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Water-Based Exercise As a Multidimensional Non-Pharmacological Intervention In Fibromyalgia Treatment: A Narrative Review

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ABSTRACT

Background. Fibromyalgia, as a multidimensional syndrome, requires interventions that target multiple aspects of the disease simultaneously. This complexity underscores the importance of non-pharmacological strategies aimed at improving patients' overall well-being. Among such interventions, aquatic therapy represents a structured form of physical activity, which offers additional therapeutic benefits related to the physical properties of water.

Aim. The purpose of this study is to evaluate the therapeutic efficacy of aquatic therapy as a part of non-pharmacological management of fibromyalgia.

Material and methods. This narrative review was conducted using PubMed and Google Scholar as the main sources of examined studies, including meta-analyses, systematic reviews and clinical trials.

Results. Studies consistently show that hydrotherapy is associated with clinically meaningful improvements in core fibromyalgia symptoms, including pain, functional capacity and psychological well-being.

Conclusions. Aquatic exercise positively influences physical function and psychological well-being in patients with fibromyalgia syndrome. As a non-pharmacological treatment, it may be effectively incorporated into multimodal care strategies. Future research should focus on the long-term effects of hydrotherapy and the development of standardized aquatic exercise protocols for patients with FMS.

Keywords: fibromyalgia, aquatic therapy, hydrotherapy, pain, quality of life

1. Introduction

Fibromyalgia is a chronic illness, whose main symptom and one of the primary diagnostic criteria is persistent musculoskeletal pain (1). Its estimated prevalence is approximately 2.7%, with women constituting the majority of affected individuals (2,3). Apart from the pain, patients report other somatic ailments, such as joint and muscle stiffness or headaches. Psychological manifestations, including sleep deprivation, psychiatric symptoms or fatigue, also represent an integral part of everyday life in patients with FMS (1,4). The psychosomatic dimension of the disease is therefore of substantial importance (3). The complexity of symptoms leads to a significant reduction in quality of life, affecting family relationships as well as professional work (5).

According to available epidemiological data, the majority of patients with fibromyalgia seek non-pharmacological forms of treatment (1). This is consistent with current clinical guidelines, as pharmacological therapy is recommended as a second-line, individualized approach, implemented when first-line non-pharmacological strategies prove insufficient (6). The most commonly used medications include antidepressants, myorelaxants and opioids (7). According to EULAR 2016 recommendations for the management of fibromyalgia, physical activity performed both on land and in a water environment is considered effective in treating this condition and is the only intervention that received a “strong for” recommendation (6). Physical exercise reduces pain perception, improves sleep quality and mental health, and enhances functional capacity. Improvement across these ailments collectively contribute to better overall quality of life (8). One of the main limitations of land-based exercise in FMS patients may be safety. The risk of falls is higher compared with activity performed in an aquatic environment (9).

Aquatic exercise appears to be a particularly promising therapeutic strategy in fibromyalgia because of its additional effects exerted by water on the human body (10). The physical properties of water facilitate reduced joint stress, increased muscle engagement and improved circulation. Aerobic capacity is another parameter that may be enhanced in this special exercise environment (11). Hydrotherapy is generally regarded as a well-tolerated form of physical activity for individuals with musculoskeletal disorders (12,13).

Although several studies have reported statistically significant outcomes of aquatic exercise in fibromyalgia management, the current evidence base remains fragmented (14). The number of adequate randomized clinical trials is still limited.

This narrative review focuses on the therapeutic role of aquatic exercise as a supportive element of fibromyalgia management. It presents how exercise in a water environment may influence the main symptoms of this disease, and general patients' functioning. Particular attention is given to the advantages of hydrotherapy, including safety and tolerance, as the potential advantage over land-based activities taken by individuals with FMS.

2. Research materials and methods

This narrative review was conducted using PubMed and Google Scholar databases to identify relevant literature on aquatic therapy in fibromyalgia. Systematic reviews, meta-analyses and randomized controlled trials published in English were considered. The search covered articles published from 2004 up to 2026. Older randomized controlled trials were included to capture foundational evidence, whereas recent systematic reviews and meta-analyses were prioritized to reflect current clinical knowledge. Studies focusing on the effects of hydrotherapy on pain, sleep quality, mental health, functional capacity and quality of life were included. Articles were selected based on relevance to the topic and methodological quality. In this paper, the terms „fibromyalgia", „fibromyalgia syndrome, „FMS" are used alternatingly, as well as terms „aquatic exercise", „hydrotherapy" and „water-based exercise".

