

Overview on aquatic therapy in reducing pain and improving quality of life in patients with fibromyalgia¹Ilona Gracie De Souza, Lecturer, College of Physiotherapy Srinivas University, Mangaluru²Deeksha K, Physical therapy assistant, College of Physiotherapy, Srinivas University, Mangaluru³Pavan Kumar G, Principal, K.V.G Institute of Physiotherapy, Sullia**Corresponding Author:** Ilona Gracie De Souza, Lecturer, College of Physiotherapy Srinivas University, Mangaluru**Type of Publication:** Review Article**Conflicts of Interest:** Nil**Abstract**

Fibromyalgia syndrome (FMS) being the most prevalent rheumatologic syndrome characterized by increased pain sensitivity, alterations in sleep patterns, fatigue and symptoms that results from disturbances in the neurophysiologic function. Theories related to cause are under investigation. Current research states that biochemical, metabolic, and immune-regulatory abnormalities are associated with fibromyalgia. FMS has been a very challenging condition to treat at the present time due to its enormous etiological and psychological predispositions. Despite the enormous rehabilitation techniques the patients with fibromyalgia still experience excruciating pain and thus affecting their activities of daily living. Several, studies claimed low volunteer rates in programmes that accentuate on exercise, exponential number of drop outs or poor exercise compliance as a result of increased pain post exercise sessions. Recent studies have asserted that aquatic therapy would have a global impact on the participant's quality of life and treatment satisfaction along with improvement in the functional level and symptomatic consequences of fibromyalgia, as compared exercise programmes. The main purpose of this scoping review is to consider what evidence there is that would support the effectiveness of

aquatic therapy in alleviating pain and enhancing quality of life in patients with fibromyalgia syndrome.

Keywords: Aquatic therapy, Fibromyalgia, Hydrotherapy, Physical therapy, Pool based exercises, Quality of life.**Introduction**

Fibromyalgia is defined as a chronic (> 3 months) musculoskeletal condition characterized by generic muscular pain and fatigue. The disease affects the connective tissue and locomotor system. Sedentary women between 30–50 years of age are most commonly affected with incidence of 3.4% among women and 0.5% among men.¹ Secondary symptoms include increased fatigue levels, depressed state of mind, sleep disturbances and irritable bowel syndrome.² World Health Organization (WHO) first recognized FMS in 1992 that is characterized by widespread body pain and fatigue. American College of Rheumatology defined FMS as a chronic (> 3 months) condition with extensive pain on palpation of at least 11 (out of 18) tender point sites throughout the body.³ Fibromyalgia have controversial etiopathogenesis and multiple predisposing factors such as genetic, environmental and neuromodulatory factors.⁴

Pathophysiology

Alterations in sleep patterns and neuroendocrine transmitters give a clear explanation that the autonomic

system along with neuro-endocrine system could contribute as predisposing factors. Depression and anxiety being the most common factors. Aberrant pain processing, results in chronic pain, leading to several interplay mechanisms. Hypersensitivity in the central nervous system, blunting of inhibitory pain pathways and distortion in neurotransmitters lead to altered neuro-chemical processing in the central nervous system, thus reducing the pain threshold and exagegeration of normal sensory signals causing persistent pain.⁵

Studies have showed a high co-morbidity in patients with mood related disorders that signifies a major role played by the stress response and abnormalities in the neuro-endocrine system. The hypothalamic pituitary axis (HPA) plays a critical role in the stress adaptation response, thus alteration in this response can lead to stress induce symptoms. Psychiatric co-morbidity needs to be identified, as it needs to be considered during treatment.⁵

FMS is associated with changes in nervous system that affect sensory information processing, amplifying peripheral input and/or generating pain perception in the truancy of a noxious stimulus. Hyperactivity of the hypothalamic-pituitary-adrenal axis may be linked to the commencement or worsening of FMS symptoms. Dopamine dysfunctions have been associated to the pathophysiology of FMS, resulting in hyperalgesia and deficient pain inhibition.⁶

New ACR Diagnostic Criteria ⁵

New Diagnostic Criteria: The Diagnostic criteria in fibromyalgia patients’s include common symptoms such as fatigue, disturbance in sleep patterns, cognitive deficits as well as constant pain. Primary-care setting has replaced the tender point test with Widespread pain index and a Symptom severity (SS) score. A detailed physical examination is performed in accordance with diagnostic tests. During the examination patients (or their physician)

may state 19 body regions in which they have been experiencing pain for the past one week. One point is given for each area, with the total score of 19. This scoring is referred to as Widespread Pain Index (WPI) and that helps in the clinical diagnosis of fibromyalgia.

