



## Effect of Aquatic Physical Therapy on Chronic Low Back Pain: A Comprehensive Systematic Review

<sup>1</sup> Tamara Gratia Sianturi, <sup>3</sup> Nadya Putri, <sup>2</sup> Daniel Setiawan Nathan, <sup>1</sup> Eka Zhaki Safira Lubis, <sup>1</sup> Yohanna Evelyne Siburian, <sup>1</sup> Rizky Cyntia Simamora

<sup>1</sup> Faculty of Medicine, North Sumatera University, Medan City, North Sumatera, Indonesia

<sup>2</sup> Faculty of Medicine, Maranatha Christian University, Bandung City, West Java, Indonesia

<sup>3</sup> Sentra Medika Hospital, Cisalak, Depok City, West Java, Indonesia

Correspondence : [tamaragsianturi@gmail.com](mailto:tamaragsianturi@gmail.com)

### Article History :

Received date : 2024/07/07

Revised date : 2024/08/15

Accepted date : 2024/09/19

Published date : 2024/10/07



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### ABSTRACT

**Background:** This study aims to provide effect of aquatic physical therapy on chronic low back pain.

**Methods:** Following PRISMA 2020 guidelines, this systematic review focused exclusively on full-text articles published in English between 2014 and 2024.

**Result:** The study conducted a comprehensive review of over 100 publications sourced from reputable databases, including ScienceDirect, SagePub, and PubMed. Following an initial screening, five publications were identified as warranting more in-depth analysis. Consequently, a thorough review of these selected studies was performed to ensure a detailed and rigorous evaluation. **Conclusion:** Aquatic physical therapy could benefit patients with chronic low back pain. However, because the articles included in this systematic review have high bias risk or are unclear, more high-quality randomized controlled trials are needed to verify.

**Keyword:** low back pain, aquatic physical therapy, treatment.

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## INTRODUCTION

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Low levels of physical fitness are associated with back pain and disability, generating a reduced quality of life in patients with low back pain. Evidence has shown that exercise can decrease pain, disability, time off work and increase quality of life in patients with chronic low back pain. Physical treatments are based on the assumption that increased muscle strength, aerobic capacity and flexibility are crucial for the resumption of activities, and hence for the restoration of functional abilities.<sup>1</sup>

Many types of physical treatment are recommended for the management of pain and disability in patients with chronic low back pain. Among them, aquatic exercise is of particular interest because the unique properties of water reduce stress in joints and decrease axial loading of the spine.<sup>8</sup> Moreover, continuous limb movements against the water resistance result in muscle strength<sup>9</sup> and cardiovascular benefits, especially in individuals with low levels of physical fitness. The aquatic environment enables the participant to perform movements that are normally difficult or impossible on land.<sup>1</sup>

Exercise in water, compared with that on land, reduces load. The level of trunk muscle activity recorded using surface electromyography (EMG) during activities performed in water has been reported to be less than 25% of maximal voluntary contraction (MVC). This level of muscle activation is lower than the reported threshold of 40% MVC at which there is an increased risk of joint pain or injury to the spine. Water immersion reduces loading of the spine because of buoyancy and allows for movements that are normally difficult to execute on land. Therefore, aquatic trunk exercise is considered safe for those who have undergone lumbar spine surgery. Previous studies have reported that aquatic exercise programs resulted in improved strength and quality of life and reduced pain and disability in patients with low back pain (LBP). Similar effects of aquatic exercise intervention were also observed in patients after total knee and hip replacement and anterior

cruciate ligament reconstruction. However, no study has investigated the effect of aquatic exercise in patients after lumbar fusion surgery.<sup>2</sup>

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## METHODS

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### Protocol

The investigation was carried out with scrupulous conformity to the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) 2020 criteria, guaranteeing strict respect to accepted methodological principles. Strictly following PRISMA 2020 standards demonstrates a dedication to improving the clarity, replicability, and systematic thoroughness of the review process. The study incorporated thorough methodologies for conducting literature searches, extracting data, and synthesizing findings. These methods were well implemented to minimize biases and guarantee the strength of the conclusions.

