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REVISIÓN / REVIEW

FIBROMYALGIA AND THERAPEUTIC EXERCISE. QUALITATIVE SYSTEMATIC REVIEW

FIBROMIALGIA Y EJERCICIO TERAPEÚTICO. REVISIÓN SISTEMÁTICA CUALITATIVA

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ABSTRACT

Objective: The purpose of this review is to determine which exercise is the best to reduce the symptomatology of fibromyalgia.

Search Strategy: Intervention studies in fibromyalgia were retrieved through searches in the main health-science databases: PEDro, PubMed, Cochrane Plus, ISI (Web of Knowledge), y PsycINFO, and in in publications of the field, Fisioterapia y Cuestiones de Fisioterapia, between March and October 2013.

Results: After applying inclusion and exclusion criteria, and analyze the level of evidence, 32 publications were accepted in this review, classified in 5 different categories, depending on the type of activity. They were all randomized clinical trials.

Conclusions: Exercise is effective for reducing symptomatology of fibromyalgia. Aquatic and combined exercise, and alternative activities seem to be more accurate in the treatment of tender points, depression, and they have higher levels of adherence. Relating to the rest of the symptoms, every other type of exercise has similar results.

KEY WORDS: Fibromyalgia, treatment, physical therapy, exercise, physical activity, sport.

RESUMEN

Objetivos: El objetivo de esta revisión es determinar qué ejercicio es más eficaz para reducir la sintomatología de la fibromialgia.

Estrategia de búsqueda: Se realizaron búsquedas en las principales bases de datos de las ciencias de la salud: PEDro, PubMed, Cochrane Plus, ISI (Web of Knowledge), y PsycINFO, y en las revistas no indexadas del área, entre marzo y octubre de 2013.

Resultados: Se analizó el nivel de evidencia y se aplicaron criterios de exclusión e inclusión para obtener 32 artículos en la revisión, clasificados en 5 categorías en función del tipo de ejercicio. Todos ellos eran ensayos clínicos aleatorios.

Conclusiones: El ejercicio terapéutico es eficaz para reducir la sintomatología de la fibromialgia. El ejercicio acuático, el combinado y las actividades alternativas parecen más eficaces para el tratamiento de puntos sensibles, de la depresión, y tiene mayores niveles de adherencia terapéutica. Para el tratamiento del resto de síntomas, todos los tipos de ejercicio tienen similares resultados.

PALABRAS CLAVE: Fibromialgia, tratamiento, fisioterapia, ejercicio, actividad física, deporte.

1. INTRODUCTION

Fibromyalgia was recognized as a disease by the World Health Organization in 1992. It is considered a chronic pain syndrome, whose etiology is unknown, and characterized by widespread diffuse pain, associated with other symptoms like sleeping pattern disorders, irritability, chronic fatigue, irritable bowel syndrome, cognitive disorders, and numbness and tingling in arms and legs.[1]

A clear cause of its etiology and pathogenesis has not been found, and several physiopathological models have been proposed to try to find an answer.[1] These models postulate different origins, including genetic, psychological or even nervous or hormonal alterations. Currently, scientific literature has a tendency to interpret the origin of this disease from a holistic point of view.

The prevalence of fibromyalgia is between 2 and 3%.[2] In Spanish population it is estimated to be between 2 and 4%.[3] There is remarkable increase in the incidence of the disease in Europe, rising from 2-3% to rates close to 5%.[2] Regarding the gender differences, all studies show a higher rate in women, with an approximate correlation of 6 to 1.[4] Moreover, its diagnosis is almost non-existent in children, and its appearance increases with age, reaching its highest point between 60 and 79 years old.[4]

Due to the fact that is a disease whose etiology is unknown and has a broad symptomatology, its diagnosis is practically as complex as its treatment. Nowadays, the criteria from 1990 of the American College of Rheumatology[5] are used. Two conditions are required: history of widespread pain and pain in 11 of 18 tender points. In 2010, these criteria were reviewed, removing tender points and introducing the concept of pain and symptoms severity and also the differential diagnosis.[6]

Being an idiopathic disease, treatment is based on palliative symptomatic care. It is focused in reducing symptomatology and improving both the quality of live and functionality of a subject with fibromyalgia. The main goals of the treatment are pain relief, keep or reestablish the mood balance, improve sleep quality, physical capacity, asthenia and other associated problems.[7]

It requires cooperation of a multidisciplinary team who combine medical, pharmacological, and psychological treatment with physiotherapy.[7-9] Within physiotherapy, it has been mainly applied hydrotherapy, electrotherapy, kinesiotherapy, and therapeutic exercise. Anyway, there are some contradictions in the treatment in scientific literature, and therapeutic exercise is one of the treatments whose efficacy seems to be proved.[10,11] In spite of this, exercise protocols are not very explicit, and they are usually reduced to recommend aerobic exercise.

