

Effect of Pilates Based Exercise Training on Pain and Quality of Life in Patients with Fibromyalgia: A Systematic Review

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Abstract

Background: Fibromyalgia (FM) is a syndrome characterized by chronic widespread musculoskeletal pain. The main symptoms of this disease are muscle stiffness, joint stiffness, insomnia, fatigue, mood disorders, cognitive dysfunction, anxiety, depression, general sensitivity and the inability to carry out normal daily activities.

Aim of Study: To summarize the best evidence of the effect of Pilates based exercise training for pain and quality of life in patients with fibromyalgia.

Subjects and Methods: By using electronic database: PubMed, Cochrane library, Pedro and science direct. Randomized Control Trials (RCTs) were only included in this review and the others were excluded according to eligibility criteria.

Results: Four RCTs were only included and were identified with good quality methodology in this review with 203 participants met the inclusion criteria, the duration of treatment was once or twice or 3 times a week for four or eight or twelve weeks. The results showed level (1a) evidence for the effectiveness of Pilates based exercise training in improving pain and quality of life in patients with fibromyalgia. All included studies showed positive effects in the measured outcomes, Meta-analyses statistics used in this review in four studies with a high-quality assessment, and descriptive analysis in one study. Pilates based exercise training has no Significant effect in pain and quality of life in patients with fibromyalgia.

Conclusion: The current study showed that, Pilates based exercise training is a safe and beneficial intervention, but has no superior effect on pain and quality of life in patients with FM compared to other traditional rehabilitation interventions. This evidence is based on a limited number of RCTs and more high-quality RCTs are needed to support this evidence.

Key Words: *Fibromyalgia – Pilate's exercise therapy – Chronic pain – Quality of life – Systematic Review.*

Introduction

FIBROMYALGIA (FM) is a poorly understood non-inflammatory chronic pain condition in which patients experience pain in the four quadrants of their body. Besides pain, patients suffer from sleep disturbances, fatigue, and mood disorders. Despite of its unknown etiopathogenesis, peripheral, spinal and supraspinal changes have been implied in its pathogenesis. Other FM characteristics include allodynia, hyperalgesia, lower pain threshold and specific points sensitive to palpation, denominated tender points, some symptoms are associated to this syndrome, such as morning stiffness, chronic cephalalgia, migraine, functional gastrointestinal disorders, anxiety and depression [1]. FM is the second most common rheumatologic disorder, behind osteoarthritis. It is more common among middle-aged women and is the most common cause of musculoskeletal pain in women aged 20-55 years [2]. As fibromyalgia does not present with any of the specific laboratory abnormalities found in the other disorders, normal results may help to rule out incorrect diagnoses. Thus, the diagnosis can become manageable with a thorough and detailed history and physical exam, along with limited laboratory testing and imaging studies [3]. Fibromyalgia is a pain-amplification syndrome; The cause for the heightened sensitivity of patients with fibromyalgia is unknown, but is likely to involve abnormalities in peripheral and central sensory processing associated with peripheral tissue abnormalities [4]. Respectively. The impact on quality of life (QOL) is significant, with a lower QOL compared to such conditions as chronic obstructive pulmonary disease and rheumatoid arthritis. Approximately 35% of persons diagnosed with fibromyalgia report difficulties in performing activities of daily living [5]. The clinical Pilates method is a form of mind-body exercises, based on 6 principles centring, concentration, control, precision, breath, and flow. It aims to coordinate the quality of movement along with breathing and active movement. Pilates exercises focus on spinal

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stabilization and are designed to ensure muscular strength, flexibility, balance, proprioception, and body awareness. These are low-impact exercises that can be performed in various positions, including standing, supine, prone, or sitting. During these exercises, breathing and muscular control reduce pain and enhance posture [6]. Pilate’s techniques were developed to achieve a strong mind and use it to obtain complete control over one’s body. Joseph Pilates, who founded and theorized this method, repeatedly emphasized its effect on strengthening and conditioning the mind, and its importance as a physical regimen for the body, calling his methodology the “art and science of Contrology [7].