### Criteria for Eligibility

The present study offers a comprehensive examination of the studies undertaken throughout the last ten years about effect of aquatic physical therapy on chronic low back pain. Through the methodical examination and integration of data from other studies, this research seeks to clarify patterns and guide the improvement of patient care approaches for this group with multiple health conditions.

The main aim of this thesis is to highlight important themes that arise from a wide range of scholarly literature, therefore enhancing our awareness of effect of aquatic physical therapy on chronic low back pain. In order to guarantee the thoroughness and precision of the study, strict criteria for inclusion and exclusion were implemented. Only English-language peer-reviewed papers published from 2014 to 2024 were considered suitable for inclusion. Materials eligible for inclusion must also possess a DOI for the purpose of confirming their authenticity. In order to preserve the focus and integrity of the dataset, the analysis in question deliberately omitted non-research materials, including reviews, editorials, and duplicate entries from the same publication.

The systematic methodology employed in this study guarantees that the data used is both pertinent and trustworthy, therefore establishing a strong basis for deriving significant findings and progressing clinical practice.

### **Search Strategy**

We used "effect of aquatic physical therapy on chronic low back pain" as keywords. The search for studies to be included in the systematic review was carried out using the PubMed, SagePub, and Sciencedirect databases.

### **Data retrieval**

The authors conducted a thorough preliminary review of each article by examining its abstract and title to assess relevance before proceeding with a more detailed investigation. Only studies that aligned with the study's objectives and met the predefined inclusion criteria were considered for further review. This method allowed for the identification of a clear and consistent pattern across the research.

Full-text articles were restricted to those published in English to maintain consistency in the language of the studies. A rigorous screening process was applied to select content that was directly relevant to the study's focus and adhered to all established inclusion criteria. Articles not meeting these criteria were systematically excluded from further analysis and not included in the final evaluation.

The evaluation process included a comprehensive review of various factors such as study design, titles, authors, publication dates, research locations, and methodologies. This meticulous approach ensured that the content analyzed was of the highest relevance and quality, thereby strengthening the overall findings of the study.

### **Quality Assessment and Data Synthesis**

The authors performed a meticulous review of each article's abstract and title to identify those deserving further investigation. After this initial screening, all relevant documents underwent a comprehensive examination. The results of this

evaluation guided the selection of review papers, ensuring that only the most pertinent studies advanced to detailed analysis. This rigorous approach streamlined the selection process and facilitated a thorough and nuanced assessment of the existing research and its context.

**Table 1. Search Strategy**

<i>Database</i>	<i>Search Strategy</i>	<i>Hits</i>
Pubmed	<i>("low back pain" OR "aquatic physical" AND "therapy")</i>	334
Science Direct	<i>("low back pain" OR "aquatic physical" AND "therapy")</i>	105
Sagepub	<i>("low back pain" OR "aquatic physical" AND "therapy")</i>	104

