

Research Article

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Analgesic efficacy of aquatic and land-based aerobic exercise in older adults with gonarthrosis. Systematic review of randomized clinical trials

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Abstract

Background and objectives: Osteoarthritis is a pathology that causes joint degeneration, which is characterized by the degradation of the hyaline articular cartilage, causing various symptoms, including pain. One location of this type of problem that causes more conflict is in the knee joint, resulting in gonarthrosis. The aim of this article is to determine the analgesic effectiveness of land-based and aquatic exercises in elderly adults with this pathology according to the systematic review of the literature from the study of several authors.

Material and methods: This is a systematic review of clinical trial research design articles where we sought to quantify the information gathered and at the same time validate the amount of data obtained. A number of digital research tools were consulted, including Pubmed, Scielo, Google Academic, Elsevier, PEDro, Web of Science.

Results: About 2,464 articles were found from different databases, of which 8 met the inclusion criteria for our study. The interventions vary in time, with the most common session time being 50 minutes. The focuses of these programs are to increase flexibility and strengthening, resulting in an improvement in pain.

Conclusions: It was demonstrated that the implementation of aerobic exercises in the treatment of gonarthrosis helps to improve the prognosis of the patients who attended the study, as well as to improve pain tolerance.

Keywords

osteoarthritis,
physiotherapy,
hydrotherapy,
aerobic exercise,
knee.

Introduction

Osteoarthritis of the knee, or gonarthrosis, is a non-inflammatory degenerative joint disease characterized by degeneration of the articular cartilage, osteophyte formation, subchondral sclerosis and alteration in the soft parts such as the joint capsule, synovial membrane, ligaments and muscles. Its progression is slow, having a multifactorial etiology in which factors such as aging, obesity and genetic load are involved, favoring the development of OA.^{3,4}

Among rheumatic diseases, osteoarthritis is the most prevalent joint disease in the world. Osteoarthritis is defined as a chronic degenerative disease that fulfills certain conditions, among which are the clinical criteria, consisting of knee pain (this may not occur in asymptomatic patients), age over 50 years, morning stiffness less than 30 minutes, bone crepitus, pain on pressure over the joint margins, joint hypertrophy and

inflammation; in the radiological criteria we can find: moderate osteophytes, clear osteophytes, joint hypertrophy, joint space narrowing, sclerosis, cysts and bone deformity.^{4,22}

For many years, arthritis was also known as osteoarthritis or osteoarthritis and was defined as a chronic and degenerative disease characterized by the gradual and progressive destruction of the cartilage lining the articular surface of knees, hips, shoulders, hands, ankles and spine where, additionally and significantly, there is inflammation of the synovial membrane, as well as damage to the menisci, tendons, ligaments, muscles and nerves associated with the affected joint, ankles and spine where additionally and significantly, there is inflammation of the synovial membrane, as well as damage to menisci, tendons, ligaments, muscles and nerves associated with the affected joint, these may be symptomatic or not, since sometimes only radiological signs may be present.³

One of the main characteristics is the presence of pain and functional limitation in people with the pathology. According to the World Health Organization (2019), rheumatic diseases are present in 20% of the population worldwide, thus being one of the main reasons for absence from work, this represented 35% of total or partial disability in adults, compared to osteoarthritis that presents only 10% of the population.¹⁸

Early diagnosis is of utmost importance for this pathology since it is a degenerative alteration and the earlier the diagnosis is made, the sooner

therapeutic measures can be taken to slow down the progression of articular cartilage degeneration. The medical and physiotherapeutic diagnosis is based on clinical manifestations and radiological examinations as the primary diagnosis and identification of the degree of osteoarthritis the patient is suffering from.

Using imaging studies it is possible to establish the degree of gonarthrosis in which patients are found according to Kellgren and Lawrence and the Consejo de Salubridad General in their Clinical Practice Guidelines. (Table 1)

Table 1
Kellgren and Lawrence, ACR: Classification of the American College of Rheumatology

GRADE	DESCRIPTION
0	No radiographic features of osteoarthritis.
1	Formation of osteophytes on the tibial spines.
2	Presence of periarticular ossicles.
3	Narrowing of joint cartilage associated with sclerosis of subchondral bones.
4	Small pseudocystic areas with sclerotic walls situated in the subchondral bone.