Subjects and Methods

Data sources:

The four electronic databases PubMed, Cochrane library, Pedro and science direct were searched from march 2022 up to December 2022. Searching was done related the three main criteria of patients, intervention and outcome. For patient (Fibromyalgia * OR chronic widespread pain* OR chronic fatigue syndrome* OR FMS* OR Myalgia). For intervention (Pilates* OR Mat Pilates* OR Reformer Pilates* OR Clinical Pilates*) For outcome (pain *AND quality of life).

Study selection:

Two independent reviewers reviewed the collected records, first by title then by abstract and finally by full text, using the following inclusion

criteria: (1) Design: Randomized control trials)published in English language from 2016 up to May 2022, (2) Population: Adults (age >18 years) from both genders with FMS with pain and quality of life deficits, (3) Intervention: Any forms of Pilates based exercise training. (4) Control/Comparator: Conventional treatment or no intervention. (5) Outcome measures: Primary: Pain, Secondary: Quality of life. Studies were excluded from this review if they met any of the following criteria: (1) Cross sectional, cohort, case control, case series, case studies and any reviews other than RCTs. (2) Articles published in non- English language.

Data were extracted from the articles by one of the reviewers (N.F.A). As well as a second reviewer double checked it.

Results

Search results:

Of the 375 retrieved articles, 157 were eliminated due to duplication, 199 studies were not included after screening their titles and abstracts, and were therefore not included, 5 inadequate studies (2 trials were reviews, 1 case study 1 cohort study, 1 study not finished) 1 study were excluded as the Control group didn’t get traditional treatment or no intervention, 1 study was published outside the target time frame, 3 not RCT studies, 5 studies that were not in English The remaining 4 articles were evaluated in more details. Results of the search are presented in the following PRISMA flowchart (Fig. 1) [8].

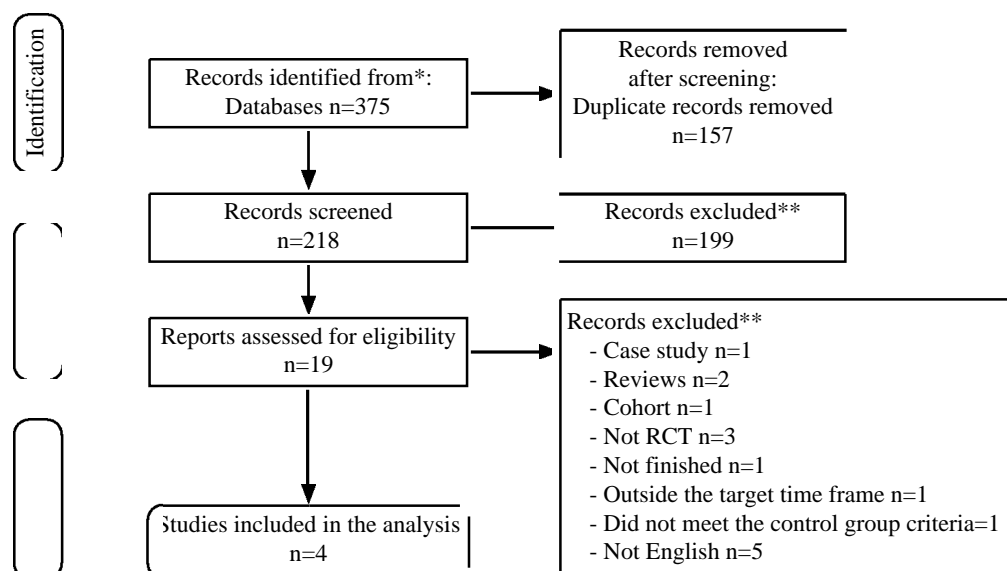


Fig. (1): Preferred Reporting Items for Systematic Reviews and Meta-Analyses diagram of study refinement and selection procedure (PRISMA).

Quality assessment:

The PEDro scale was used to assess the methodological quality of the included studies [9]. Two

authors independently used the PEDro scale to assess the studies, and the third author resolving any disagreements.

The methodological quality was rated using the following classification: PEDro score of less than

4=Poor quality; 4-5=Fair quality; 6-8=Good quality; and 9-10=Excellent quality [10].

Table (1): Methodology assessment of studies according to the Physiotherapy Evidence Database (PEDro) scale.