2. OBJECTIVES

Owing to fibromyalgia is a disease with a high prevalence and increasing incidence, which presents a complex symptomatology that could seriously affect the quality of life of the people who suffer it, and whose treatment show some uncertainties; this review expect to delve deeply, unify, and specify the different levels of evidence of the different type of exercises, the only treatment broadly recommended and which seems to be effective.

The main purpose of this study is; therefore, to find the most effective type of exercise for subjects with fibromyalgia. Additionally, the following secondary objectives have been considered:

- Find whether an individual or group treatment is more effective, or if it is more effective practicing individual or team sports, whether or not with professional supervision;

- Find which exercise is more effective: aerobic exercise, strength exercise, combined exercise or other type of exercise;

- Find the most suitable frequency and intensity for the physical exercise;

- Evaluate the effectiveness of the exercise in the short and long term.

3. METHODS

The studied population is adults, from different European and American nationalities, with a diagnosis of fibromyalgia.

The interventions included are based on therapies with physical exercise. To simplify their analysis, they have been divided into five different categories: aerobic exercise, strength exercise, combined aerobic and strength exercise, aquatic exercise and other activities like tai-chi or yoga. Majority of these studies compare these therapies with a control group or with other physical therapy treatments described in the results section.

Moreover, to quantify and evaluate objectively the data obtained from the results, this study tries to compare clinical trials which use the same evaluation tools. Due to the complexity of fibromyalgia, it is difficult to quantify its symptoms, and therefore, there are many instruments used in the clinical trials included in this review. Questionnaires have been the paramount instrument, mentioned below in order of importance and frequency of use:

The fibromyalgia Impact Questionnaire (FIQ)[12] is a validated instrument to evaluate the impact of fibromyalgia in the health of the subjects. Values obtained fluctuate between 0 and 100. It is really similar to *the 36-Item Short-Form Health Survey (SF-36)* a questionnaire which offers a general view of the health status of a person, given that it evaluates 8 different dimensions through 36 items. As FIQ does, the final score of this test varies between 0 and 100, being 100 an optimal health.

The Brief Pain Inventory (BPI)[13] is another instrument to quantify the severity of the subject's pain (sensory dimension) and the impact of this pain on the patient's daily functioning (reactive dimension). Scores are between 0 and 10, where a 10 means non-existing or non-interfering pain.

The *Pittsburgh Sleep Quality Index* (PSQI)[14] is a questionnaire to assess the sleep quality and sleep patterns in adults. Although scores oscillate between 0 and 25, a score of 5 or over shows a poor sleep quality.

The Beck Depression Inventory (BDI)[15] is another questionnaire with 21 items to assess depression. Scores over 13 mean the presence of depression and over 21 indicate severe depression.

Also there were used other less important instruments focused on measuring physical capacity. In most of them, the subject has to complete a repetitive test as many times as he can, in a given time. Some of these tests are the 6-minute walk test (6MWT), chair test, or hand-grip strength test. As regards to physical performance, is measured by BORG scale. The subject will determine his grade of physical exertion in a range from 6 to 20.

3.1 Search strategy

The literature has been reviewed between March and October of 2013, via the following databases: PeDRo, PubMed, Cochrane Plus, ISI (*Web of Knowledge*), and PsycINFO, in addition to manual searches in the journals Fisioterapia and Cuestiones de Fisioterapia.

In all database, with the aim of covering all the studies related to this issue, the key word combination included the terms fibromyalgia, treatment, exercise, sport and physical activity.

These terms were adapted to the specific requirements (such as language) of each database, as it is described below.

In Pubmed database, a search was done with key words in English accepted as Mesh descriptors. The search algorithm was ("*Fibromyalgia*"[Mesh]) AND ("*Exercise*"[Mesh] OR "*Sports*"[Mesh] OR "*Physical Education and Training*"[Mesh])

In PEDro and PsycINFO database**,** due to the simplicity of their browser, three different searches were done, all of them in English, and combining fibromyalgia with the other three terms. First one was "*fibromyalgia"* AND "*exercise"*, second one "*fibromyalgia"* AND "*sport"* and the last one was "*fibromyalgia"* AND "*physical activity"*.

In Cochrane Plus, searches were exactly the same tan the ones above, but with the key words in Spanish. The three searches were "fibromyalgia" AND "ejercicio", "fibromyalgia" AND "deporte" and finally "fibromyalgia" AND "actividad física".

