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Literature review

## Benefits of physical training in fibromyalgia and related syndromes

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### Abstract

**Objective.** – To review the published information on physical training for fibromyalgia (FM) and related syndromes.

**Methods.** – A search of Medline literature (via Ovid and PubMed) with the following keywords: *FM, chronic fatigue syndrome, therapy, rehabilitation, aerobic, exercise, and cognitive behavioral therapy*. The reference lists of articles were examined for additional related articles.

**Results.** – Several studies investigated the benefits of graded exercise therapy for patients with FM or related syndromes. Although some systematic reviews have not established an unequivocal benefit of physical training, most authors report a benefit for patients with chronic pain or fatigue. Ideally, such a therapy should be a part of multidisciplinary program. Muscular rehabilitation is reserved for preventing the deconditioning syndrome often reported in patients and the vicious cycle of pain, avoidance and inactivity behaviors, or even kinesiophobia, deconditioning, incapacity and psychological distress.

**Conclusion.** – This review emphasizes the relevance of graded physical training for treating FM and related syndromes. The development of rehabilitation centers, with experts able to propose a relevant therapy to patients with chronic pain or fatigue, should help alleviate this public health problem.

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**Keywords:** Fibromyalgia; Chronic fatigue syndrome; Rehabilitation; Physical training; Therapy

### 1. Introduction

Fibromyalgia (FM) is defined as a chronic and diffuse polyalgic syndrome characterized by musculoskeletal pain (axially distributed, including pain on both left and right sides of the body and pain above and below the waist) for more than 3 months [93]. This syndrome is associated with a widespread state of allodynia, abnormal manifestations of nociception, defined as pain perception resulting from a stimulus that normally should not induce a painful response [38]. Patients with FM usually have additional complaints such as pronounced fatigue, sleep disturbances, psychological distress, articular pain, muscular spasms and morning stiffness [91]. The co-existence of FM with other non-musculoskeletal affections, such as genitourinary disorders, irritable bowel syndrome or restless leg syndrome, are frequent [28,72,74,82,85,91,94].

FM in the general population has relatively high prevalence. The syndrome represents a major public health problem

because of the increased need for health care and the high rate of work absenteeism (sometimes longer than 1 year) [41, 42,50]. In 1981, Yunus et al. [96] reported that 20% of patients consulting a rheumatologist for the first time presented with FM syndrome, making it the most common diagnosis after rheumatoid arthritis [12,23]. In 1995, Wolfe et al. [92], in a study of 3000 subjects, reported a prevalence of 2% in the North American adult population. The mean was 3.4% for females and 0.6% for males. A more recent study [87] revealed 3.3% of subjects had FM (4.9% females vs. 1.6% males), with an increased rate in women 50–64 years old (8.9%). A sex ratio analysis finds that 90% of FM patients are women [92]. A fibromyalgia diagnosis has been reported in children [95]. Low socioeconomic level, heavy physical work, low educational level or divorced status are some of the factors related to FM [87]. The psycho-socio-cultural aspect probably plays a part in the life and “exteriorization” of chronic pain [5].

Therapists frequently treat patients with chronic pain or fatigue, one of these symptoms sometimes predominating over the other. The diagnosis of FM is made only after the exclusion of objective diseases (rheumatic, systemic, endocrine disorders,

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anomaly of calcic metabolism, underlying neoplasia) [90,94]. Investigations must exclude metabolic, toxic or inflammatory myalgia, among others [90,94]. FM represents a syndrome consisting of a group of symptoms likely to constitute a particular nosologic entity. The syndrome has at its boundaries other entities with no systematically explained etiology such as spasmophilia [3] and chronic fatigue syndrome (CFS) [24, 36]. About 70% of CFS patients display symptomatic signs of FM, whereas 42% of FM patients meet CFS criteria [8,9, 29–31,55,63] and 37% of CFS subjects meet FM criteria [15]. Wessely et al. [86] suggested that CFS, FM and irritable bowel syndrome are polymorph expressions of the same somatic and psychological disorder.

## 2. Materials and methods

We conducted a Medline search (via OVID and PubMed) for articles on FM. Keywords included *FM, CFS, therapy, rehabilitation, aerobic, exercise, and cognitive behavioral therapy*. The reference list of articles were examined for additional related studies.