Study	1	2	3	4	5	6	7	8	9	10	Total score (0:10)	Quality
Komatsu et al., 2016 [1]	Y	Y	Y	N	N	Y	N	Y	Y	Y	7	Good
EKİCİ et al., 2017 [11]	Y	Y	Y	N	N	Y	Y	Y	Y	Y	8	Good
Franco et al., 2022 [12]	Y	Y	Y	N	N	Y	Y	Y	Y	Y	8	Good
Medeiros et al., 2020 [13]	Y	Y	Y	N	N	Y	Y	Y	Y	Y	8	Good

Description of the included studies:

The collected studies were summarized in Table (2). From Table (2) we can conclude that there is homogeneity in patient’s characteristics as age

average and duration of diagnosis, intervention as all patients treated by the different form of Pilates based exercise training therapybut there is substantial heterogeneity in outcomes measurements.

Table (2): Summary of included studies.

Author (Year)	Subjects number (M/F) Age range	Selection criteria	Intervention	Protocol	Outcome (measure)	Main results
Komatsu et al., 2016	20 (0/20) 18 y or more	Patients with medical fibromyalgia diagnosis, classified according to the 1990 American College of Rheumatology (ACR) diagnosis criteria being of female gender, and aged over 18 years	G I mat Pilates exercises for trunk, upper and lower limbs G II no treatment	G I -1-hour weekly Pilate’s session for 8 weeks. - G II patients did not receive any interventions during the 8 weeks of the TG treatment; besides those they were already receiving	Pain intensity with the visual analogue scale, quality of life with the Fibromyalgia Impact Questionnaire	G II did not show significant differences between the first and the last evaluation for any variable. G I showed significant improvement in the number of pain regions and pain intensity after treatment. Differences between GI and G II before and after treatment were not significant
EKİCİ et al., 2017	43 (0/43) 25 y or more	Meeting the criteria for FM as defined by the American College of Rheumatology (ACR), having moderate pain (>5 based on Visual Analogue Scale (VAS)) before the baseline visit having pain in the neck and shoulder region, and never having been treated for FM	GI: Pilates exercises G II: Connective tissue massage (CTM)	G I: One hour 3 times a week for 4 weeks G II: 3 times a week for 4 weeks	Pain intensity: Was obtained by VAS quality of life: Using the Fibromyalgia Impact Questionnaire	The exercise group showed more advantages than massage group and thus might be preferred for patients with fibromyalgia. However, an adequately powered trial is required to determine this with certainty

Table (2): Count.

Author (Year)	Subjects number (M/F) Age range	Selection criteria	Intervention	Protocol	Outcome (measure)	Main results
Franco et.al., 2022	98 (NM) (20: 75)	Patients of both genders who meet the fibromyalgia classification criteria of the American College of Rheumatology 2010 s, and with pain intensity greater than or equal to 3 points in the Pain Numerical Rating Scale	G I: Pilates Group G II : Aerobic Group exercises	G I Mat and equipment based pilates exercises performed Twice aweek for 8 weeks the session lasted for 60 mins ,started with 5 specific pilates ex and at the end of each session 10 mins relaxation with a ball massage G II The aerobic exercises were performed on a treadmill or stationary bicycle Patients had to keep their training heart rate between 57% to 76% of the maximum heart rate The sessions started with a warm-up (10 min of light walking) and ended with relaxation (10-min massage with a toning ball) twice a week for 8 weeks	Pain intensity: using the Pain Numerical Rating Scale Quality of life: using the Fibromyalgia Impact Questionnaire	G II did not show No difference was detected between the groups in the performed evaluations for all variables.
Medeiros et.al., 2020	42 (0:42) (18:60)	All women had medical referrals from local rheumatologists who confirmed the disease. with pain between 3 and 8 on the Visual Analogue Pain Scale (VAS)	G I mat Pilates G II aquatic aerobic exercise	G I treatment twice a week for 12 weeks the session lasted 50 mins with 9 exercises and Swiss ball relaxation ex at the end of each session. G II aquatic aerobic exercises at a swimming pool for 40 min the program consisted of six exercises lasting 30 mins. Two warm-up exercises and two cool-down exercises were performed before and after the program	Pain - visual analogue scale (VAS) Disease-related quality of life (Short Form 36 [SF-36])	No difference was detected between the groups in the performed evaluations for all variables