Finally, in the ISI (*Web of Knowledge*) database, and owing to the high number of results obtained, a more precise search was done, adding always the key

word treatment to fibromyalgia; and combining both of them with sports, exercise and physical activity. Consequently, the following searches were done: first one Title=(*fibromyalgia*) AND Topic=(*treatment*) AND Title=(*exercise*), second one Title=(*fibromyalgia*) AND Topic=(*treatment*) AND Title=(*sport*), and third one Title=(*fibromyalgia*) AND Topic=(*treatment*) AND Title=(*physical activity*).

Besides, manual search in the journals Fisioterapia and Cuestiones de Fisioterapia was conducted in the issues corresponding to the last 10 years, using the same key words: fibromyalgia, physiotherapy, sport, exercise, physical activity and treatment.

3.2 Selection of studies

Studies obtained from the different combination of key words were analyzed subsequently to meet the inclusion and exclusion criteria.

After getting the first results, and due to the high number of articles about this issue, in this review they were included only the studies published within last 10 years, whose original languages publication were English or Spanish, were tested in humans and their design were meta-analysis or randomized controlled trial (RCTs).

Publications including cases of juvenile or pediatric fibromyalgia were excluded, as well as the one which include other type of diseases, or other treatments apart from exercise, regardless of being pharmacological, psychological or physical therapy.

Altogether, 583 publications were extracted in the initial search. After getting them through the exclusion and inclusion criteria the number of articles was reduced to 51.

After a process of comparing and removing coincident articles, a final number of 32 publications were included in this systematic qualitative review (see Figure 1). This selection process was conducted independently by two separate researchers.

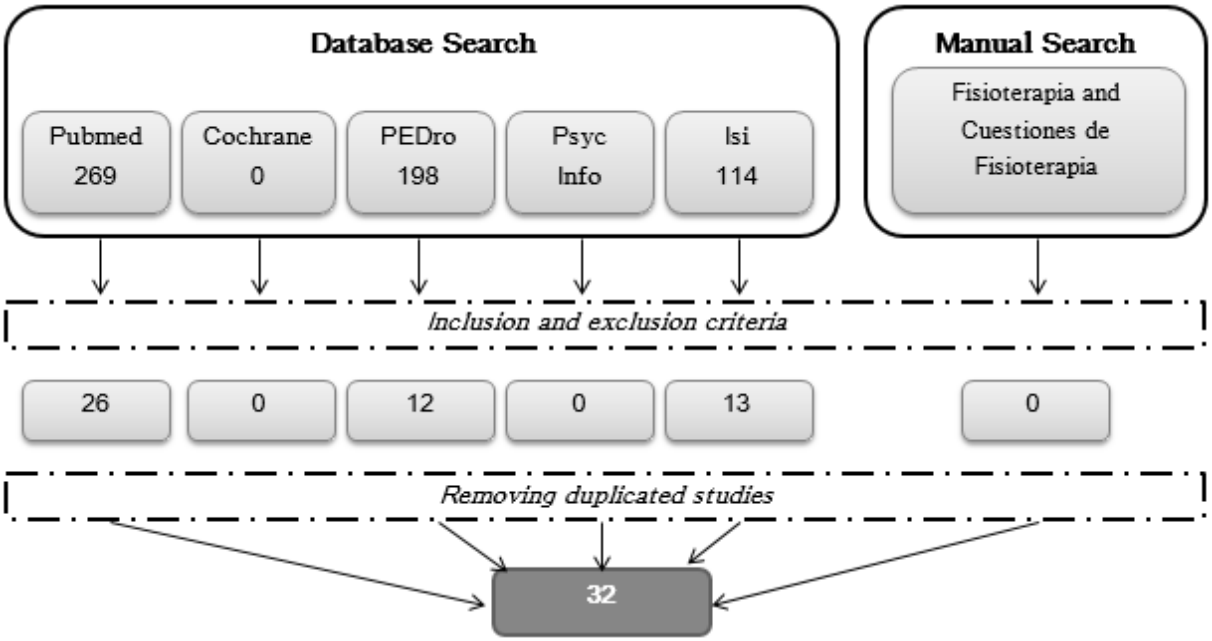

Figure 1: Flow diagram of study selection process

Once all publications were abstracted, their scientific and methodological quality was assessed.

The impact factor of a journal is considered an objective index, but unfair, given that the publications in the same journal will get the same score. This review intends to take into account both the impact factor and the individual score of each separate article.

The impact factor of each journal was retrieved from the Journal Citation Reports, from 2011[16]. The specific score of each publication was evaluated by the SIGN scale (*Scottish Intercollegiate Guidelines Network*).[17] This scale is divided into 8 different levels, with scores from 1 to 4, where 1++ is the highest level of evidence and 4 is the lowest.