## 3. Therapy and benefits of reconditioning programs

The pathophysiology of FM remains unknown. Several hypothesis have suggested muscular anomalies, sleep, neuroendocrinal, psychological, immunological, and central nervous system disorders, although none has been clearly demonstrated. In fact, such changes could represent symptoms secondary to the FM syndrome.

Although the pathophysiology of FM is still unclear, rigorous clinical assessment and the establishment of therapeutic objectives represent essential preconditions to determine the best therapeutic option [79]. Would the patient accept persistent pain? Which kind of activity is preferred? How can the quality of life and functional capacity be improved? Educating patients appears necessary to avoid drug over-consumption [2].

Several cognitive factors, such as patients' beliefs related to the interpretation of their chronic pain status, can play an essential role in the expression of symptoms. These erroneous beliefs—dramatization, untreatable affection, avoidance behavior—represent obstacles to a “reactivation” program. Smith et al. [73] showed that cognitive distortion related to pain was associated with incapacity. Consequently, the medical care of FM patients requires a multidisciplinary approach including information, education, medical follow-up, cognitive-behavior strategies, and exercise therapy, the latter being a key component in the therapy.

Because pharmacological therapy does not provide evident benefits to FM patients, nonpharmacological therapy is essential [50]. The influence of some molecules has been investigated in randomized controlled studies, but results appear to be conflicting.

Tricyclic antidepressants have various effects through their action on serotonin systems [56]. Amitriptyline (10–25 mg/day) appears effective to improve the quality of sleep and pain intensity in FM, although fatigue is better improved with

cyclobenzaprine (10–30 mg), which has a major myorelaxant effect [13,45]. Decreased pain resulting from antidepressant medications does not seem to be related to the antidepressive action, because no difference was observed on treatment of patients with or without depression [60]. The positive effect of such therapy is decreased over time, thus reducing its relevance. Moreover, adverse effects resulted from anticholinergic actions [17]. The selective serotonin reuptake inhibitors (fluoxetine, citalopram) result in nonsignificant pain decrease. However, sleep disturbances, depression and mood can be improved [2,17]. A nonselective serotonin reuptake inhibitor (venlafaxin) decreased symptoms, including fatigue, in 55% of FM patients with an associated psychiatric disorder (depression and anxiety) [2,22]. Some studies reported a benefit of benzodiazepines in treating specific symptoms (anxiety, myorelaxant effect and pain). However, such drugs can result in physical dependence and should therefore be used with caution. A double-blind randomized study revealed that alprazolam (0.5–3 mg/day for a short period) was effective [68]. Nonsteroidal inflammatory drugs do not seem to be effective and can only play a co-analgesic action in FM treatment [2,68]. The association of ibuprofen and alprazolam appears more efficacious than ibuprofen alone, although additional benefits are limited [68]. Naproxen would be better taken with amitriptyline [68]. In a recent double-blind randomized study, Crofford et al. [18] revealed the effectiveness of pregabalin (450 mg/day) in pain decrease as well as fatigue and sleep improvements as compared with a placebo group. Melatonin does not seem to improve the quality of sleep in FM patients, despite its regulatory action on the various cycles [62]. Ketamine, a molecule blocking the *N*-methyl-D-aspartate receptors, appears effective in decreasing pain perception [35].

Local injections of lidocaine in three or four tender points [7, 49] have been shown to decrease pain intensity. The effects could be explained by the mechanical action rather than by the product used [37].

In association with pharmacological therapy, which provides symptomatic action, physical training appears clearly indicated in the FM syndrome. Several studies, most often randomized controlled trials, investigated the benefit of graded exercise therapy, alone or included in a multidisciplinary program. In 1989, Bennett et al. [6] reported that 80% of FM subjects had an abnormally low cardiovascular fitness. As a result, several studies investigated the benefits of a rehabilitation program. McCain et al. [51] reported the benefits of a cardiovascular program. The authors observed an increase in pain threshold, as well as improvements in quality of life and cardiovascular fitness but no difference in pain intensity or sleep disturbances. In a Mengshoel et al. [53] study, subjects attended biweekly sessions of aerobic dance for 20 weeks, with only improved static endurance of upper limbs as compared with the control group.