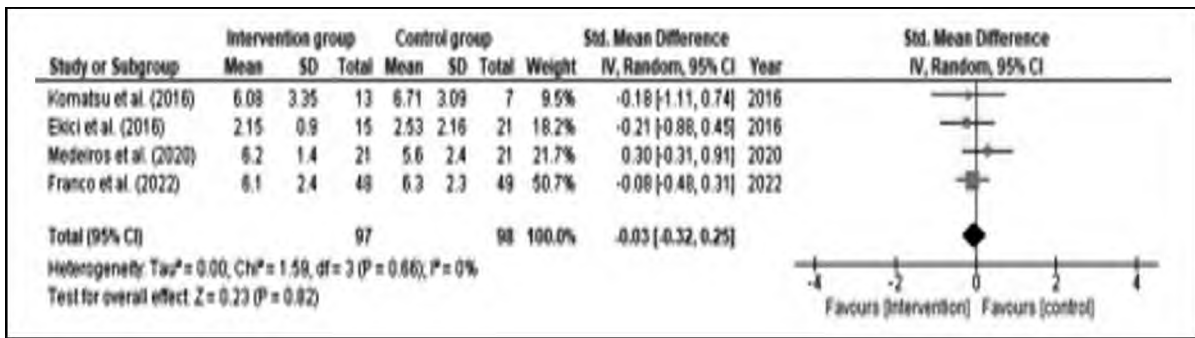
G: Group

Synthesis of Results:

Effect of Mat Pilates on pain:

Four studies assessed fibromyalgia syndrome by pain measurement using visual analogue scale (VAS) and numeric rating scale between intervention group and control group to improve patients with fibromyalgia syndrome (Forest plot 1). There

was no heterogeneity in pain measurement by VAS and numeric rating scale between four studies ($n=4$ studies, $n=195$ participants, $p=0.66$; $I^2=0\%$). There was no significant difference ($p=0.82$; $p>0.05$) in overall effect of fibromyalgia syndrome by pain measurement using VAS and numeric rating scale (SMD=-0.03; 95% CI, -0.32 to 0.25) between intervention group and control group.



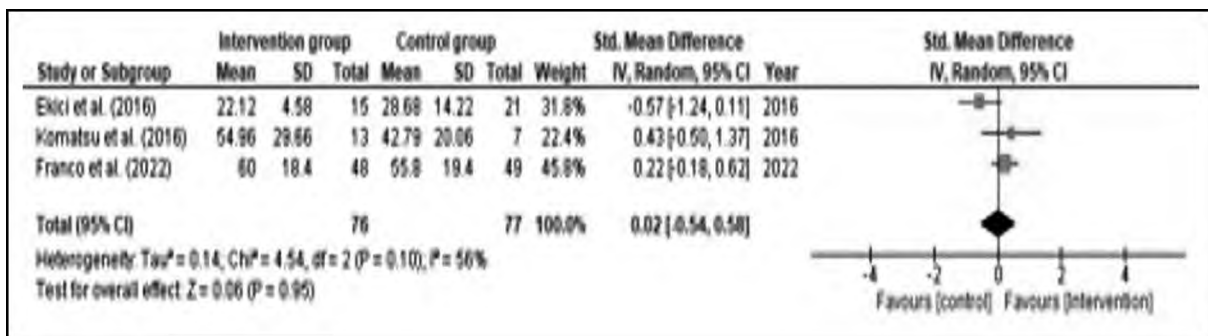
Forest plot (1): Standardized mean differences (95% CI) of fibromyalgia syndrome by pain measurement using visual analogue scale (VAS) and numeric rating scale after assisted as compared with a control from four studies.

Quality of life:

Effect of Mat Pilates on quality of life:

Three studies assessed fibromyalgia syndrome by quality-of-life measurement using fibromyalgia impact questionnaire (FIQ) between intervention group and control group to improve patients with fibromyalgia syndrome (Forest plot 2). There was

substantial heterogeneity in quality-of-life measurement by FIQ between three studies (n=3 studies, n=153 participants, p=0.10; I²=56%). There was no significant difference (p=0.18; p>0.05) in overall effect of fibromyalgia syndrome by quality-of-life measurement using FIQ (SMD=0.02; 95% CI, -0.54 to 0.58) between intervention group and control group.



Forest plot (2): Standardized mean differences (95% CI) of quality-of-life measurement using fibromyalgia impact questionnaire (FIQ) after assisted as compared with a control from three studies.