3. Results

3.1 Mechanisms underlying the effects of aquatic therapy

Recent literature on hydrotherapy highlights its primary effects on the nervous system, which secondarily influence musculoskeletal function (15). Aquatic therapy utilizes properties of water such as buoyancy, resistance, hydrostatic pressure, and thermal conductivity, to create a unique exercise environment that may alleviate the symptoms of patients with fibromyalgia.

These features make water-based exercises a well-tolerated and potentially beneficial component in the FM treatment (10).

Buoyancy

Water exhibits a higher than humans' body and relatively stable density, generating buoyant forces that counteract gravity. In accordance with Archimedes' principle, this buoyancy results from water displacement during immersion and permits the human body to float when submerged (11). Consequently, reduced effective body weight during water immersion contributes to a decrease in mechanical load exerted on articular structures, as observed in vivo measurements of joint forces during aquatic exercise (16). This reduction in joint stress may be particularly beneficial for patients experiencing pain, which allows them to participate in physical activity more safely than in a land-based environment (13).

Resistance

Movement in water is naturally resisted by the surrounding fluid, which increases muscular demands and leads to greater muscle engagement compared with land based-exercise (11). It may be especially beneficial for individuals with fibromyalgia who experience balance deficits as the enhanced muscle strength improves postural control (3,17). Resistance increases proportionally with movement speed, meaning that faster movements generate greater resistance, enabling patients to autonomously regulate exercise intensity to their physical abilities (10).

Hydrostatic pressure

Aquatic exercise affects not only the musculoskeletal system but also the cardiovascular and respiratory systems. Hydrostatic pressure during water immersion promotes central redistribution of blood volume and increases the work of breathing, which modifies physiological response to physical activity (11). Sensation of swelling is one of the symptoms that patients' with FMS complain about, hydrotherapy may provide additional benefits for these individuals by reducing edema through the effects of hydrostatic pressure (18,19).

Thermal conductivity

Due to its molecular structure, water exhibits high thermal conductivity, enabling rapid heat exchange with the body and influencing tissue temperature and physiological responses (10,11). Immersion in warm water is associated with reduced pain perception and increased muscle

relaxation as a result of vasodilation and improved circulation, which may be particularly beneficial for patients with fibromyalgia (20,21). In addition, warm water may stimulate the parasympathetic nervous system, potentially improving sleep quality in individuals performing aquatic exercise (14). In contrast, cold water exposure may reduce muscle inflammation, a factor considered to contribute to pain in patients with FMS (1,11).

3.2 Clinical effects of aquatic exercise

The findings suggest that aquatic exercise is an effective intervention for women with fibromyalgia, providing multidimensional benefits not only on physical function but also on psychological health (21). Importantly, the reviewed studies consistently report that hydrotherapy interventions are well tolerated, with few adverse events and high adherence among patients with FMS (13,14,20).

To standardise the reporting of clinical outcomes, validated instruments were used to assess the key domains of fibromyalgia symptomatology. Pain intensity was evaluated using the Visual Analogue Scale (VAS), in which patients rate their pain on a scale from 0 to 100 (21). Quality of life was assessed with Fibromyalgia Impact Questionnaire (FIQ), measuring pain, fatigue and limitations in daily activities (22). Functional capacity was measured using the 6-Minute Walk Test (6MWT), where patients are asked to walk as far as they are able to in six minutes (21). Mental health was assessed with the Beck Depression Inventory (BDI), a questionnaire assessing symptoms of depression (23). Sleep quality was evaluated using the Pittsburgh Sleep Quality Index (PSQI), consisting of questions about patients' sleep quality during the preceding month (24). For all validated instruments except the 6MWT, higher scores indicate greater severity, whereas in the 6MWT higher values reflect better functional capacity.

Pain reduction

Chronic musculoskeletal pain is the hallmark symptom of fibromyalgia, affecting multiple body regions and significantly impacting patients' overall health (1). In a randomized controlled trial of 75 women with FMS, the effects of aquatic aerobic exercise were compared with aerobic gymnastics and isometric strength-stretching on land. Although all three programmes produced significant pain reduction, the greatest decrease in VAS scores was observed in the aquatic exercise group (21). Furthermore, a 6-week follow-up in another clinical study demonstrated that pain relief was maintained longer in the hydrotherapy group than in the land-based group, suggesting sustained analgesic benefits of water-based exercise (24). Overall, current evidence

suggests that aquatic therapy provides clinically meaningful pain relief in patients with fibromyalgia syndrome, likely due to a combination of neuropsychological and biomechanical mechanisms associated with water immersion and physical activity (10, 25).