Martin et al. [48] conducted a 6-week program (three sessions per week) of aerobic strength and stretching exercises. Significant improvement was seen in pain, endurance and tender point count. Nichols and Glenn [58], with a small sample, tested an 8-week program of walking, with only significant

improvement in the positive symptom total subscale of the Brief Symptom Inventory. Valim et al. [80] examined the effect of a 20-week aerobic program of sessions attended three times a week and found improvements in maximal oxygen consumption, anaerobic threshold, pain intensity, mental status and emotional distress. Gowans et al. [34] reported positive changes in physical fitness as well as reduction of mental health problems and somatic symptoms 1 year after completion of a 23-week program of aerobic exercises. Da Costa et al. [19] observed functional improvement and pain decrease in patients attending a home exercise program for 12 weeks. However, according to Dobkin et al. [21], a supervised program results in additional benefits because of the lower long-term adherence observed in a home program. Tiidus et al. [76], as well as Dawson et al. [20], studied the benefits of physical training programs (including aerobic, strength and flexibility exercises). Mood, tender point count and walking speed improved but not work capacity or flexibility. Rooks et al. [67] observed an increase in strength, 6-min walk distance and scores on the Fibromyalgia Impact Questionnaire (FIQ) after a 20-week program of strength and fitness exercises. The authors also reported that such a program was well tolerated by FM patients with high adherence. McCain et al. [51] compared patients undergoing aerobic exercises for 20 weeks with a group attending flexibility sessions and found improvements in physical function and pain threshold scores in the former group but no difference in pain intensity or sleep disturbances. White and Nielson [88] randomized subjects to usual care, stress management training or aerobic exercise. The latter program led to benefits in function, work capacity and pain (intensity and distribution). Martin et al. [48] randomized patients to a program of aerobic and flexibility exercises or relaxation, with more benefits seen in patients attending the aerobic and flexibility program. Verstappen et al. [84] also reported improvement in physical function of FM patients following a physical training program.

Other works assessed the efficacy of physical training in an inpatient multidisciplinary approach. Nielson et al. [59] investigated patients attending a 3-week program (EMG biofeedback relaxation, aerobic exercises, stretching, cognitive-behavioral therapy, family education, and pacing and enhancement of pain tolerance) and observed decreased pain and improvements in pain control, emotional distress and functional ability. These benefits were maintained at 30-month follow-up [88]. Turk et al. [79] evaluated a multimodal treatment program combining education, exercise therapy and functional re-education, and cognitive-behavioral therapy. Patients showed significant improvements in pain severity, anxiety, depression and fatigue. Results of a study on the benefits of a short (1.5 days) but intensive multidisciplinary outpatient program (including cognitive behavioral therapy, physical exercises and patient education) showed a significant increase in FIQ scores [61]. Bailey et al. [1] found significant improvement in physical function following a 12-week multimodal program consisting of education and physical exercises.

Physical training has also been recommended in the treatment of syndromes related to FM and appears to be a key com-

ponent in the rehabilitation program for CFS patients. A study by Fulcher and White [25] allocated 66 CFS patients to a daily (30 min/day) aerobic exercise program (cycling, walking or swimming with an intensity corresponding to 60% of oxygen maximal consumption) or to a program combining relaxation and flexibility exercises (30 min/day, five times per week). Subjects performing the aerobic exercise program showed significant improvements in well-being (55% versus 27%). The authors also underlined the benefits of exercises on fatigue and physical function. Powell et al. [64] compared patient education to encouraged graded exercise versus written information (control group). At 1 year, the educational intervention resulted in improved physical functioning, fatigue, mood, sleep and disability as compared with written information. Moreover, no study found harmful effects with prolonged rest in CFS patients. However, perpetuated or increased fatigue in healthy subjects or people recovering from viral illness has been reported after prolonged rest [66].

#### 4. Discussion

To suggest a treatment including a graded physical training program can appear paradoxical in patients with continuous pain or fatigue. Nevertheless, several studies reported that most patients with FM are physically deconditioned [6,46]. Thus, such rehabilitation programs aim to avoid the vicious cycle of pain, avoidance and inactivity behaviors or even kinesiophobia, deconditioning, incapacity and psychological distress. Actually, pain, whose expression and modulation are usually influenced by various psychological, behavioral [78] and socioeconomical [5] factors, could lead to avoidance behavior or even complete inactivity. Such a situation results in a real deconditioning that is associated with bioenergetic changes, perpetuated inactivity, and can explain the increase of pain subjects feel when possibly starting physical activities again. In consequence, the resulting professional, leisure and home incapacity appear all the more difficult to deal with, because it remains unexplained by somatic elements.