With the intention of demarcating the methodological quality of the studies, and consequently, classified them according the SIGN level of evidence; each article was evaluated independently by the Consort statement (*Consolidated Standards of Reporting Trials*).[18]

After a critical reading and analysis of these randomized trials, all of them were accepted over the established minimum as regards to methodological and scientific quality, with a score of 2 or over in the SIGN scale.

The most important and relevant data of these studies was extracted and classified into tables to facilitate their comparison and analysis. The extracted

data from each study was: study limitations, measuring instruments, objectives, interventions, result variables, outcomes, long and short term follow-up and if the exercise was done individually or in a group, and with or without professional supervision.

4. RESULTS

4.1 Aerobic exercise

The effectiveness of aerobic exercises in the symptomatology of fibromyalgia has been broadly researched (see Table 1).

Table 1: Methodological quality of the studies of aerobic exercise as a treatment for fibromyalgia

Authors	Objectives	Intervention	Result variables	I.F.	LoE	Country	S	Year
Fontaine KR, Conn L, Clauw DJ	Asses the effects of a healthy lifestyle	Therapeutic education against 60 minutes of physical activity	Pain, fatigue, depression and function	1.364	1++	USA	73	2011
Sanudo B, Galiano D, Carrasco L, Blagojevic M.	Compare the effectiveness of aerobic exercise with combined exercise	3 groups: control, aerobic exercise (2 times per week, 45-60 minutes, 65-80% intensity) and combined (strength, flexibility and aerobic)	Physical functionality, depression and pain	2.284	1++	Spain	64	2010
Mannerkorpi K, Nordeman L, Cider A, Jonsson G.	Investigate the effects of Nordic walking of moderate and high intensity	High intensity Nordic walking (20 minutes 60-80%) and low intensity(45 minutes and less than 50% intensity)	Pain, functionality and physical capacity	4.445	1+	Sweden	67	2010
Dobkin PL, Abrahamowicz M, et all.	Assess the effects of physical activity in daily life of women with fibromyalgia	Control group with 3 sessions per week of 60-120 minutes, stretching and high intensity 60-85% aerobic exercise, and afterwards, 12 weeks exercising on their own	Pain, functionality, stress and autonomy	4.851	2+	Canada	39	2005
Gowans SE, Dehueck A, Voss S, Silaj A, Abbey SE.	Measure mood and functionality after an intervention with aerobic exercise	Control group against physical exercise 3 times per week 30 minutes (aerobic exercise 60-75% and 6 first weeks in pool	Tender points, depression, functionality, autonomy and physical status	4.851	1++	Canada	29	2004
da Costa D, Abrahamo M, Lowensteyn I, et al.	Determine the effectiveness of a program of home-based exercises	Control group against home based exercises, stretching and aerobic exercise 60-85% and 60 to 120 minutes per week	Pain, functionality and stress	//	1++	Canada	79	2005

Fontaine KR, Conn L, Clauw DJ.	Investigate the effects of 30 minutes of physical activity of free choice	Control group with therapeutic education versus physical activity (free choice activity, moderate intensity at least for 30 minutes, 5 and 7 days per week	Functionality, pain, fatigue, depression and physical capacity	4.445	1++	USA	84	2010
Newcomb LW, Koltyn KF, Morgan WP, Cook DB.	Compare the effectiveness of exercise depending if the intensity is chosen or prescribed	Two groups: 20 minutes of stationary bicycle with preferred intensity against 70% prescribed intensity	Intensity, pain and mood status	4.431	1-	USA	21	2010

IF: Impact factor
LoE: Level of evidence
S: Sample

Sanudo,[19] comparing an exercise program, design exclusively with aerobic exercise, with another of combined exercise, got similar improvements around 14% in FIQ and SF-36 tests. The only differences were found in the decrease of depression, which was 8,5 points in the BDI compared to the 6,5 of the combined exercise. On the other hand, the mental dimension of the SF-36 had better progress with combined exercise, the same as mobility and strength. These results were very similar to the ones of Gowans[20] and Da Costa,[21] who also proved that the improvements were kept in the long term follow-up.

Once the effectiveness of aerobic exercise has been proved, some other authors tried to find what the optimal exercise intensity is.[22,23,24] Mannerkorpi[22] had no statistically significant differences between both groups in FIQ and pain, he only had improvements in terms of physical performance. Newcomb,[24] concluded that the exercise intensity was indifferent, and that the pain in the lower extremities increased during exercise, although some days later decreased to lower levels than the pre-intervention state. The fact of choosing the intensity of the exercise, made their mood better. Fontaine[23] went one step further, and he simply encouraged the subjects to have a healthier lifestyle by therapeutic education, improving their FIQ levels a 10% and pain in a 15%, although there were no significant differences in the number of tender points, fatigue or distance covered in the 6MWT. A year later, he completed his study with long term results[25]. Physical activity was reduced virtually to the pre-intervention levels, as well as the FIQ and pain scores.