Better quality of life

The complexity of fibromyalgia syndrome affects many aspects of patients daily lives, including family relationships, social activities and professional work (5). Participants assigned to the hydrotherapy programme in a chest-high pool, demonstrated a clinically and statistically meaningful reduction in Fibromyalgia Impact Questionnaire (FIQ) score, reflecting improvement in functional status and symptom burden (26). Comparable effects were observed after a 6-week self-management intervention, which included aquatic exercise and patient education. Improvements in quality of life, assessed by the FIQ were maintained for the next 6 weeks after the programme (27). Moreover, a 20-week randomized controlled trial demonstrated significantly greater improvements in FIQ scores in the group combining pool-based exercise with education compared with the education group alone (28). External factors such as weather conditions or air pollution may further influence quality of life in FMS, therefore reducing modifiable lifestyle-related aspects remains an important therapeutic goal (5).

Improved functional capacity

Patients affected by fibromyalgia demonstrate impaired functional capacity, characterized by low aerobic endurance, restricted mobility and reduced tolerance for everyday physical activities (23). A clinically meaningful improvement in functional capacity, assessed using the 6-Minute Walk Test (6MWT), was observed following aquatic exercise intervention, with a small but persistent benefit maintained at 11-12 months of follow-up. Notably, the authors selected pool-based exercise as the preferred modality for patients with fibromyalgia, emphasizing its feasibility and acceptability in this population (28). Consistent results were reported in another randomized clinical study, where improvements in functional capacity in the aquatic aerobic exercise group were greater than in patients undertaking land-based exercise programmes (21). Meta-analytic data further suggest that hydrotherapy enhances overall aerobic performance, thereby supporting cardiovascular function in individuals with fibromyalgia (29).

The mental health improvement

Depression, anxiety and stress-related disorders are highly prevalent among patients with fibromyalgia, with anxiety present in over 60% and depression in nearly 40% of cases. These statistics are highlighting the frequent co-occurance of psychological issues in this population (30). A controlled clinical study demonstrated a reduction in depressive symptoms, measured in Beck Depression Inventory (BDI), across exercise programmes on land and in the water environment. Aquatic therapy showed the most marked reduction in BDI scores, compared with land-based interventions (21). Furthermore, in a subsequent controlled study, with 11-12 months follow up, there was an interesting association observed: patients with lower perceived stress levels demonstrated greater and statistically significant improvements in FIQ scores compared with controls. These findings indicate that psychological well-being may modulate the overall impact of FM and enhance the benefits of interventions such as aquatic therapy (28).

Better sleep

Sleep disturbances are a common and relevant feature of fibromyalgia, contributing to heightened pain sensitivity, mood disorders and overall symptom severity (1,31). Evidence from a controlled clinical study demonstrates that participation in a 12-week aquatic exercise programme performed three times a week is associated with a clinically significant improvement in sleep quality compared with training on the land. Patients engaged in hydrotherapy demonstrated significantly lower PSQI scores following the intervention compared with baseline values (24). Consistent results were noted in another randomized controlled trial, where patients were engaged in a warm-pool, 16-week training routine (26). In a quasi-experimental study of women with fibromyalgia a 24-week water-based exercise programme significantly reduced general fatigue and improved global sleep quality compared to controls (32). These findings are supported by a large meta-analysis, suggesting that individuals with FMS experiencing sleep disturbances may particularly benefit from regular aquatic exercise (33).

3.3 Discussion

The physical properties of water interact with various receptors, and both their activation and inhibition appear to underline clinical effects. One of the key mechanisms involved in pain generation in fibromyalgia is the persistent activation of the nociceptive pathways (1). Immersion in warm water combined with buoyancy may reduce nociceptor activity, which can partially explain the analgesic effect of aquatic therapy (10).

Beyond pain reduction, aquatic exercise appears to improve overall functional capacity and mental well-being. The controlled clinical trials discussed in the paper showed significant improvement in reducing symptoms, but the number of such studies is certainly not sufficient. The available findings indicate that these benefits in individuals with FMS, are best maintained through regular and continuous participation in aquatic exercise programmes (23). In one controlled trial, almost half of the participants continued hydrotherapy independently for up to 12 months after completing a 16-week supervised warm-water programme, despite the lack of further encouragement (26). The favourable tolerability and safety characteristics of aquatic interventions are likely to promote long-term engagement in therapy and sustained clinical benefits in patients with fibromyalgia.