Effect of Mat Pilates on SF-36:

The mean values of short form-36 (SF-36) in mat Pilates (MP) group (intervention group) and aquatic aerobic exercise (AAE) group (control group) were

48.89±11.17 and 39.56±10.84, respectively. Pairwise comparison by independent t-test revealed that there was no significant difference (p<0.05) in SF-36 (p=0.112) between MP group and AAE group (Table 3 and Fig. 3).

Table (3): Mean values of short form-36 (SF-36) in MP group and AAE group.

Items	Short Form-36 (Mean ± SD)
MP group (n=21)	48.89±11.17
AAE group (n=25)	39.56±10.84
t-value	1.694
p-value	0.112
Significance	NS

MP : Mat pilates.
 AAE: Aquatic aerobic exercise group.
 Data are expressed as mean ± standard deviation.
 p-value: Probability value.
 S: Significant.
 *Significant (p<0.05).

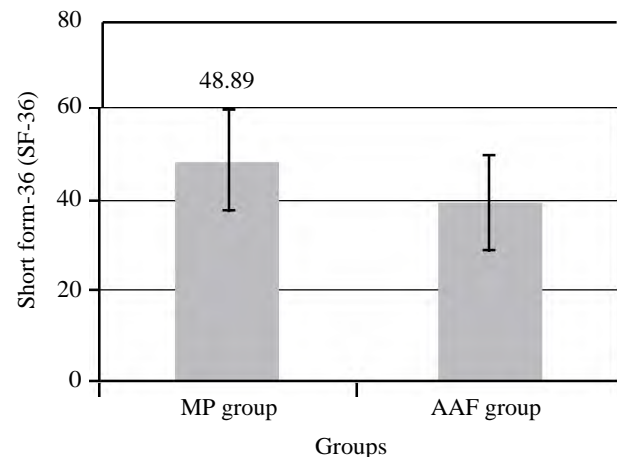


Fig. (3): Mean values of short form-36 (SF-36) in mat Pilates (MP) group and aquatic aerobic exercise (AAE) group.

Level of evidence:

Based on modified Sacketts scale there is level 1a evidence for the effect of Pilates based exercise training on improving pain and quality of life when compared to conventional therapy; with no significant difference between both groups' results.

Discussion

The purpose of the current review was to evaluate the effect of Pilates training on pain and quality of life in patients with fibromyalgia. This review included four studies published from 2016 to 2022 searched in Medline data base through Pub Med, Cochrane library, web of science and Pedro web site that most likely include huge number of papers published each year, we searched in other resources as faculty of physical therapy library.

This review used (PEDro) scale scores for quality assessment of included studies (range, zero to ten points). The methodological quality was rated using the following classification: PEDro score of less than four=Poor quality; four-five=Fair quality; six-eight=Good quality; and nine-ten=Excellent quality. The Four of the included studies were with good quality Komatsu et al., [1], Medeiros et al., [13], EKİCİ et al., [11] and Franco et al., [12].

The primary outcomes searched in the included studies were pain and quality of life. Four RCTs are included in this study with two outcomes pain and quality of life.

Pain is measured in four studies Medeiros et al., [13], Komatsu et al., [1], EKİCİ et al., [11] and Franco et al., [12] by visual analogue scale (VAS), this allowed to do meta-analysis for the results.

Quality of life is measured in three studies Franco et al., [12], EKİCİ et al., [11] and Komatsu et al., [1] using the (Fibromyalgia Impact Questionnaire), this allowed to do meta-analysis for the results, (Medeiros et al., 2020) measured quality of life by Short Form 36 [SF-36]) different ways of measurement did not allow to do meta-analysis so the results were analysed descriptively.

Four studies Medeiros et al., [13], Komatsu et al., [1], EKİCİ et al., [11] and Franco et al., [12] measured pain by VAS with ninety-seven patients in intervention group and ninety-eight patients in control group and demonstrated that there were significant intragroup results in both groups (Pilates and Aerobic group or Aquatic Arabic group or CTM) but not in (no intervention control group) regarding the pain evaluated by the VAS. Furthermore, the groups showed no significant differences.