Lastly, Dobkin[26] focused in a very important aspect such as the variables related to the desertion of the exercise programs. He could assert that for stretching programs, the high levels of stress pre and post-intervention were closely connected to the desertion. The same happened with the aerobic exercise during the intervention and the perceived levels of disability.

4.2 Strength exercise

Strength exercise has been as well studied as aerobic exercise, but it shows more contradictory results (see Table 2). In this review 6 articles were included, whose main intervention was a program of strength exercise.

It seems there are no big differences comparing the strength exercise programs with aerobic exercise. Hooten[27] observed that, with both interventions there were improvements of 1,5 points in the VAS, Kayo[28] got scores close to 3 points, and Birgan[29] reached 3,5. Moreover, they obtained FIQ scores reduced in 30 points, fatigue and sleep in 3 points in the PSQI, and an average decrease of 3 tender points.[29] In the long term, it was proved that the benefits gained during intervention were reduced to a 50%, independently of the type of exercise.[28]

Table 2: Methodological quality of the studies of strength exercise as a treatment for fibromyalgia

Authors	Objectives	Intervention	Result variables	I.F.	LoE	Country	S	Year
Hooten WM, Qu W, Townsend CO, Judd JW	Compare aerobic with strength exercise to reduce pain	Strength 30 minutes 3 times per week, 10 repetitions per exercise against aerobic exercise in bike for 10 minutes daily	Pain, maximal O2 consumption, strength	5.777	1+	USA	72	2012
Kayo AH, Peccin MS, Sanches CM, Trevisani VF	Assess the effectiveness of walking and strength exercise to reduce pain	3 groups: control; aerobic 25-50 minutes and 50-70% intensity; and strength with free weight 3 sets of 10 to 15 repetitions	Pain, functionality and quality of life	1.885	1-	Brazil	90	2012
Bircan C, Karasel SA, Akgun B, El O, Alper S.	Compare the effects of aerobic exercise with strength exercise	2 groups: aerobic exercise (20-30 minutes 60-70% intensity) Strength exercises (5-12 repetitions with free weight or without weight)	Tender points, functionality, sleep, fatigue, pain and depression	1.885	1-	Turkey	30	2008
Kingsley JD, Panton LB, Toole T, Sirithienthad P, Mathis R, McMillan V.	Evaluate if strength exercise has benefits in women with fibromyalgia	Control group against strength exercise twice a week, 11 muscular groups with 40 to 80 of its maximum capacity	Tender points, functionality and strength	2.284	1-	USA	29	2005

Hoeger Bement MK, Weyer A, Hartley S, Drewek B, Harkins AL, Hunter SK.	Find if isometric contraction relieve pain in women with fibromyalgia	A group that complete 4 sessions of isometric contractions varying the intensity	Pain and functionality	2.284	1-	USA	15	2011
Valkeinen H, Alen M, Hannonen P, Hakkinen A, Airaksinen O, Hakkinen K.	Research the effects of a training program in the neuromuscular function in women with fibromyalgia	Three groups: control, healthy, and experimental – strength (2 times per week, 60-90 minutes, 2 sets of 15-20 repetitions and 40-60% intensity)	Pain, functionality and maximal strength	4.058	1-	Finland	37	2004

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LoE: Level of evidence
S: Sample

The main contrast was the differences in scores in relation to physical capacity. Subjects who completed aerobic exercise programs increased much more their maximum oxygen consumption, whereas the ones in strength exercise program improved much more their performance in maximum strength tests.[27]

Studies from Kingsley[30] and Valkeinen[31] showed lower scientific evidence and less relevance. They could not find significant differences in FIQ scores, neither in the number of tender points or pain, although they found it in the strength gain.

On the other hand, Hoeger[32] observed that women, who suffered a greater pain after an isometric voluntary contraction, and the younger ones, were the only ones who made some improvements with a strength exercise program.

4.3 Combined exercise

The term combined exercises comprise all programs which combine strength, aerobic, and flexibility exercises, without prevailing one of them over the others (see Table 3).