Economic aspects are becoming increasingly important in evaluating therapeutic interventions for fibromyalgia. A randomized controlled trial showed that incorporating an 8-month aquatic exercise programme into usual care of these patients significantly improved health-related quality of life, expressed in QALY(Quality Adjusted Life Years, a measure combining both length and quality of life). The intervention, consisting of supervised 1-hour water-based exercise sessions performed three times a week, was cost-effective from both healthcare and societal perspectives (34). These findings suggest that aquatic therapy may represent not only clinically beneficial but also an economically reasonable treatment option, although further studies are required to confirm its cost-effectiveness in larger populations.

3.4 Conclusion

The evidence gathered in this narrative review confirms that aquatic exercise is a safe, well-tolerated and multifaceted non-pharmacological intervention in fibromyalgia syndrome. The main advantage of hydrotherapy is its simultaneous influence on several core clinical symptoms, including pain, functional capacity, mental health and sleep quality, which results from the physical properties of water. Regular participation in aquatic programmes appears to support the beneficial effects over time and may improve adherence to the therapy.

Despite the promising results presented in this narrative review, further high-quality randomized controlled trials are needed to establish standardized aquatic exercise protocols and to determine the long term effects of hydrotherapy in fibromyalgia management.

Disclosures:

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Bibliography

1. Siracusa R, Di Paola R, Cuzzocrea S, Impellizzeri D. (2021). Fibromyalgia: Pathogenesis, mechanisms, diagnosis and treatment options update. *International Journal of Molecular Sciences*, *22*(8), 3891. https://doi.org/10.3390/ijms22083891

2. Moore A, Bidonde J, Fisher E, Häuser W, Bell R F, Perrot S, Makri S, Straube S. (2024). Effectiveness of pharmacological therapies for fibromyalgia syndrome in adults: an overview of Cochrane Reviews. *Lara D. Veeken*, *64*(5), 2385–2394. https://doi.org/10.1093/rheumatology/keae707

3. Núñez-Fuentes D, Obrero-Gaitán E, Zagalaz-Anula N, Ibáñez-Vera A J, Achalandabaso-Ochoa A, Del Carmen López-Ruiz M, Rodríguez-Almagro D, Lomas-Vega R. (2021). Alteration of Postural Balance in Patients with Fibromyalgia Syndrome—A Systematic Review and Meta-Analysis. *Diagnostics*, *11*(1), 127. https://doi.org/10.3390/diagnostics11010127

4. Drozd M, Marzęda M, Blicharz A, Czarnota J, Piecewicz-Szczęsna H. (2020). Unclear etiology and current hypotheses of the pathogenesis of fibromyalgia. *Journal of Education, Health and Sport*, 10(9), 338–344. https://doi.org/10.12775/JEHS.2020.10.09.038

5. Iannuccelli C, Favretti M, Dolcini G, Di Carlo M, Pellegrino G, Bazzichi L, Atzeni F, Lucini D, Varassi G, Leoni M L G, Fornasari D M M, Conti F, Salaffi F, Puttini P S, Di Franco M. (2025). Fibromyalgia: one year in review 2025. *Clinical and Experimental Rheumatology*, *43*(6), 957–969. https://doi.org/10.55563/clinexprheumatol/buhd2z

6. Macfarlane G J, Kronisch C, Dean L E, Atzeni F, Häuser W, Fluß E, Choy E, Kosek E, Amris K, Branco J, Dincer F, Leino-Arjas P, Longley K, McCarthy G M, Makri S, Perrot S, Sarzi-Puttini P, Taylor A, Jones G T. (2017). EULAR revised recommendations for the management of fibromyalgia. *Annals of the Rheumatic Diseases, 76(2)*, 318–328. https://doi.org/10.1136/annrheumdis-2016-209724

7. Bujak M, Rulewska N, Grabowski F, Siemko J, Neska D, Prystacka-Szar D, Stadler-Szajda J, Czyżnikiewicz A, Stołowski W, Waśniowska M. (2025). Treatment of Fibromyalgia – duloxetine or pregabalin? *Journal of Education, Health and Sport*, 80, 57856. https://doi.org/10.12775/JEHS.2025.80.57856