Three studies Franco et al., [12], EKİCİ et al., [11] and Komatsu et al., [1] measured quality of life by FIQ with seventy-six patients in intervention group and seventy-seven patients in control group

demonstrated that there were no significant differences between both groups.

Comparison between Pilates and the control group with no intervention Komatsu et al., [1] demonstrated that Pilate's treatment has positive effects on pain intensity and painful regions of women with fibromyalgia. In that sense, positive results observed in this study support the use of Pilates as a form of physical therapy treatment of fibromyalgia. Depression and anxiety associated with fibromyalgia showed no significant improvement both in CG and in TG. These data seem to point to the fact that the intensity of pain may not be directly linked to depression and anxiety, Whereas treated group presented a greater pain level in the beginning, which levelled up with the control group at the end of the study, we consider our results as positive, given that an improvement of 14% in the FIQ score is considered clinically relevant treated group presented an improvement of 20% in the FIQ score after treatment, and 31.5% improvement in pain intensity measured by VAS, which can be considered clinically relevant. The main limitation of the study is the small sample size along with the high dropout rates presented by the CG. Given that the CG did not receive any kind of physical therapy treatment, it may have directly influenced the adherence to the study.

Franco et al., [12] this study was to assess the effectiveness and cost- effectiveness of modified Pilates compared to aerobic exercises in the treatment of patients with fibromyalgia syndrome. It demonstrated that there was no difference between the two modalities of exercise for the impact of fibromyalgia. There was a statistically significant improvement in pain intensity after treatment, sleep quality after 6 months and health-related quality of life after 12 months of randomization in favour of the Pilates group. However, this improvement was not clinically relevant for any outcome.

Medeiros et al., [13] the mat Pilates method and the aquatic aerobic exercise in the present study were effective as a form of treatment for 12 weeks for women with fibromyalgia, promoting improvement in pain and quality of life. These results were intragroup, without significant differences between the groups. Thus, the strength of this study lies in showing the benefits of two different exercise modalities for women with fibromyalgia Additionally.

EKİCİ et al., [11] in this study Significant improvements were found in both groups for all parameters. PE and CTM may be of benefit in the treatment of FM. However, PE had more effectiveness on anxiety symptoms and PP threshold than CTM. The study did have some limitations worth noting in interpreting the results.

In previous systematic review published Jesus et al. [14]. The four randomized clinical trials includ-

ed in this review were conducted in Brazil (n = 2) and Turkey (n = 2) All participants were women, diagnosed with FM according to ACR criteria and aged between 45 and 60 years. The interventions assessed were the Pilates method versus home-based stretching and relaxation exercises, the Pilates method versus a control group with no physiotherapy intervention and the Pilates method versus aerobic exercises. Only one study compared individual and group Pilate's methods. With respect to the pain indicators assessed, three studies used the visual analog scale (VAS) of pain, four the fibromyalgia impact questionnaire (FIQ), two tender point palpation, and only one algometric analysis to quantify pain intensity Considering pain indicators, the groups that used Pilates as intervention significantly improved pain intensity (VAS) in three studies, and FIQ in four studies after the intervention.

Pilates was significantly better in improving pain intensity (VAS), tender points, and FIQ when compared to home-based stretching/relaxation exercises in only one study Altan et al., [15].

When compared to aquatic aerobic exercises, Pilates showed no significant differences in terms of pain intensity in one study Medeiros et al., [13]. Similarly, the improvement in pain intensity did not differ between the groups that underwent individualized or group-based Pilate's sessions Caglayan et al., [16]. A statistically significant improvement was observed in pain intensity and the number of tender points in the Pilates group in one study Komatsu et al., [1]. while the control group, which did not receive physiotherapy for FM, showed no significant improvement for the same parameters. In this case, the intergroup differences pre- and postintervention were not significant.

Johnson et al. [17] have reported improvement of dynamic balance compared with the control group after 10 Pilates-based exercise sessions. Pilates exercises may improve impaired posture and balance in FMS patients, because Pilate's techniques aim to correct body posture by training the muscular system as a whole. More specifically, the Pilates concept locates the body centre in deep muscles in proximity to the spine, and training aims to form a robust musculoskeletal structure in the upper body by providing a balanced back and abdominal musculature Muscolino et al., [18].

In addition, Pilates was significantly better in improving function and quality of life in the FIQ analysis when compared to stretching/relaxation exercises Altan et al., [15].