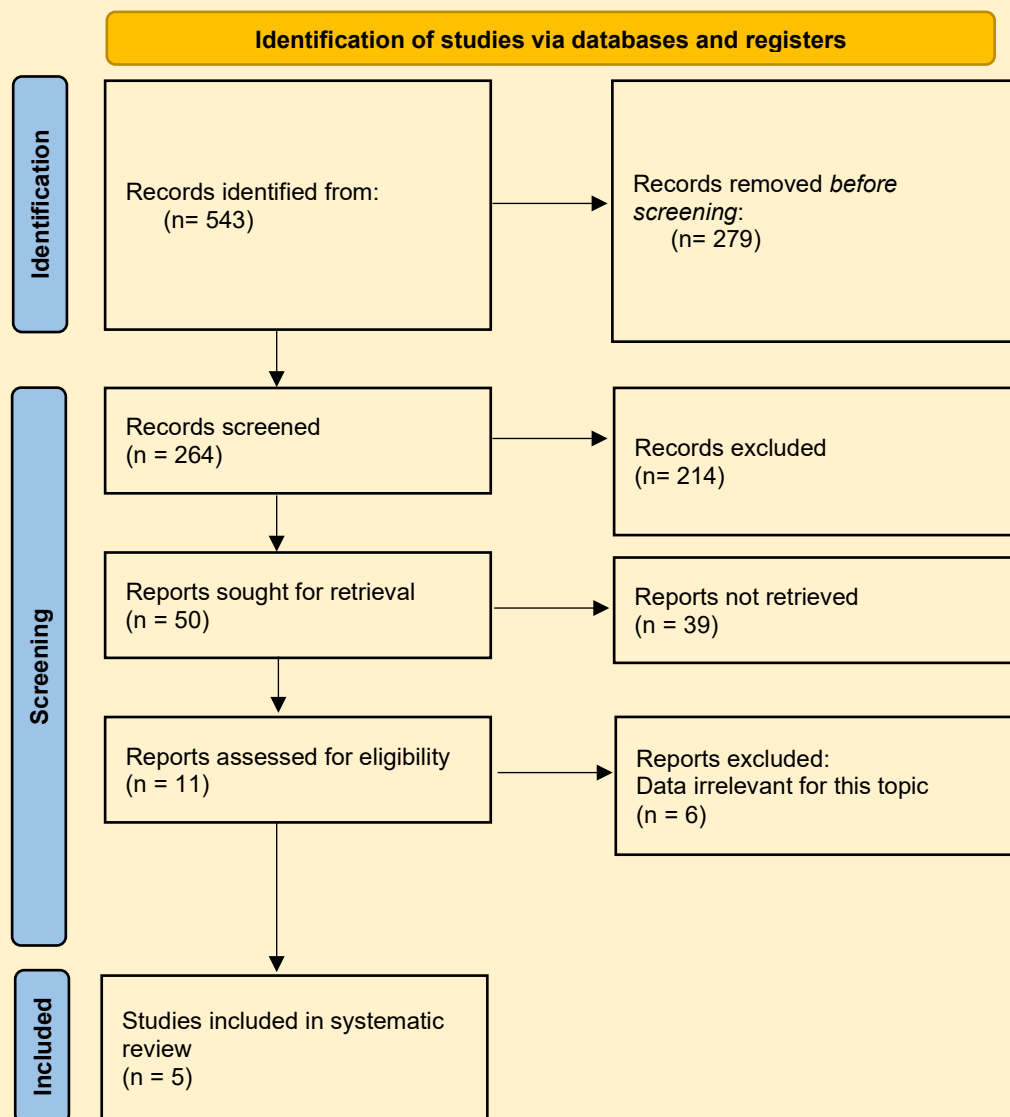


Figure 1. Article search flow chart

Table 2. Critical appraisal of Study

Parameters	(Abadi, FH et al., 2019)	(Taheri, M., 2015)	(Irاندوست , K & Peng, MS et al., 2022)	(Rosenstein, et al., 2023)	(Wang, T et al., 2023)
<b>1. Bias related to temporal precedence</b>					
Is it clear in the study what is the “cause” and what is the “effect” (ie, there is no confusion about which variable comes first)?	Yes	Yes	Yes	Yes	Yes
<b>2. Bias related to selection and</b>					

<b>allocation</b>					
Was there a control group?	No	Yes	No	No	No
<b>3. Bias related to confounding factors</b>					
Were participants included in any comparisons similar?	No	No	No	No	No
<b>4. Bias related to administration of intervention/exposure</b>					
Were the participants included in any comparisons receiving similar treatment/care, other than the exposure or intervention of interest?	Yes.	Yes.	Yes.	Yes.	Yes.
<b>5. Bias related to assessment, detection, and measurement of the outcome</b>					
Were there multiple measurements of the outcome, both pre and post the intervention/exposure?	No	No	No	No	No
Were the outcomes of participants included in any comparisons measured in the same way?	Yes	Yes	Yes	Yes	Yes
Were outcomes measured in a reliable way?	Yes	Yes	Yes	Yes	Yes
<b>6. Bias related to participant retention</b>					
Was follow-up complete and, if not, were differences between groups in terms of their follow-up adequately described and analyzed?	No	Yes	No	No	No
<b>7. Statistical conclusion validity</b>					
Was appropriate statistical analysis used?	Yes	Yes	Yes	Yes	Yes

## RESULT

We initiated the investigation by systematically gathering a significant assortment of papers from reputable sources such as Science Direct, PubMed, and SagePub. After a thorough three-stage screening process, we selected five papers that were considered very pertinent to our ongoing systematic inquiry. Subsequently, we selected certain topics for further examination and meticulously evaluated each report. In order to expedite our study, we have included a concise summary of the evaluated information in Table 3.