Table 3: Methodological quality of the studies of combined exercise as a treatment for fibromyalgia

Authors	Objectives	Intervention	Result variables	I.F.	LoE	Country	S	Year
Sanudo B, Galiano D, Carrasco L, de Hoyo M, McVeigh JG	Compare a physical exercise program with regular cares	Control group against aerobic, strength, and flexibility 2 times per week 60 minutes	Depression, welfare and functionality	2.049	1++	Spain	42	2011
Garcia-Martinez AM, de Paz JA, Marquez S.	Evaluate the impact of physical exercise in the quality of life of women with fibromyalgia	Control group against individualized physical exercise 3 times per week for 1 hour, aerobic 60-80%, stretching and strength exercise	Physical and psychological functionality	1.885	1+	Spain	28	2011
Sanudo B, de Hoyo M, Carrasco L, et al	Evaluate a program of traditional exercise adding whole body vibrations	3 groups: control, traditional combined exercise and traditional combined exercise in a vibratory platform	Physical functionality, pain, health and fatigue	1.585	1+	Spain	36	2008
Wennemer HK, Borg-Stein J, et al.	Evaluate functionality after completing a combined exercise program	Combined exercise of flexibility, low impact aerobic, strength, balance, and Taichi, 3 times per week 120 minutes	Functionality, physical capacity	1.581	2+	USA	23	2006

IF: Impact factor
LoE: Level of evidence
S: Sample

All the included studies have reported very positive results. Among them, it could be found improvements in the scores of the SF-36 from 8 to 20%, in FIQ between 13% and 18%, and 18% of depression.[33,34] Wennemer[35], obtained similar results, and in spite of the low scientific evidence without a control group, there were also benefits in functionality, mobility and in the 6MWT.

Using vibratory platforms seems to double the effectiveness in symptoms such as pain, fatigue and stiffness; although there are no substantial differences in the scores of depression[36].

4.4 Aquatic exercise

Aquatic exercises has been also broadly described as an effective treatment (see Table 4) All the studies included performed a similar intervention, with a pool of temperatures oscillating between 31º and 37º, in 60 minutes sessions. Frequency of these sessions varies between 2 and 3 times per week, during 12 or 16 weeks. The only one who is not following this pattern is Evcik[37], with just a 5 weeks intervention.

Munguía Izquierdo[38,39], Gusi[40] and Tomas-Carus[41,42] found improvements from 5 to 20 points in the FIQ score, a decrease of 4,5 tender points and of the PSQI

score in 2 points, but above all, a great improvement of the physical condition, mobility, autonomy and anxiety.

In the long term, Gusi proved that after a distrainment period as long as the training one, half of the benefits achieved with the program were lost, whereas in the randomized trial of Tomas-Carus, values returned to the pre-intervention levels, which means that all benefits were lost. Altan[43] support these results, proving firstly that balneotherapy improved symptomatology less than the exercise; and secondly, he observed that after 6 month symptomatology worsened, although that worsening was slower in the group who did physical exercise.

Other researches have tried to compare aquatic exercise with other type of exercise. Evcik[37] compares it with a home-based exercise program. In both interventions, FIQ and BDI scores were reduced to similar levels, around 10 and 5 points respectively. Greatest differences were found in the levels of pain and number of tender points, reduced double with the pool program up to 2 points in the VAS of pain, and 4 tender points. It is important to mention that Evcik observed that the benefits were maintained in the long term with both exercise programs.

On the other hand, Assis[44] compared land-based aerobic exercise with aquatic aerobic exercise. There were some improvements, although they were no significant differences between both groups in depression or pain. Only the FIQ score had a higher and faster improvement with aquatic exercise.
Finally, De Andrade[45] research proved that there are no major differences in completing a program in a pool or in seawater. He obtained similar results to the authors previously quoted, but depression in the sea water group double in benefits.

Table 4: Methodological quality of the studies of aquatic exercise as a treatment for fibromyalgia

Authors	Objectives	Intervention	Result variables	I.F.	LoE	Country	S	Year
Munguia-Izquierdo D, Legaz-Arrese A.	Evaluate the effects of a training program in a pool and its adherence	Control group against aquatic exercise, 3 week sessions of 60 minutes, 20 strength and 20-30 aerobic with 50-80% intensity	Tender points, psychological, cognitive and physical status, sleep	2.284	1+	Spain	85	2008
de Andrade SC, de Carvalho RF, et al.	Compare the effectiveness of aerobic exercise in a pool with exercise in the sea	2 groups: aerobic exercise (pool, 3 times per week, 60 minutes, 50-70% intensity) and the same program in the sea	Tender points, pain, functionality, psychological and physical status and depression	1.885	1+	Brazil	46	2008