Source by: American College of Rheumatology.

Among the most commonly used scales for patients with osteoarthritis of the knee are the WOMAC scale (Western Ontario and McMaster Universities Osteoarthritis Index), the KOOS and the WOMAC surveys and the Modified Index for Clinical Status of Osteoarthritic Knee (MSH1).

These scales and index have great relevance in the diagnosis of knee osteoarthritis, so it is important that the evaluator knows the instructions of each of these and that the patient is sincere when answering them, since they can be used later to evaluate the effectiveness of the physiotherapeutic treatment concerning the initial and final clinical manifestations.

The American College of Rheumatology (ACR), the American Academy of Orthopaedic Surgeons (AAOS) and the European League Against Rheumatism (EULAR) consider that the optimal treatment of osteoarthritis is based on a combination of non-pharmacological and pharmacological strategies.¹⁶

In non-pharmacological options, exercise is the best strategy to treat osteoarthritis. The Arthritis Foundation (2016), recommends starting the treatment in water, considering its physical properties, to have a greater positive effect on the physical rehabilitation of the patient. However, using any type of exercise would be beneficial, as long as the control of the weight is in accordance with the patient's needs.²

The World Confederation for Physical Therapy (2011) mentions that Physiotherapy is about maintaining and restoring movement and the maximum functional capacity of people during their lifetime.²⁴

Materials and Methods

A systematic review was carried out with articles published with a clinical design in which we sought to quantify the information obtained and at the same time, validate the quality of the data presented. The scope is focused on the descriptive because it is a non-experimental research, where only the different scientific articles found in the different databases will be studied.

A strategic search was carried out using different digital research tools, including databases such as

Pubmed, Scielo, Google Academic, Elsevier, PEDro, Web of Science both in English and Spanish with Boolean operators (“and”, “or” and “not”) and adequate quality assessment of the articles found. Specific time parameters were used according to the oldest article found during the search and the most current one, between 2003-2020. The search strategy was based on combinations of different keywords in both English and Spanish.

For the search of articles in the area of ground exercise, the keywords were the following: aerobic exercise, gonarthrosis, elderly, pain. This resulted in more than 2100 articles, of which, reviewing the title and description, only 15 were accepted for review through the inclusion and exclusion criteria. (Diagram 1)

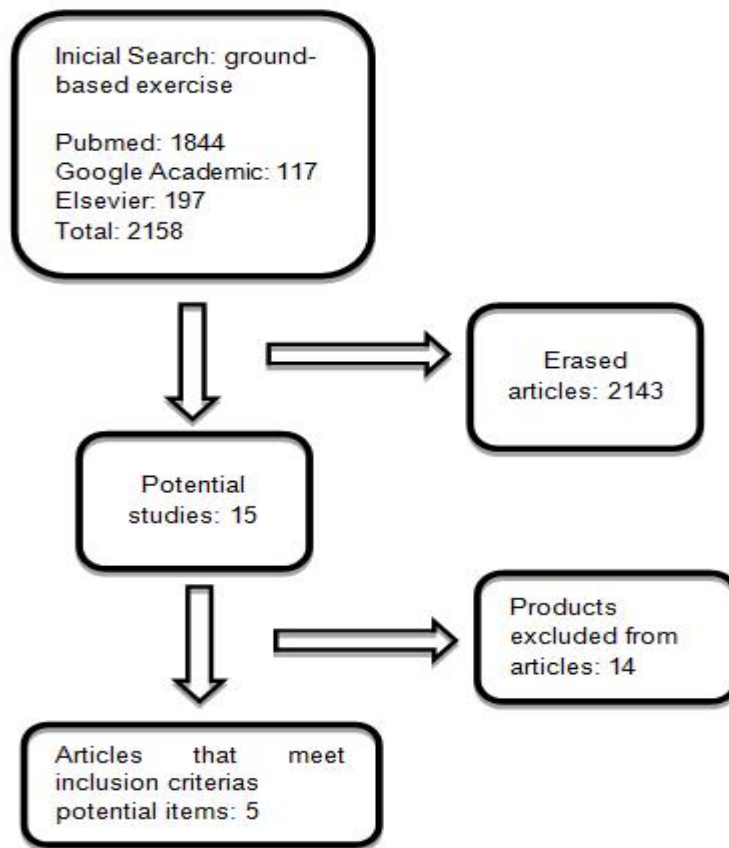


Diagram 1. Results of the search for soil articles. Source: own authorship.