Second part involves evaluation of patient’s symptoms. Patient is requested to rank his/her symptoms on a scale of 0-3. Symptoms commonly include: Waking unrefreshed, Cognitive symptoms, Somatic (physical) symptoms in general (such as headache, numbness/tingling, weakness, bowel problems, nausea, dizziness, hair loss), Fatigue. The score assigned to each are summed up, for a total score of 0-12.

Thus the final diagnosis is based on combined use of the Widespread Pain Index score and the Symptom severity score either:

- WPI of at least 7 and SS scale score of at least 5, **OR**
- WPI of 3-6 and SS scale score of at least 9.

Fatigue	Waking unrefreshed	Cognitive symptoms
0 = No problem	0 = No problem	0 = No problem
1 = Mild/intermittent symptoms	1 = Mild/intermittent symptoms	1 = Mild/intermittent symptoms
2 = Moderate; considerable Problems; often present and/or moderate level	2 = Moderate; considerable Problems; often present and/or moderate level	2 = Moderate; considerable Problems; often present and/or moderate level
3 = severe: pervasive, continuous, Life disturbing problems	3 = severe: pervasive, continuous, Life disturbing problems	3 = severe: pervasive, continuous, Life disturbing problems

Laboratory Investigations⁵

Laboratory testing is performed in order to rule out various other disorders. Common laboratory investigations are complete blood count (CBC), thyroid-stimulating hormone (TSH), T3, T4, erythrocyte sedimentation rate (ESR), rheumatoid factor (RH), antinuclear antibody, creatinine phosphokinase. Additional tests such as serum muscle enzyme, vitamin D, Creatine reactive protein (CRP), renal and liver function tests. X-rays, specialized scans such as CT scan, nuclear medicine and muscle biopsy are the common radiographic scans done in patients suffering from fibromyalgia.

Aquatic therapy also known as pool therapy or hydrotherapy is defined by the Chartered Society of Physiotherapists as a therapy program designed by a qualified physiotherapist using the properties of water to improve function, ideally in a suitably heated pool.⁶ Nowadays health professionals strongly believe the use of non pharmacological therapy as the first choice of treatment, leaving the pharmacological therapy as the second line of treatment. This reveals the importance of researching and developing new forms of treatment for the subjects with fibromyalgia.⁷ The properties of aquatic physical therapy such as pressure and warmth of water facilitates ease of movement, reduces swelling and pain. However, the effects of water resistance (i.e., drag forces) increases energy expenditure and decrease mechanical loads on lower extremity joints. Rehabilitative clinicians should thoroughly understand the biomechanical and physiological responses of various modes of aquatic exercises. Deep water (DW) and shallow water (SW) exercise, water calisthenics (WC), and underwater treadmill (UT) exercise, balneotherapy, hydrokinesiotherapy are some of the most popular forms of aquatic exercise. Current literature has proved the effectiveness of various rehabilitation methods such as ground-based,

aerobic exercises, cognitive behavioural therapy, hot water spa balneotherapy, isokinetic strength stretching, aerobic and strengthening exercise, combined therapy (ultrasound and interferential therapy), myofascial release, massage and aquatic therapy for the management of reducing pain and improving quality of life (QOL) in patients with fibromyalgia.⁸ Despite the wide range of rehabilitation techniques the patients with fibromyalgia still experience excruciating pain and thus affecting activities of daily living. However, programmes emphasising exercise has low volunteer rates, increased drop outs or poor compliance as a result of excruciating pain after exercise. Recent studies stated that aquatic therapy would improve the participants quality of life and patient satisfaction with treatment in addition improving the functional and symptomatic consequences of FM, in comparison with exercise therapy.⁹ The purpose of this scoping review is to consider what evidence there is that would support the efficacy of aquatic therapy in alleviating pain and improving quality of life (QOL) in fibromyalgia population.