Gusi N, Tomas-Carus P, et al.	Assess the effectiveness in the short and long term of therapeutic exercise in water	Control group against pool based exercise (20 minutes of aerobic, 65-75 intensity, plus mobility and strength)	Quality of life, pain and physical capacity	4.851	1+	USA	34	2006
Assis MR, Silva LE, Alves AM, et al.	Compare effectiveness of aerobic exercise with water aerobic exercise.	Two groups: aquatic running versus land running. Both 3 times per week, 60 minutes each session	Pain, depression, psychological and physical status, functionality	4.851	1+	Brazil	60	2005
Altan L, Bingol U, Aykac M, Koc Z, Yurtkuran M.	Compare effectiveness of pool-based exercise with balneotherapy	Balneotherapy in a pool against exercise in a pool (35 minutes of joints mobility, stretching and relaxing exercise) 3 times per week	Pain, stiffness, sleep and depression	1.885	1-	Turkey	50	2004
Evcik D, Yigit I, Pusak H, Kavuncu V.	Research the effects of aquatic exercise as a treatment for fibromyalgia	Home based exercise against aquatic exercise. 3 sessions per week of 60 minutes with aerobic and mobility exercise	Pain, tender points, depression and functionality	1.885	1+	Turkey	63	2008
Munguia-Izquierdo D, Legaz-Arrese A.	Assess the effect in the cognitive function of water exercise in women	Control group against pool based exercise 3 sessions per week (mobility, aerobic, strength and relaxing exercises)	Pain, physical status and cognitive function	2.148	1-	Spain	60	2007
Tomas-Carus P, Gusi N, et al.	Assess the effects of warm water exercise in women with fibromyalgia	Control group against aquatic exercise 3 times per week of 60 minutes	Functionality, welfare, stiffness, pain, anxiety, depression	1.364	1+	Spain	34	2007
Tomas-Carus P, Raimundo A, et al.	Assess the effects of warm water exercise in pain relief and tender points	Control group against aquatic exercise of 60 minutes, 3 times per week	Tender point, functionality, stiffness, pain and depression	4.431	1++	Spain	35	2007

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4.5 Alternative activities

Tai Chi, Yoga and Pilates have been other studied activities as a treatment for fibromyalgia (see Table 5).

Tai Chi practice is effective to reduce symptomatology of fibromyalgia. Both Jones[46] and Wang[47] applied a similar methodology with similar results. They

obtained benefits in FIQ scores between 16 and 27%. Jones also observed improvements in the severity and impact of pain, as well as sleep quality and autonomy; and Wand in the mental component scores. After 12 weeks post-intervention, benefits from Tai Chi were maintained with 20 minutes of individual practice at home. The third study and also the one with the lowest evidence (given that it did not include a control group), it also obtained positive results[48].

Another alternative activity is Yoga. Carson[49] assessed the effects of a weekly practice in women with fibromyalgia, getting a reduction of FIQ scores in 20%, specially fatigue, stiffness and pain. It was also included the decrease in tender points number from 17 to 15. There were no significant differences in the remaining variables measured.

Finally, last randomized trial of Pilates[50] in subjects with fibromyalgia is, so far, merely illustrative, although it shows interesting outcomes. After the intervention, it seems to improve the pain-generating pressure threshold, the number of tender points (from 18 to 14) and FIQ and pain scores (22% in FIQ and 20% in VAS). After 12 weeks the health status of the subjects was reassessed and the results were practically equal to the ones obtained immediately after treatment. Only a slight pain increase and FIQ scores are worth mentioning.

Table 5: Methodological quality of the studies of alternative activities as a treatment for fibromyalgia

Authors	Objectives	Intervention	Result variables	I.F.	LoE	Country	S	Year
Harbour R, Miller JA.	Compare effectiveness of TaiChi practise with therapeutical education	TaiChi twice a week, 90 minutes against therapeutic education control group	Functionality, pain, sleep, autonomy and mobility	1.364	1++	USA	101	2012
Carson JW, Carson KM, Jones KD, Bennett RM, Wright CL, Mist SD.	Asses the effectiveness of a Yoga program in women with fibromyalgia	Control group against Yoga program, 120 minutes a week, plus daily home practice for 20-40 minutes	Pain, fatigue, mood status	5.777	1+	USA	53	2010
Wang C, Schmid CH, Rones R, et al.	Evaluate TaiChi as paliative care for fibromyalgia	Control group against TaiChi program. Two sessions per week of 60 minutes, plus home daily practice for 20 minutes	Pain, functionality, physical capacity	53.29	1++	USA	66	2010
Taggart HM, Arslanian CL, Bae S, Singh K.	Assess effects of TaiChi in the symptoms of fibromyalgia	A TaiChi program, sessions of an hour twice a week	Depression, functionality, fatigue, stiffness and pain	0.471	2+	USA	39	2003
Altan L, Korkmaz N, Bingol U, Gunay B.	Assess the effects of a Pilates program in the quality of life of women with fibromyalgia	Two groups: home based exercises of stretching and muscle strengthening, against a Pilates program of 3 sessions per week for an hour	Pain, tender points, psychological and physical status and functionality	2.284	1+	Turkey	50	2009

IF: Impact factor
LoE: Level of evidence
S: Sample

5. DISCUSSION

Although there is some diversity in the results obtained in the different interventions with therapeutic exercise, it is important to notice that none of these programs or physical activities studied was counter-productive or damaging. There is only a slight increase in pain during the physical practice, but is a temporary fact that improves quickly in the short term.