For the search for articles in the area of hydrotherapy the key words were the following: Gonartrosis, ejercicioaeróbico, hidroterapia, adulto mayor, dolor,ejercicioenagua. Gonarthrosis, aerobic exercise, hydrotherapy,

elderly, pain, aquatic exercise. This resulted in more than 325 articles, of which only 19 were selected for content review for inclusion and exclusion criteria. (Diagram 2)

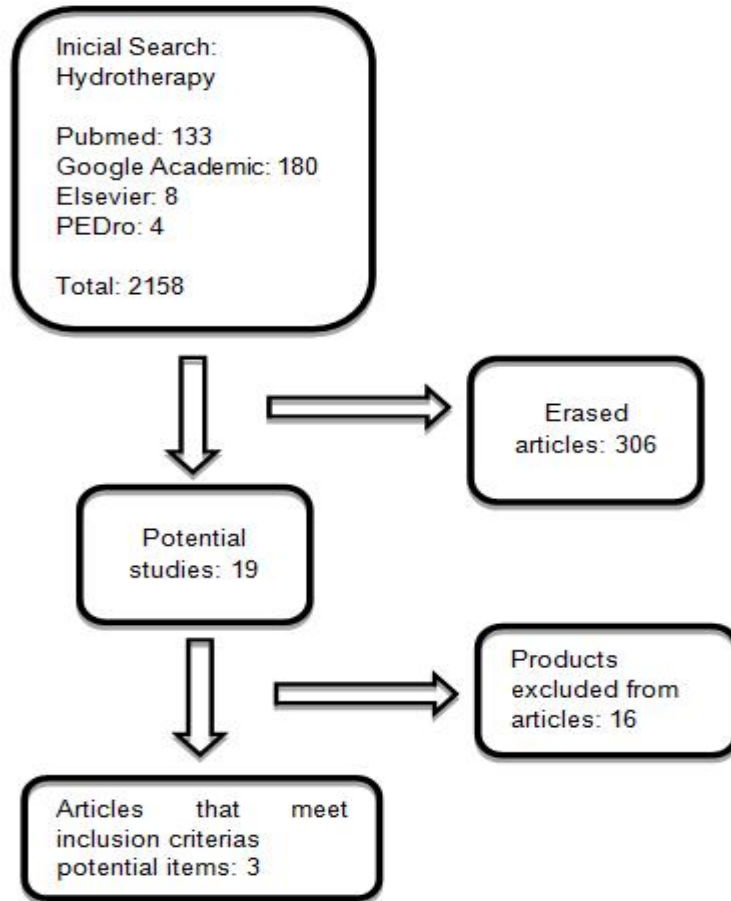


Diagram 2. Results of the search for water items. Source: own authorship.

Of the 35 scientific articles in total that were reviewed in this research, only 3 hydrotherapy and 5-floor articles met the following criteria:

- Inclusion criteria: Patients diagnosed with gonarthrosis, patients older than 50 years, physiotherapeutic intervention in water, physiotherapeutic intervention on the floor, implementation of aerobic exercises, focused effects on pain and the type of study was based on a randomized controlled trial.

- Exclusion criteria: patients with other types of osteoarthritis, implementation of anaerobic exercise only, interventions not aimed at reducing pain and based on systematic searches.

The quality assessment of the articles was performed by peers, including authors A.D.C.P. and D.L.M.B. using McMaster and CASPe guides.

Results

In the research search, 2,464 articles were found through different databases. Of these, only 8 were included in the research after applying the inclusion and exclusion criteria. A summary of

these is shown in Table 2, where we can see that these publications were published in different countries, such as the United Kingdom, China, Cuba, Holland, Panama, the United States, Canada and Spain. These were published in English, Spanish and Chinese. (Table 2)