8. González-Álvarez M E, Riquelme-Aguado V, Rossettini G, Fernández-Carnero J, Villafañe J H. (2024). Exercise Intervention in Women with Fibromyalgia and Its Influence on Pain, Psychological Variables, and Disability: An Observational Study. *Life*, *15*(1), 40. https://doi.org/10.3390/life15010040

9. Kim Y, Vakula M N, Waller B, Bressel E. (2020). A systematic review and meta-analysis comparing the effect of aquatic and land exercise on dynamic balance in older adults. *BMC Geriatrics*, *20*(1), 302. https://doi.org/10.1186/s12877-020-01702-9

10. Zamunér A R, Andrade C P, Arca E A, Avila M A. (2019). Impact of water therapy on pain management in patients with fibromyalgia: current perspectives. *Journal of Pain Research, Volume 12*, 1971–2007. https://doi.org/10.2147/jpr.s161494

11. Torres-Ronda L, Del Alcázar X S I. (2014). The Properties of Water and their Applications for Training. *Journal of Human Kinetics*, *44*(1), 237–248. https://doi.org/10.2478/hukin-2014-0129

12. Waller B, Ogonowska-Słodownik A, Vitor M, Rodionova K, Lambeck J, Heinonen A, Daly D. (2016). The effect of aquatic exercise on physical functioning in the older adult: a systematic review with meta-analysis. *Age And Ageing*, *45*(5), 594–602. https://doi.org/10.1093/ageing/afw102

13. Altowairqi W M, Alshanbari M A, Attiah N T, Radwan M H, Al Jassas T M A, Mathkoor O H, Alsufyani T M, Alsufyani F M, Alzhrany F A. (2022). Evaluating the effectiveness of aquatic therapy in musculoskeletal conditions. *Journal of Population Therapeutics and Clinical Pharmacology, 29(04)*, 3159–3164. https://doi.org/10.53555/jptcp.v29i04.5812

14. Langhorst J, Musial F, Klose P, Hauser W. (2009). Efficacy of hydrotherapy in fibromyalgia syndrome--a meta-analysis of randomized controlled clinical trials. *Lara D. Veeken*, *48*(9), 1155–1159. https://doi.org/10.1093/rheumatology/kep182

15. Iłżecka J. (2015). Hydrotherapy in nervous system diseases. *Physiotherapy and Health Activity*, 23(1), 33–38. https://doi.org/10.12775/PPS.2015.05.01.005

16. Kutzner I, Richter A, Gordt K, Dymke J, Damm P, Duda G N, Günzl R, Bergmann G. (2017). Does aquatic exercise reduce hip and knee joint loading? In vivo load

measurements with instrumented implants. *PLoS ONE*, *12*(3), e0171972. https://doi.org/10.1371/journal.pone.0171972

17. Neira S R, Marques A P, Pérez I P, Cervantes R F, Costa J. V. (2017). Effectiveness of Aquatic Therapy vs Land-based Therapy for Balance and Pain in Women with Fibromyalgia: a study protocol for a randomised controlled trial. *BMC Musculoskeletal Disorders*, *18*(1), 22. https://doi.org/10.1186/s12891-016-1364-5

18. Galvez-Sánchez C M, Del Paso G A R. (2020). Diagnostic criteria for fibromyalgia: Critical review and future perspectives. *Journal of Clinical Medicine*, *9(4)*, Article 1219. https://doi.org/10.3390/jcm9041219

19. Mooventhan A, Nivethitha L. (2014). Scientific evidence-based effects of hydrotherapy on various systems of the body. *North American Journal of Medical Sciences*, *6*(5), 199. https://doi.org/10.4103/1947-2714.132935

20. Ferreira J C, Melo M M C, De Jesus Pereira Barros R, De Lima Sipaúba L R. (2025). Effects of aquatic physiotherapy on pain and sleep quality in women with fibromyalgia: a Pre-Post study. *Physiotherapy Research International*, *31*(1), e70150. https://doi.org/10.1002/pri.70150

21. Sevimli D, Kozanoglu E, Guzel R, Doganay A. (2015). The effects of aquatic, isometric strength-stretching and aerobic exercise on physical and psychological parameters of female patients with fibromyalgia syndrome. *Journal of Physical Therapy Science*, *27*(6), 1781–1786. https://doi.org/10.1589/jpts.27.1781

22. Zhang K, Wang L, Zhang Z, Zhang D, Lin X, Meng T, Qi F. (2022). Effect of Exercise Interventions on Health-Related Quality of Life in Patients with Fibromyalgia Syndrome: A Systematic Review and Network Meta-Analysis. *Journal of Pain Research*, *Volume 15*, 3639–3656. https://doi.org/10.2147/jpr.s384215