There are no great differences in terms of effectiveness between the different types of exercise. Symptomatology decrease oscillates in all of them from 8 to 20%, but it is important that subjects involved in aquatic programs and alternative activities refer lower pain while completing the sessions. As regards to tender points and depression reduction, aquatic and combined exercise programs and alternative activities, seem to be slightly more effective.

Despite the fact that the majority of exercise programs are following the recommendations of the *American College of Sports Medicine*[51], there are no scientific evidence that these guidelines are more effective. Moreover, there are some signs that lower intensities and daily training sessions are as effective as moderate and high intensities, 2 or 3 times per week.

Furthermore, the improvement in physical capacities, such as strength, endurance or flexibility, is related to the symptomatology reduction but it is not a necessary condition. The impact of this disease can be palliated without improving the physical performance. It also seems probable that the greater impact and severity of the disease, the more effective the exercise becomes. There is also greater improvement when the subject with fibromyalgia is younger.

Besides that, benefits of exercise in long term are very unalike. Rates oscillate from maintain the improvements after the intervention to lose them completely, but never reaching levels under the pre-intervention state. With individual and independent exercise, benefits are kept. It is needed a further research about if it is better to exercise individually or in a group, and with or without supervision, owing to the results obtained are not conclusive.

Finally, it has been proved that therapeutic adherence rates are higher in programs that include a variety of activities, or in the ones that the subject has the possibility of choosing the intensity or type of exercise. Within the established programs, alternative and aquatic activities tend to be more successful that aerobic and strength exercise.

This review has some limitations that should be taken into account when analyzing the results. Main limitation is, as it is found in all systematic reviews, that is a retrospective study, which means it could have suffered scientific bias in all the stages of the process. One of them is publication bias. Another limitation could be observed in search and study selection process. Including and excluding criteria could affect the result. It is worth to mention language as one of them.

Furthermore, a review will always be limited by the quantity and quality of the previous studies. First of these limitations, as regards to the articles here included, is that most of them use the criteria from 1990 of the *American College of Rheumatology* for the diagnosis and selection of the sample, but there is a new diagnosis criteria established on 2010. The second is the

impossibility of completing a double-blind trial due to the specific characteristics of the intervention, although the main variable was blind in 29 out of 32 randomized trials. The third one, is the inclusion of a single exercise supervisor. The forth, is that most of the studies use subjective questionnaires to evaluate the improvement, with the possibility that this result could be influenced by other factors such as the subjects taking part into the clinical trial. The fifth one is the reduced sample size in the majority of the researches.

Finally it is also worth to mention that a high percentage of the included publications are done with a sample of only women. Although general population of subjects with fibromyalgia is women, it is important to take into account this fact if there is an intention of extrapolating these results to other population.

In light of the aforestated, this review opens two lines of future research. First one, to cover the lack of information about how psychological and social factors, affect the subjects with fibromyalgia who practice physical activity. It has been proved that sport practice has great psychological benefits[52]. Being fibromyalgia a disease whose etiology is unknown and having a psychosomatic symptomatology, it could be immensely affected by these factors, but it is necessary deeper investigation if physical activity has the same effects in subjects with this pathology.

The second line is about the exercise guidelines. There is some evidence that practically, all type of activity, intensity, duration and frequency are effective reducing symptomatology. Therefore, it would be necessary to verify this hypothesis, to start experimenting with different activities to the ones here described. It would be extremely positive to broaden the scope of choices equally effective. Broadening the choices and variety of activities according to the subject preference, could increase the therapeutic adherence to the programs. Within this context, it is highly recommended to assess the effects of different sports, given that they are low cost activities, widely spread and easily accessible to everyone; but they have not been studied yet.

6. Conclusion

After this review, it is concluded that any type of exercise is efficient to reduce the symptomatology of fibromyalgia. Aquatic exercise, combined exercise and alternative activities seem to be more effective for the treatment of tender points, depression and they have higher rates of therapeutic adherence. To treat the rest of the symptoms, all types of exercises have similar results, independently of the modification of variables such as exercise intensity, duration, or frequency. In addition, there is a need of more studies, which delve deeply into the effectiveness of other activities and sports, as well as a long term follow-up and assessing the benefits of individual or group practice.

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