Table 2						
ARTICLE	TYPE OF STUDY	COUNTRY	NUMBER OF PARTICIPANTS	AGE	DIAGNOSTIC	RESEARCH OBJECTIVES
Taglietti et al (2018)	Research study	Italy	N=60 Experimental group= 31 W=23 M=8 Control group=29 W=18 M=11	67 (±5) age	Criteria: Kellgren–Lawrence	To compare the effectiveness of aquatic exercise vs education of the patient with gonarthrosis.
Lim et al (2010)	Research study	Korea	N=75 Experimental group =51 M=24 W=27 Control group=24 M=3 W=21	65 (±5) age	WOMAC	Design an aquatic and land-based exercise program to improve function and decrease pain.
Mcllroy et al (2017)	Research study	United Kingdom	N=14 Experimental group =7 Control group=7 W=7	63 (±5) age	Criteria: Kellgren – Lawrence	To assess the feasibility of an in-water intervention compared to usual care in patients with gonarthrosis.
Espejo et al (2012)	Randomised controlled trial	Spain	N=31 Experimental group M=2 W=15 Control group M=5 W=9	82 (±5) age	Criteria: Kellgren – Lawrence	To know the effect of a treatment aerobic physical exercise in patients with gonarthrosis.

González (2019)	Research study	Panamá	N=15 Experimental group=15 M=4 W=11 Control group=N/A	64 (± 5) age	MRC EVA WOMAC	To determine the benefits of exercise in the elderly.
Prada et al (2011)	Prospective longitudinal study	Cuba	N=50 Experimental group =50 M=17 W=33 Control group=N/A	60 (± 5) age	WOMAC	To incorporate patients diagnosed with gonarthrosis of the knee into an integrative rehabilitation program.
Cheung et al (2016)	Pilot randomised controlled trial	United States	N=83 Experimental group =60 M=13 W=70 Group shows in exercises aerobic=28 Control group=23	60 (± 5) age	WOMAC	To compare the effects of Hata Yoga and aerobic exercises in gonarthrosis.
Lun et al (2015)	Randomised single-blind controlled trial	Canada	N=71 Group of exercises hip=37 Group of exercises lower extremity lower extremity=34	50 -73 age	KOOS WOMAC	To compare the efficacy of hip and leg of hip and leg strengthening exercise programs on knee pain in patients with knee osteoarthritis.

In the articles, it is found that more women have participated in the different investigations. In the same way, the average age of the participants shows a great variety ranging from 50 to 82 years old. Some studies require a degree of osteoarthritis to be included in these studies, but

they coincide in that the patients have not undergone surgery in order to be able to participate. However, each of the articles presents different ways in which they performed their interventions. (Table 3)

Table 3				
ARTICLE	INTERVENTION PHYSIOTHERAPY	INTERVENTION TIME	EXERCISE PROGRAMME	RESULTS ON PAIN
Taglietti et al (2018)	Aquatic Exercise	8 weeks, twice a week, 60 minutes each session.	Warm-up and stretching. Isometric and dynamic knee and hip exercises. Aerobic exercise. Proprioception. Cooling down.	WOMAC: Start = 7.6 Finish = 4.2
Lim et al (2010)	Aquatic and land-based exercises to improve knee function.	8 weeks, 3 times a week, 40 minutes per session.	Warm-up. Water exercise or land exercise (depending on the group). Cool down.	Both exercise groups (aquatic and land-based) showed significant improvements in the disability index using the WOMAC scale. With regard to pain, no significant differences in pain were found.
Mclroy et al (2017)	Water aerobic exercise	6 weeks, once a week	In-water warm-up Flexibility and strengthening exercises in the water, standing and seated Stretching Aquatic cycling	V.A.S. Start = 7.9 Finish = 4.5 Change= 3.4
Espejo et al (2012)	Flexibility and muscle toning exercises for the lower limbs out of the water.	4 weeks, twice a week. 50 minutes per session.	Exercises with the aim of improving the flexibility and toning of the lower limbs, in 3 phases: Stretching phase Isometric strengthening phase Isotonic strengthening phase	V.A.S. Start: 6.08 Finish: 3.85