Table 3. The literature included in this study

Author	Origin	Method	Sample	Result
<b>Abadi, FH et al., 2019<sup>3</sup></b>	Malaysia	This study aimed to investigate the effect of aquatic exercise on LBP disability among obese women.	39	Results showed no significant difference in age, weight, BMI, waist to hip ratio, and percentage of body fat in both groups. An analyzing of multivariate analysis of covariance revealed that there was significant improvement on pain intensity, personal care, sitting, standing, sleeping, employment and total disability score in aquatic group, while there was no significant difference in lifting, walking, social life, and traveling abilities after 12 weeks between the groups. As a conclusion, this progressive aquatic exercise was a convenience and effective intervention program to reduce pain intensity, and improve personal care, sitting, standing, sleeping, and employment abilities in obese LBP women.
<b>Irاندoust, K &amp; Taheri, M., 2015<sup>4</sup></b>	Iran	Thirty-two elderly men aged 65 or older were recruited and randomly allocated to two groups: aquatic training (3 d/wk for 12 wk) or a control group.	32	The results suggested that all obesity variables including BMI, WHR, and PBF of the aquatic training group were decreased significantly, while the trunk muscle mass of the aquatic training group was increased significantly. Furthermore, low back pain was decreased in the subjects after the intervention.



<p>Peng, MS et al., 2022<sup>5</sup></p>	<p>China</p>	<p>This 3-month, single-blind randomized clinical trial with a 12-month follow-up period was performed from September 10, 2018, to March 12, 2019, and the trial follow-up was completed March 17, 2020. A total of 113 people with chronic low back pain were included in the experiment.</p>	<p>113</p> <p>Of the 113 participants, 59 were women (52.2%) (mean [SD] age, 31.0 [11.5] years). Participants were randomly allocated into the therapeutic aquatic exercise group (n = 56) or the physical therapy modalities group (n = 57), and 98 patients (86.7%) completed the 12-month follow-up. Compared with the physical therapy modalities group, the therapeutic aquatic exercise group showed greater alleviation of disability, with adjusted mean group differences of -1.77 (95% CI, -3.02 to -0.51; <i>P</i> = .006) after the 3-month intervention, -2.42 (95% CI, -4.13 to -0.70; <i>P</i> = .006) at the 6-month follow-up, and -3.61 (95% CI, -5.63 to -1.58; <i>P</i> = .001) at the 12-month follow-up (<i>P</i> &lt; .001 for overall group × time interaction). At the 12-month follow-up point, improvements were significantly greater in the therapeutic aquatic exercise group vs the physical therapy modalities group in the number of participants who met the minimal clinically important difference in pain (at least a 2-point improvement on the numeric rating scale) (most severe pain, 30 [53.57%] vs 12 [21.05%]; average pain, 14 [25%] vs 11 [19.30%]; and current pain, 22 [39.29%] vs 10 [17.54%]) and disability (at least a 5-point improvement on the Roland-Morris Disability</p>
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				Questionnaire) (26 [46.43%] vs 4 [7.02%]). One of the 56 participants (1.8%) in the therapeutic aquatic exercise group vs 2 of the 57 participants (3.5%) in the physical therapy modalities group experienced low back pain and other pains related to the intervention.
<b>Rosenstein, et al., 2023<sup>6</sup></b>	Canada	This study will include 34 participants with chronic non-specific LBP and moderate to severe disability, aged between 18 and 65, who will be randomly assigned (1:1) to the aquatic exercise group or land-based standard care exercise group.	34	This study will determine if water-based exercises targeting the lower back and gluteal muscles can lead to important changes in muscle quality and function, and their possible relation with patients' pain and functional improvements. Our findings will have strong clinical implications and provide preliminary data to design a community program to better support individuals with chronic LBP.
<b>Wang, T et al., 2023<sup>7</sup></b>	China	PRISMA guidelines were followed, and our study protocol was published online at PROSPERO under registration number CRD42023417411. We	2200	This meta-analysis included 32 trials with 2,200 participants; these patients were all between the ages of 38–80. The study showed that compared to the no exercise (NE) group, patients in the AE group experienced a remarkable reduction in pain (SMD: -0.64, $P < 0.001$ ), a significant increase in physical function (SMD:

		searched PubMed, Embase, Web of Science, and Cochrane library databases for English-language articles published before April 11, 2023, including studies from all relevant randomized controlled trials (RCTs).	0.62, $P < 0.001$ ), and a statistically significant improvement in quality of life (SMD: $-0.64$ , $P < 0.001$ ). When compared to land-based exercise (LE), AE significantly relieves patients' pain (SMD: $-0.35$ , $P = 0.03$ ).
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## DISCUSSION

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Chronic low back pain was defined as back pain with or without leg pain for more than 12 weeks between the lower ribs and the folds above the buttocks. Chronic low back pain is a common and increasing skeletal muscle disease. Maher describes back pain syndrome as a major health problem with huge economic and social costs, as more than 80% of health care costs go to patients with the disease. Therefore, it is very important to relieve the pain intensity and disability of patients with chronic low back pain and improve their quality of life.<sup>8,9</sup>

The treatment of chronic low back pain is still in constant exploration. Scaturro et al. have observed the effect of combination of rehabilitative therapy with ultramized palmitoylethanolamide on patients with chronic low back pain. The results showed that the pain intensity and disability of patients were relieved, and the quality of life was improved. However, Guidelines for the management of patients with chronic low back pain still recommend exercise therapy as a first-line treatment to reduce pain intensity and disability. Among them, aquatic physical therapy is particularly interesting, and one of the methods in rehabilitation treatment

recently. Aquatic physical therapy (APT) is defined as exercising in water, or using the characteristics of water to relieve pain intensity, relax muscles and promote better exercise, it includes hydrotherapy and aquatic exercise. Silva et al. previously reported the positive effect of hydrotherapy on the management of patients with knee osteoarthritis.<sup>8,10,11</sup>

The use of warm water to reduce muscular tension and pain was reported over the millennia and finds support in contemporary applications, e.g., during childbirth. Pain reduction by immersion in warm water was reported in animal models. Contributing factors to reduction of pain during immersion in warm water could be, e.g., increased blood flow and thus improved oxygenation of tissues or activation of c-tactile fibers by bypassing warm water. Nevertheless, the evidence on specific passive warm-water treatments in cnLBP is still sparse. Several trials report that Flotation REST (resting in a supine immersed position in salt water) was effective in acute and chronic pain conditions.<sup>12</sup>

Water immersion with its buoyancy effect reduces the axial load of the spine that permits the movements which are difficult or impossible on land. Water has several special characteristics that make it a suitable medium for exercises resulting in that choice of aquatic therapy program has favorable advantages relatively than common modalities. The warmth and resilience of water acting on thermoreceptors and mechanical receptors result in block nociception. As a result, influence segmental spinal mechanisms. There was enough evidence to recommend that aquatic therapy is probably beneficial to subjects complain from constant LBP and pregnancy-allied LBP.<sup>13,14</sup>

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## CONCLUSION

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In conclusion, Aquatic physical therapy could benefit patients with chronic low back pain. However, because the articles included in this systematic review have high bias risk or are unclear, more high-quality randomized controlled trials are needed to verify.

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## DISCLOSURE STATEMENT

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Disclosure Statement : The authors have no conflicts of Interest to declare.