Several studies conducted for more than a decade underline the benefits of physical training, although some systematic reviews of literature [11,71,72] did not report clearly the effectiveness of this therapeutic option. Such therapy can follow some pain and disability assessments (including various physical tests, pain assessment, and several questionnaires about quality of life, anxiety and depression), which allow for a rigorous longitudinal follow-up [47]. The kind and the progression of the activities recommended, and duration, frequency, intensity of the sessions represent essential parameters in the rehabilitation programs for FM patients [43,69].

A frequency of training reaching three sessions per week, as recommended by the American College of Sports Medicine (1999), appears relevant. According to several authors, attending the training sessions with a higher frequency is problematic for FM patients [53,54,89]. The level of exercise intensity recommended corresponds generally to an aerobic training. Thus, it should range from 60% to 75% of the theoretical maximum heart rate (HR), allowing a graded progression without

any risk of overtraining [16]. Nevertheless, the patient should be made aware of a tolerable short-term increase in pain and fatigue during the first sessions. McCain et al. [51] advocate a higher level of exercise intensity (with a HR higher than 150 bpm) that induces the release of beta-endorphin [32,44,70], growth hormone [27,39,83] or serotonin [14,26,40,51]. According to the authors, the absence of pain decrease sometimes reported in literature results from physical training with too of a low level of exercise intensity. However, other authors found increased pain and decreased FIQ scores with too high of a level of exercise intensity [54,81]. The recommended exercises can include various aerobic activity (walking, cycling, stepping, rowing), as well as dynamic exercise for the upper and the lower limbs. Relaxation and stretching exercises allow for reducing excessive muscular tone and increasing flexibility, respectively. A high adherence rate should be advised.

Moreover, the exercise drop-out rate in healthy subjects averages sometimes 50% after a 6-month training program [43]. In a work by Wigers et al. [89] on physical training for FM patients, the authors had to stop the study earlier than expected because of lack of participants. Thus, despite the presence of nearby rehabilitation centers and patients motivation, regular attendance remains difficult, especially when patients have to carry out physical training individually [89].

Improvements in muscular performance could be explained by various adaptations commonly observed following training such as hypertrophy of slow-twitch fibers and increased capillary and mitochondrial density and myoglobin concentration, contributing to oxygen diffusion into the cytoplasmic compartment [43,58]. Physical exercises have a positive influence on other parameters such as the following:

- reduced anxiety and depression [16,51];
- increased pain threshold [44];
- increased tolerance to symptoms [16,44];
- released of endorphins resulting from stimulation of the opioid system [44] when efforts exceed the aerobic threshold or when they last more than 60 min [70] or with exercises at a lower level of intensity, when performed by subjects strongly deconditioned [32];
- improved mood, well-being and self-confidence, as well as a decrease of helplessness feeling [33,57,65,75];
- improved quality of sleep [51,77].

Group treatment gives FM patients the opportunity to talk and to be taken into account by health care professionals. Cognitive-behavioral therapy, aiming to change unfavorable behavior, to learn symptom management and coping skills and performing physical activities, represents a relevant complementary approach [4,10,52,69,79].

Physical training programs should be at least 12 weeks for the expected benefits [10,48] and will be maintained only if patients continue to perform physical activities. Poor results have been observed in patients interrupting the program [33,89], whereas the literature generally reports good outcome in FM patients who continue performing physical activity indi-

vidually (for a short period but with sufficient frequency and intensity) [89].

Despite a still unclear physiopathology, the diagnosis of FM allows patients to remove the “imaginary sick” feelings and to accept the reality of the condition. Such a realization is necessary to establish a relation of trust between the therapist and the patient. Medical care preceded by assessments of somatic, psychosocial and behavioral factors is ideally realized in a multidisciplinary team composed of therapists who share similar common and consistent therapeutic concepts. Therapy is often complicated by feelings of individual inefficacy, discouragement, or even aggressiveness resulting from several therapeutic failures and frustration. The therapeutic options should encourage patients to be active. Physical training represents a key component; it aims to improve physical functions to possibly induce a secondary pain decrease. Reconceptualizing erroneous belief and learning strategies (relaxation, self-coping, realistic planning of daily activity, stress management, etc.) will help to replace the unfavorable behavior into new more adapted attitudes, necessary to the maintenance and the progression of the benefits [5,49,69].

## 5. Conclusion

This article underlines the benefits of progressive muscular rehabilitation in the treatment of FM. The development of rehabilitation centers with specialized experts who could propose a relevant therapy to such patients should contribute to the medical care of this public health problem.

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