Method

Intensive literature search was conducted to determine the presence of related research within the databases: Cumulative Index to Nursing and Allied Health Literature (CINAHL), Google Scholar, PUBMED, Cochrane Library. Within these databases, the following search terms were paired and searched for within article titles and abstracts: aquatic therapy and fibromyalgia, aquatic therapy and quality of life, aquatic therapy/ hydrotherapy and pain.

First all articles found in the search were compiled; second duplicates within the databases and across databases were eliminated. Third, a title analysis of the remaining articles was conducted to include those with the following criteria: English language articles only, aquatic/

water based therapy, or presence of other search terms within the title. Fourth, detailed analysis of abstracts was conducted to further determine the relevance of the remaining articles. Irrelevant articles were eliminated using the following exclusion criteria: articles more than 10 years, opinion papers and a solely orthopaedic focus unrelated to fibromyalgia.

Review of Literature

1. Antonio I. Cuesta-Vargas & Nicola Adams (2011) conducted a pilot study to assess the effectiveness of a pool-based exercise using deep water running (DWR) as part of a multimodal physiotherapy programme in fibromyalgia subjects. 44 patients were recruited and allocated into experimental group that included DWR three times a week for an 8-week period and control group received a leaflet containing advice and continued with normal activities. Outcome measures were evaluated for physical function (Fibromyalgia Impact Questionnaire, FIQ), pain, general health (Short Form-12 Health Survey) and quality of life (European Quality of Life Scale-5D) pre- and post intervention. Experimental group showed statistically significant results for FIQ total score, incorporating physical function, pain, fatigue, stiffness and psychological variables ($p < 0.05$). However, both groups showed statistically significant differences for general health ($p < 0.05$) and quality of life ($p < 0.05$). Results suggest that multimodal programme incorporating DWR is a safe and effective intervention for fibromyalgia syndrome that is acceptable for FMS patients.¹⁰

2. Dilek Sevimli et al (2015) conducted a study to investigate the effects of aquatic, aerobic and isometric strength-stretching exercises on the physical, psychological parameters of patients with FMS. 75 female patients were

randomized into three groups. Patients were treated for duration of 3 months using one of three methods: a home-based isometric strength and stretching exercise program (ISSEP), a gym-based aerobic exercise program (AEP) and pool-based aquatic aerobic exercise program (AAEP). Outcomes were number of tender points, Visual Analog Scale (VAS), Fibromyalgia Impact Questionnaire (FIQ), Six-Minute Walk Test (6MWT), SF-36 physical and mental health scores, Beck Depression Inventory (BDI). Results showed that AAEP was the most effective treatment of the three. Significant improvements were observed in all three groups in all variables between pre-and post-test, except the mean values of VAS and BDI in ISSEP. The results suggest that aquatic aerobic exercise program is more effective than AEP and ISSEP in the treatment of FMS.¹

3. Johannes Naumann and Catharina Sadaghiani (2014) conducted a meta-analysis and systematic review to evaluate the different forms of balneotherapy (BT) and hydrotherapy (HT) in the management of fibromyalgia. Pubmed, Cochrane Central Register of Controlled Trials, EMBASE and CAMBASE were used as search engines. After evaluating the articles thoroughly, 11 Balneotherapy studies and 10 Hydrotherapy studies were taken. Meta-analysis showed moderate-to-strong evidence for a small reduction in pain ($P < 0.00001$; $I^2 = 0\%$) following hydrotherapy and moderate-to-strong evidence for a small improvement in health-related quality of life at the end of therapy ($P = 0.0004$; $I^2 = 15\%$). No effect was seen at the end of therapy for depressive symptoms and tender point count (TPC). BT in mineral/thermal water showed moderate evidence for a medium-to-large size reduction in pain and TPC at

the end of treatment $P=0.002$; $I^2=63\%$ and $P=0.006$; $I^2=71\%$. A significant effect on depressive symptoms was not found.²