23. Andrade C P, Zamunér A R, Forti M, Tamburús N Y, Silva E. (2019). Effects of aquatic training and detraining on women with fibromyalgia: controlled randomized clinical trial. *European Journal of Physical and Rehabilitation Medicine*, *55*(1), 79–88. https://doi.org/10.23736/s1973-9087.18.05041-4

24. Neira S R, Marques A P, Cervantes R F, Pillado M S, Costa J V. (2024). Efficacy of aquatic vs land-based therapy for pain management in women with fibromyalgia: a randomised controlled trial. *Physiotherapy*, *123*, 91–101. https://doi.org/10.1016/j.physio.2024.02.005

25. Rodríguez-Huguet M, Ayala-Martínez C, Góngora-Rodríguez P, Rosety-Rodríguez M Á, Martín-Valero R, Góngora-Rodríguez J. (2024). Aquatic Exercise in Physical Therapy Treatment for Fibromyalgia: Systematic Review. *Healthcare*, *12*(6), 701. https://doi.org/10.3390/healthcare12060701

26. Munguía-Izquierdo D, Legaz-Arrese A. (2008). Assessment of the effects of aquatic therapy on global symptomatology in patients with fibromyalgia syndrome: A randomized controlled trial. *Archives of Physical Medicine and Rehabilitation*, *89(12)*, 2250–2257. https://doi.org/10.1016/j.apmr.2008.03.026

27. Cedraschi C, Desmeules J, Rapiti E, Baumgartner E, Cohen P, Finckh A, Allaz A F, Vischer, T L. (2004). Fibromyalgia: A randomised, controlled trial of a treatment programme based on self management. *Annals of the Rheumatic Diseases*, *63(3)*, 290–296. https://doi.org/10.1136/ard.2002.004945

28. Mannerkorpi K, Nordeman L, Ericsson A, Arndorw M, Group G S. (2009). Pool exercise for patients with fibromyalgia or chronic widespread pain: A randomized controlled trial and subgroup analyses. *Journal of Rehabilitation Medicine*, *41*(9), 751–760. https://doi.org/10.2340/16501977-0409

29. Faíl L B, Marinho D A, Marques E A, Costa M J, Santos C C, Marques M C, Izquierdo M, Neiva H P. (2021). Benefits of aquatic exercise in adults with and without chronic disease—A systematic review with meta-analysis. *Scandinavian Journal of Medicine and Science in Sports*, *32*(3), 465–486. https://doi.org/10.1111/sms.14112

30. Rahangdale A, Ferraro J. (2025). Assessing comorbid PTSD, depression, and anxiety in fibromyalgia patients: a retrospective observational study. *BMC Psychiatry*, *25*(1), 444. https://doi.org/10.1186/s12888-025-06708-4

31. Bochenek O, Koper M, Nowak A, Kałuża J, Konaszczuk A, Ratyna K, *et al.* (2024). Beyond Pills: Synergizing Pharmacological and Physical Activity Interventions in Fibromyalgia Treatment. *Quality in Sport*, 19, 53279. https://doi.org/10.12775/QS.2024.19.53279

32. Gavilán-Carrera B, Borges-Cosic M, Álvarez-Gallardo I C, Soriano-Maldonado A, Acosta-Manzano P, Camiletti-Moirón D, Carbonell-Baeza A, Casimiro A J, Girela-Rejón M J, Walitt B, Estévez-López F (2023). Effectiveness of land- and water-based exercise on fatigue and sleep quality in women with fibromyalgia: the Al-Ándalus Quasi-Experimental Study. *Archives of Physical Medicine and Rehabilitation*, *104*(11), 1775–1784. https://doi.org/10.1016/j.apmr.2023.04.028

33. Bravo C, Rubí-Carnacea F, Colomo I, Sánchez-De-La-Torre M, Fernández-Lago H, Climent-Sanz C. (2023). Aquatic therapy improves self-reported sleep quality in fibromyalgia patients: a systematic review and meta-analysis. *Sleep and Breathing*, *28*(2), 565–583. https://doi.org/10.1007/s11325-023-02933-x

34. Gusi N, Tomas-Carus P. (2008). Cost-utility of an 8-month aquatic training for women with fibromyalgia: a randomized controlled trial. *Arthritis Research & Therapy*, *10*(1), R24. https://doi.org/10.1186/ar2377