer-based measure of spasticity confirms limited association between plantar flexor spasticity and walking function in persons with multiple sclerosis. *J Rehabil Res Develop* 2014; 51: 975-84.
- [25] Lam CM, Monroe BR. Successful treatment of central pain and spasticity in patient with multiple sclerosis with dorsal column, paresthesia-free spinal cord stimulator: a case report. *A A Practice* 2019; 12: 308-12.
- [26] Luque-Moreno C, Granja-Dominguez A, Moral-Munoz JA, Izquierdo-Ayuso G, Lucena-Anton D, Heredia-Rizo AM. Effectiveness of dry needling versus placebo on gait performance, spasticity, electromyographic activity, pain, range-of-movement and quality of life in patients with multiple sclerosis: a randomized controlled trial protocol. *Brain Sci* 2020; 10.
- [27] Manca A, Martinez G, Aiello E, Ventura L, Deriu F. Effect of eccentric strength training on elbow flexor spasticity and muscle weakness in people with Multiple Sclerosis: proof-of-concept single-system case series. *Phys Ther* 2020; 100: 1142-52.
- [28] Mazzei G, Giovannelli T. Kinesio Taping does not improve standing balance in subjects with multiple sclerosis: a pilot single blind, randomised controlled trial. *Italian Journal of Physiother* 2014; 4: 84-9.
- [29] Moss-Morris R, McCrone P, Yardley L, van Kessel K, Wills G, Dennison L. A pilot randomised controlled trial of an internet-based cognitive behavioural therapy self-management programme (MS Invigor8) for multiple sclerosis fatigue. *Behav Res Ther* 2022; 50: 415-21.
- [30] Motamedzadeh O, Ansari NN, Naghdi S, Azimi A, Mahmoudzadeh A, Calvo S, et al. A Study on the effects of dry needling in multiple sclerosis patients with spasticity: protocol of a randomized waitlist-controlled trial. *J Acupunct Meridian Stud* 2021; 14: 82-8.
- [31] Munoz-Lasa S, Lopez de Silanes C, Atin-Arratibel MA, Bravo-Llatas C, Pastor-Jimeno S, Maximo-Bocanegra N. Effects of hippotherapy in multiple sclerosis: pilot study on quality of life, spasticity, gait, pelvic floor, depression and fatigue. *Medical Clinic* 2019; 152: 55-8.
- [32] Norbye AD, Midgard R, Thrane G. Spasticity, gait, and balance in patients with multiple sclerosis: A cross-sectional study. *Physiother Res Int* 2020; 25: e1799.
- [33] Ozkan I, Polat Dunya C, Demir S. Life experiences of patients with Multiple Sclerosis about their spasticity: a phenomenological study. *Clin Nurs Res* 2023; 32: 49-59.
- [34] Pau M, Coghe G, Corona F, Marrosu MG, Cocco E. Effect of spasticity on kinematics of gait and muscular activation in people with Multiple Sclerosis. *J Neurol Sci* 2015; 358: 339-44.
- [35] Pompa A, Morone G, Iosa M, Pace L, Catani S, Casillo P. Does robot-assisted gait training improve ambulation in highly disabled multiple sclerosis people? A pilot randomized control trial. *Mult Scler* 2017; 23: 696-703.
- [36] Salbaş E, Karahan AY. Effects of hippotherapy simulation exercise vs. conventional home exercises on muscle strength and balance in people with multiple sclerosis: a randomized controlled trial. *Mult Scler Relat Disord* 2022; 68: 104111.
- [37] Sakel M, Saunders K, Hodgson P, Stephensen D, Phadke CP, Bassett PA, et al. Feasibility and Safety of a Powered Exoskeleton for Balance Training for People Living with Multiple Sclerosis: A Single-Group Preliminary Study (Rapper III). *J Rehabil Med* 2022; 54: jrm00357.
- [38] Schatz L, Boswell S, Eitel A, Gusowski K, Flachenecker P. Hippotherapy in multiple sclerosis - Results of a prospective, controlled, randomized single-blind trial and review of the literature. *Neurol Rehabil* 2014; 20: 246-52.
- [39] Seebacher B, Kuisma R, Glynn A, Berger T. The effect of rhythmic-cued motor imagery on walking, fatigue and quality of life in people with multiple sclerosis: a randomized controlled trial. *Mult Scler J* 2017; 23: 286-96.
- [40] Smith KA, Piehl F, Olsson T, Alfredsson L, Hillert J, Kockum I, et al. Spasticity treatment patterns among people with multiple sclerosis: a Swedish cohort study. *J Neurol Neurosurg Psychiat* 2023; 94: 337-48.
- [41] Solaro C, Cattaneo D, Basteris A, Carpinella I, de Luca A, Mueller M. Haptic versus sensorimotor training in the treatment of upper limb dysfunction in multiple sclerosis: a multi-center, randomised controlled trial. *J Neurol Sci* 2020; 412: 116743.
- [42] Spina E, Carotenuto A, Aceto MG, Cerillo I, Silvestre F, Arace F. The effects of mechanical focal vibration on walking impairment in multiple sclerosis patients: A randomized, dou-

ble-blinded vs placebo study. *Restorat Neurol Neurosci* 2016; 34: 869-76.

[43] Uszynski MK, Purtill H, Donnelly A, Coote S. Comparing the effects of whole-body vibration to standard exercise in ambulatory people with multiple sclerosis: a randomized controlled feasibility study. *Clin Rehabil* 2016; 30: 657-68.

[44] Ventura L, Martinez G, Aiello E, Zeevi Dvir Z, Deriu F, Manca A. Isokinetic resistance training for ankle plantar flexor spasticity and muscle weakness in people with multiple sclerosis: a proof-of-concept case series. *Phys Ther* 2022; 103: 146.

[45] Vermersch P. MObility ImproVEment with spasticity in multiple sclerosis in Europe: the MOVE 1 EU study. *Neurodegen Disord Manag* 2014; 4: 407-15.

[46] Wens I, Dalgas U, Enabeele F, Grevendonk L, Verboven K, Hansen D. High intensity exercise in multiple sclerosis: effects on muscle contractile characteristics and exercise

capacity, a randomised controlled trial. *PLoS ONE* 2015; 10: e0133697.

[47] Williams K, Low Choy NL, Brauer SG. Center-based group and home-based individual exercise programs have similar impacts on gait and balance in people with multiple sclerosis: a randomized trial. *Phys Med Rehabil* 2021; 13: 9-18.

[48] Wollenweber V, Drache M, Schickendantz S, Gerber-Grote A, Schiller P, Pohlau D. Study of the effectiveness of hippotherapy on the symptoms of multiple sclerosis - Outline of a randomised controlled multicentre study (MS-HIPPO). *Contemp Clin Trial Commun* 2016; 3: 6-11.

[49] Yamaguchi T, Hvass Petersen T, Kirk H, Forman C, Svane C, Kofoed-Hansen M. Spasticity in adults with cerebral palsy and multiple sclerosis measured by objective clinically applicable technique. *Clin Neurophysiol* 2018; 129: 2010-21.