4. Sagrario perez de la cruz and Johan lambeck (2016) conducted a pilot study to assess the effects of water-based Ai Chi on health related quality of life of subjects with FMS. 20 female subjects diagnosed with FM were recruited from two different settings. Assessments were performed using visual analog scale (VAS) and Short Form-36 physical and mental well being summary scores. Outcomes were taken at baseline and upon completion of 10 treatment sessions. Results showed significant improvements ($P< 0.05$) in all the variables, with significant differences in values such as pain perception, vitality, mental health, as well as perceived overall improvement in patient's quality of life. Study concluded that water-based Ai Chi program may contribute to the improvement of physical and mental well being and the quality of life in women with FMS.³
5. Suzy Araújo de Medeiros et al conducted a single blinded randomized controlled trial in 42 women with fibromyalgia were randomly assigned into two groups: mat Pilates and aquatic aerobic exercise. The exercises were performed twice a week for 12 weeks. Subject was evaluated at baseline and another at 12 weeks after randomization. The primary outcome was Visual Analogue Scale (VAS) while secondary outcomes were function (Fibromyalgia Impact Questionnaire), sleep (Pittsburgh Sleep Quality Index [PSQI]), quality of life (Short Form 36 [SF-36]), fear avoidance (Fear Avoidance Beliefs Questionnaire [FABQ-BR]) and pain catastrophizing (Pain-Related Catastrophizing Thoughts Scale [PRCTS]). Study showed a vast improvement both the groups in relation to reduction in pain and improving function ($p < 0.05$). The aspects related to patients quality of life and FABQ questionnaire only showed improvement in mat Pilates group ($p < 0.05$). There was improvement in the PSQI and PRCTS variables only in the aquatic aerobic exercise group ($p < 0.05$), but no significant differences were observed between the two groups for the evaluated variables.⁴
6. Sabela Rivas Neira et al conducted a single-blind randomized controlled trial. Forty women were randomly allotted into 2 groups: Aquatic Therapy or Land-based Therapy. Both interventions included 60-min therapy sessions, structured into 4 sections: Warm-up, Proprioceptive Exercises, Stretching and Relaxation that were carried out 3 times a week for 3 months. Primary outcomes were balance (static and dynamic) and pain (intensity and threshold). Secondary outcomes evaluated were functional balance, quality of life, quality of sleep, fatigue, self-confidence in balance and physical ability that were evaluated at baseline, at the end of 3-month intervention period, and 6-weeks post-treatment. Study concluded stating no improvement seen in any of the outcome measures in land based therapy or aquatic therapy.⁷
7. C Cedraschi et al conducted a study to evaluate the effect of pool exercises and education in fibromyalgia patients. One hundred and sixty four patients were allocated to a 6 week programme ($n = 84$) and control group ($n = 80$). Outcomes evaluated were quality of life, functional level activity, patient satisfaction and perception of pain, using patient questionnaires and detailed clinical examinations. Patient satisfaction measures, Psychological General Well-Being (PGWB) index, regional pain score diagrams, and Fibromyalgia Impact Questionnaire

(FIQ were used with a six months follow up period. Result concluded that after the six months programme completion, subjects in the treatment group showed significant improvements in quality of life and functional consequences compared with controls with FIQ (total score $p = 0.025$; fatigue $p = 0.003$; depression $p = 0.031$) and PGWB (total score $p = 0.032$; anxiety $p = 0.011$; vitality $p = 0.013$). There was greater improvement in all areas of patient satisfaction in the treatment groups; between-group differences showed statistically significant values for “physical therapy”, “psychosocial factors”, and “control of symptoms” with absolutely no change in pain values. Study concluded that a 6 week pool exercises and patient education significantly improve the patients quality of life (QOL) and their satisfaction with treatment.⁹

8. Rubens Vinícius Letieri et al conducted a study to analyze the effects of hydrotherapy on quality of life, perception of pain and the severity of depression in patients with fibromyalgia. 64 females were allocated into two groups: hydrokinesiotherapy and control group. Individuals were assessed by Visual Analog Scale of Pain (VAS), Fibromyalgia Impact Questionnaire (FIQ) and Beck Depression Inventory. Hydrokinesiotherapy was for a period of 15 weeks, two sessions per week of 45 minutes, a total of 30 sessions. Underwater exercises included cardiovascular conditioning, strength training, mobility, coordination, balance and still, stretching exercises and muscle relaxation. Study concluded a statistically significant result in the perception of pain intensity ($p < 0.01$), quality of life of subjects ($p < 0.05$) and depression symptoms ($p < 0.05$) in favor of the Hydrotherapy compared to control group. Thus

suggesting that hydrokinesiotherapy was effective as an alternative therapy for fibromyalgia.¹¹