According to Martinez et al. [19] the lower number of tender points and pain intensity (measured by the VAS) is correlated with the improved quality of life and physical function of patients with FM. In this respect, the Pilates group showed significant improvements in all the function and quality of life

indicators analysed (FIQ, HAQ, NHP and SF-36) in the studies included in this systematic review.

Group-based Pilates also obtained a significant improvement in the HAQ and FIQ when compared to individual Pilates in one study, which, according to Caglayan et al., [16] maybe directly associated with social interaction factors.

Similarly, the studies included in this review also exhibited a significant improvement in at least one of the stress, depression and anxiety indicators assessed, demonstrating the effectiveness and safety of Pilates in controlling biopsychosocial factors.

Strength of the study:

This study depended mostly on good quality RCTs that published from 2016 to 2022. All studies used different types of Pilates based exercise training.

Limitation:

The limitation of the review is (1) Restriction of language; only articles published in English were reviewed leading to potential bias on the study selection., (2) Few numbers of eligible RCTs studies related to fibromyalgia. (3) Few numbers of patients related to the studies of fibromyalgia. (4) Inability to do meta-analysis for all results.

Conflict of interest:

Author(s) declared no possible conflicts of interest.

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تأثير التدريب بتمارين بيلاتس على الالم وجوده الحياه لمرضى الالم العضلى الليفى : دراسة منهجية

الفيروميالوجيا هي متلازمة تتميز بألم عضلى هيكلى مزمن منتشر على نطاق واسع الأعراض الرئيسية لهذا المرض هي تصلب العضلات، وتصلب المفاصل، والأرق، والتعب، واضطرابات المزاج، والخلل المعرفى، والقلق، والاكتئاب، والحساسية العامة وعدم القدرة على القيام بالأنشطة اليومية العادية.

الهدف: تهدف هذه الدراسة المرجعية الى عمل مسح للدراسات السابقة وتقييم تأثير تأهيل مركز الاتزان بالأذن الوسطى على الدوار واضطراب التوازن فى مرضى اصابة الرأس.

طرق البحث: بواسطة استخدام البيانات الالكترونية التالية:

PubMed Cochrane library, Pedro, Science direct بجانب فحص جميع قوائم المراجع الاخرى وتتضمن الدراسات المختارة الدراسات العشوائية فقط طبقا لمعايير الاشتمال المختارة.

النتائج: وقع الاختيار على اربع دراسات تشمل ٢٠٣ مريضاً تراوحت مدة العلاج لهم من مره إلى ثلاث مرات اسبوعياً لمدة تراوحت بين اربعة وثمانيه واثنى عشره اسبوع. جميع الدراسات المدرجة اشارت الى ان هناك تأثير إيجابى فى النتائج التى تم قياسها باستخدام التحليل الاحصائى فى هذه الدراسة فى اربع دراسات و التحليل الوصفى فى دراسه واحده، التدريب بتمارين بيلاتس ليس لها تأثيراً يفوق العلاج التقليدى فى علاج الالم وجوده الحياه لمرضى الالم العضلى الليفى.

الاستنتاج: هذه الدراسة اظهرت ان التدريب بتمارين بيلاتس هو علاج امن ومفيد ولكن ليس لديه تأثير يفوق العلاج التقليدى على الالم وجوده الحياه فى مرضى الالم العضلى الليفى. هذا الدليل يعتمد على عدد محدود من التجارب السريرية وهناك حاجة الى المزيد من التجارب السريرية عالية الجودة لدعم هذا الدليل.

التوصيات:

١- عمل المزيد من التجارب العشوائية عالية الجودة على مدى فاعلية تأثير التدريب بتمارين بيلاتس على الالم وجوده الحياه لمرضى الالم العضلى الليفى.

٢- عمل دراسات ذات متابعة طويلة المدى وعدد اكبر من المشاركين لبيان مدى فاعلية تأثير التدريب بتمارين بيلاتس على الالم وجوده الحياه لمرضى الالم العضلى الليفى.

٣- لا تزال هناك الحاجة إلى اجراء المزيد من التجارب السريرية لتغطية الفجوة فى استخدام تأثير التدريب بتمارين بيلاتس على الالم وجوده الحياه لمرضى الالم العضلى الليفى.