<p>González (2019)</p>	<p>Intensive treatment where the aim is to educate the patient so that he/she can perform the exercises in order to strengthen the muscles out of the water muscular strengthening out of the water.</p>	<p>8 weeks.</p>	<p>Reduction of oedema and pain. Isometric and static exercises. Isotonic and dynamic exercises</p>	<p>Evaluated by MCR: Start: 73% rating scale 3, 20% rating scale 3+ y 7% rating scale 4. Finish: 47% rating scale 4, 40% rating scale 3+ and 13% rating scale 4+.</p>
<p>Prada et al (2011)</p>	<p>Static and dynamic exercises, gait re-education and to prevent deformities.</p>	<p>4 weeks</p>	<p>Application of techniques to reduce pain so that patients could carry out the exercises progressively. Isometric exercises Active-assisted exercises strengthening and resistance exercises Free strengthening exercises with progressive weight.</p>	<p>There was a significant decrease in the areas assessed (WOMAC). The success of the therapeutic scheme exceeds 50% improvement for pain, stiffness and functional capacity.</p>
<p>Cheung et al (2016)</p>	<p>The study was divided into three groups: Hata Yoga group, aerobic exercise group and control group. We concentrated on the aerobic exercise part and its results out of the water.</p>	<p>8 weeks, 1 session weekly.</p>	<p>Aerobic Exercises (warm-up and isometric and isotonic exercises) and stretching. 15 minutes warm-up 30 minutes of exercise 15-30 minutes of aerobic exercise (4 times a week) 30 minutes of stretching practice (2 times per week)</p>	<p>There was an improvement in participants' WOMAC scores, as well as an improvement in patients' symptomatology.</p>

<p>Lun et al (2015)</p>	<p>Hip and lower limb exercises, both with the same purpose, improve pain and quality of life in patients with gonarthrosis.</p>	<p>12 weeks</p>	<p>Group of hip exercises: Dynamic resistance exercises and hip stretching with elastic bands, elastic bands and stretching with elastic bands, 3 times a week with supervision and 2 times weekly home exercises. Lower extremity exercise group: Dynamic resistance exercises for lower extremity muscles, of the lower extremity.</p>	<p>In both groups, there was improvement in KOSS and WOMAC scores according to pain and quality of life. In the lower extremity exercise group, there was an improvement in knee flexor strength. There was no significant difference in the results between the two groups, although the purpose was the same.</p>
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The interventions vary in time, with the most common session time being 50 min. Some asked their patients to report 2-3 times a week while others only 1 a week. In the exercise programs they apply a warm-up before, or even a cool-down phase after the session. The focus of these programs is to improve flexibility and strengthening, resulting in an improvement in pain, where all the articles reported that patients presented a decrease in pain.

On the other hand, one of the errors presented in the articles was that when forming the intervention and control groups, there was a great difference between them and sometimes they did not report how many concluded or left the intervention.

Discussion

In the present investigation, it was found that aerobic type therapeutic exercise in patients with gonarthrosis helps to reduce the presence of pain in most of the experimental studies of the literature reviewed, on the other hand, Lim et al (2010) differs slightly, as it mentions that no significant differences were found in the decrease of both groups regarding pain but there were improvements regarding the functionality of the participants, the other articles did report a decrease of at least 3 points in VAS.

Another important aspect to mention is that the interventions consisted of a warm-up, exercise and cool-down phase. Most of them lasted more than 45 minutes. The decrease in pain can be attributed to the improvement in the musculature of the lower limbs, as well as the work on their flexibility. The patients had good adherence to the physiotherapeutic programs, with only less than 10% of the group not concluding the program.

Conclusion

With this research, we can conclude that aerobic exercise is one of the best interventions in patients with gonarthrosis to avoid surgery. It is worth mentioning that the 2 types of intervention presented the same decrease of 3 points on the VAS scale, which could indicate that hydrotherapy is not a better intervention than exercise on the ground, but depends on the type of exercise and treatment indicated to the patient. What may be a difference is the perception of patients in and out of the water, since patients in the water are more comfortable due to the physical properties of the water, which is of great help in overweight patients or those who do not tolerate exercise due to pain.

The research is left open to future proposals, such as the comparison of more detailed articles or a deep experimental intervention and that it is a more medium and long term treatment since these treatments studied have a duration ranging from 4 to 8 weeks, so they do not know well the effects that may have a longer time of the application of the treatment. It would also be advisable to carry out an investigation of this type of exercise only with the anaerobic type, in order to later make an adequate comparison between the two as a treatment for pain in patients with gonarthrosis.

What we can say is that it is proven that exercise is one of the best intervention techniques within physiotherapy for different treatments, in this case gonarthrosis.

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