9. V. Segura-Jiménez et al conducted a study on 33 Spanish women to determine the immediate changes of a warm water pool-based exercise program (12 weeks) on pain (before vs. after session) in subjects with FMS. Outcomes measured were Visual Analogue Scale pre and post each single session (i. e., 24 sessions). Study showed that a warm water pool-based exercise program for 12 weeks (2 times/week) led to a positive immediate decrease in level of pain in female patients.¹²
10. P.A. Latorre et al analyzed the effect of a 24-week physical training programme in water and on land on 72 women with fibromyalgia. Subjects were assigned to an exercise group (3 sessions/week, 2 sessions in water, 1 session on land) ($n=42$) and to a control group ($n=30$). Variables analyzed were: number of tender points, visual analogue scale (VAS) of pain, algometer score, functional capacity (leg strength, hand-grip dynamometry, flexibility, agility, balance, aerobic endurance, heart response), body composition (body mass index, fat mass index, percentage of body fat and skeletal muscle mass index) and psychological variables (Fibromyalgia Impact Questionnaire [FIQ] and Short Form Health Survey 36 [SF-36]). There was significant improvement in all the outcome variables. Thus study concluded that a 24-week physical training programme reduces pain and disease impact and improves functional capacity in women with fibromyalgia.¹³

Discussion

Fibromyalgia is characterized as widespread musculoskeletal pain and symptoms, such as fatigue, stiffness, and disturbances in sleep pattern, anxiety,

depression and cognitive difficulties. The fear of pain has impacted the patients with fibromyalgia to decrease their activity level thus hindering their quality of life.¹⁴ Studies have proved co-morbidity is associated with increases in all variable scores related to fibromyalgia, including polysymptomatic distress scale (PSD), symptom severity score (SSS), widespread pain index (WPI).¹⁵ Physical exercise is form of therapy that is frequently prescribed for subjects experiencing chronic pain and is a low-cost, easy-to-administer intervention for the majority of individuals with fibromyalgia compared to pharmacological therapy.¹⁶ Shuji Matsumoto et al stated that repeated thermal therapy upregulated the expression of arterial endothelial nitric oxide synthesis (eNOS), promotes capillary dilatation, and relieves muscular spasms related to tonic muscle contraction and pain and reduce the levels of oxidative stress. It has also shown to have sedative effects via the sensory nerve endings.¹⁷ Aquatic therapy plays a fundamental role in the rehabilitation of musculoskeletal, cardiovascular and neurological conditions as it offers a safe and social alternative to common land-based protocols. The physical properties of the water including buoyancy, viscosity and hydrostatic pressure has beneficial effects on joint loading, pain perception and blood flow.¹⁸ Researchers suggest that motor activity leads to betterment in the quality of life of patients so exercise is recommended for the treatment of FM.¹⁹ Neuroimmune activation has been suggested by Albrecht and colleagues for a possible means to central sensitization in patients with fibromyalgia.²⁰ Sevimli et al. performed a study on fibromyalgia subjects and randomly allocated into three treatment groups, one of which received aquatic therapy treatment, other two received therapy on dry land, with the aim of studying the effect of these treatments on pain and quality of life. The study concluded that water-based

therapy produced greater changes to the quality of life, reduction in pain and improving range of motion of compared to land based training. Thus considerably alleviating pain and improving quality of life (QOL) of the subjects.³ The effect of aquatic therapy on the neuro-endocrine system has shown a considerable reduction in plasma levels of nor-epinephrine, epinephrine, β -endorphin, and cortisol. In this context, it can be concluded that aquatic therapy may contribute to a reduction of stress, improvement of sleep quality, and reduction of pain sensitivity.⁶

Conclusion

Numerous effects of aquatic/ water based therapy on the musculoskeletal, cardiovascular and neuro-endocrine system has stated that aquatic therapy can be recommended as an adjunct to pharmacological therapy approach for the management of FMS patients in reducing pain, coping with fatigue, and improving quality of life. These therapeutic effects are achieved primarily by the physiological changes caused by in-water exercising. However, future studies should be conducted to evaluate its effect in long term and with appropriate follow up sessions.

Contribution of The Paper

- The above review has stated the enormous benefits of aquatic therapy in patients with fibromyalgia thus reducing the dropout rates and improving patients compliance with exercise therapy.
- Aquatic therapy has shown to have a major effect of reducing pain and improving quality of life in patients.
- Aquatic therapy can be recommended as an adjunct to pharmacological therapy approach.

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