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## REFERENCES

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1. Baena-Beato PÁ, Artero EG, Arroyo-Morales M, Robles-Fuentes A, Gatto-Cardia MC, Delgado-Fernández M. Aquatic therapy improves pain, disability, quality of life, body composition and fitness in sedentary adults with chronic low back pain. A controlled clinical trial. *Clin Rehabil.* 2014;28(4):350–60.
2. Huang AH, Chou WH, Wang WTJ, Chen WY, Shih YF. Effects of early aquatic exercise intervention on trunk strength and functional recovery of patients with lumbar fusion: a randomized controlled trial. *Sci Rep [Internet].* 2023;13(1):1–8. Available from: <https://doi.org/10.1038/s41598-023-37237-3>
3. Abadi FH, Sankaravel M, Zainuddin FF, Elumalai G, Razli AI. The effect of aquatic exercise program on low-back pain disability in obese women. *J Exerc Rehabil [Internet].* 2019 Dec 31;15(6):855–60. Available from: <http://e-jer.org/journal/view.php?number=2013600771>
4. Irandoust K, Taheri M. The effects of aquatic exercise on body composition and nonspecific low back pain in elderly males. *J Phys Ther Sci.* 2015;27(2):433–5.
5. Peng MS, Wang R, Wang YZ, Chen CC, Wang J, Liu XC, et al. Efficacy of Therapeutic Aquatic Exercise vs Physical Therapy Modalities for Patients With Chronic Low Back Pain. *JAMA Netw Open [Internet].* 2022 Jan 7;5(1):e2142069. Available from: <https://jamanetwork.com/journals/jamanetworkopen/fullarticle/2787713>
6. Rosenstein B, Montpetit C, Vaillancourt N, Dover G, Khalini-Mahani N, Weiss C, et al. Effect of aquatic exercise versus standard care on paraspinal and gluteal muscles morphology in individuals with chronic low back pain: a randomized controlled trial protocol. *BMC Musculoskelet Disord [Internet].* 2023;24(1):1–17. Available from:

- <https://doi.org/10.1186/s12891-023-07034-0>
7. Wang T, Wang J, Chen Y, Ruan Y, Dai S. Efficacy of aquatic exercise in chronic musculoskeletal disorders: a systematic review and meta-analysis of randomized controlled trials. *J Orthop Surg Res* [Internet]. 2023;18(1):1–16. Available from: <https://doi.org/10.1186/s13018-023-04417-w>
  8. Ma J, Zhang T, He Y, Li X, Chen H, Zhao Q. Effect of aquatic physical therapy on chronic low back pain: a systematic review and meta-analysis. *BMC Musculoskelet Disord*. 2022;23(1):1–14.
  9. Scaturro D, Asaro C, Lauricella L, Tomasello S, Varrassi G, Letizia Mauro G. Combination of Rehabilitative Therapy with Ultramicronized Palmitoylethanolamide for Chronic Low Back Pain: An Observational Study. *Pain Ther* [Internet]. 2020;9(1):319–26. Available from: <https://doi.org/10.1007/s40122-019-00140-9>
  10. Awad LN, Bae J, Kudzia P, Long A, Hendron K, Holt KG, et al. Reducing Circumduction and Hip Hiking During Hemiparetic Walking Through Targeted Assistance of the Paretic Limb Using a Soft Robotic Exosuit. *Am J Phys Med Rehabil*. 2017;96(10):S157–64.
  11. Pérez-De la Cruz S. Influence of an aquatic therapy program on perceived pain, stress, and quality of life in chronic stroke patients: A randomized trial. *Int J Environ Res Public Health*. 2020;17(13):1–12.
  12. Schitter AM, Frei P, Elfering A, Kurpiers N, Radlinger L. Evaluation of short-term effects of three passive aquatic interventions on chronic non-specific low back pain: Study protocol for a randomized cross-over clinical trial. *Contemp Clin Trials Commun* [Internet]. 2022;26:100904. Available from: <https://doi.org/10.1016/j.conctc.2022.100904>
  13. Mahfouz MM, Sedhom MG, Essa MM, Kamel RM, Yosry AH. Effect of Aquatic Versus Conventional Therapy in Treatment of Chronic Low Back Pain. *Int J Physiother*. 2018;5(6):184–9.
  14. Zamunér AR, Andrade CP, Arca EA, Avila MA. Impact of water therapy on pain management in patients with fibromyalgia: current perspectives. *J Pain Res* [Internet]. 2019;12:1971–2007. Available from:

<http://www.ncbi.nlm.nih.gov/pubmed/31308729>