EFFECTIVENESS OF ACTIVE SEGMENTAL STRETCHING AND 30-MINUTE WALKING ON FIBROMYALGIA SYMPTOMS REDUCTION IN FEMALE

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ABSTRACT

Background:
Fibromyalgia (FM) as a considerable pain that can last for maximum three months and pain on palpation of minimum 11 of the body's 18 specific tender points. Rheumatologic criteria (WPI and SS) was used and it directly impact 1.3% to 8% of the overall population.

Objective:
To compare the efficacy of active segmental stretching and 30-minute walking on the reduction symptoms and to check the quality of life in fibromyalgia symptoms.

Methodology:
A randomized controlled trail was conducted on 62 participants diagnosed with fibromyalgia by ACR or in outpatient clinics in THQ Aziz Bhatti hospital Gujrat. Females were placed arbitrary into active segmental stretching group (N=31) and 30 min walking group (N=31). Each intervention was performed thrice a week for first three weeks and four time per week for the next three weeks. The outcome measures were FIQR for FM symptoms, SF-12 Health survey for quality of life and NPRS for pain assessment in patients. Data was analyzed by SPSS version 25 and significant value was less than 0.05 ($p<0.05$).

Results:
It showed active segmental stretching group had more prominent improvements at 3rd and 6th week, according to their mean ± standard deviation values for FIQR, SF-12 and NPRS as compared to control group. The between groups effects with outcome measures had significant effects for SF-12 ($p= 0.044$, $p= 0.046$) while FIQR and NPRS showed non-significant effect, with overall significance for both interventions (partial $\eta 2 =0.19$, $p= 0.013$). The within subject effect with time period showed remarkably significant ($p<0.001$) results for all measures with 95% effect size ($\eta 2 =0.95$). The interaction of different time period with experimental and control group were also effectively significant ($p< 0.001$) for all measures with 76% effect size ($\eta,2 =0.76$), respectively.

Conclusion:
Both interventions were appropriate for fibromyalgia. But, active segmental stretching exercise program showed more significant improvements in FM patient by decreasing its symptoms and reducing pain at tender points of muscles, thus improving quality of life as compared to 30-minute walking program.

Keywords:
Fibromyalgia, physical activity, pain, active stretching, walking

INTRODUCTION

American Rheumatology criteria for diagnosis, published in 1990, characterized fibromyalgia (FM) as a considerable pain that can last for maximum three months and pain on palpation of minimum 11 of the body's 18 specific tender points.[1] Although the rheumatologic criteria is mostly used in research studies, clinicians may use the American Pain Society criteria for diagnosing FM, which involves pain (in all four quadrants of the body and along the midline axial) that lasted less than three months and tenderness on palpation of 9 of 11 bilateral tender points on the body.[2] Moreover, some studies uses London-4 criteria for finding FM by using screening questionnaire with ideal vulnerability.[3, 4] Less than 20% of patient diagnosed with fibromyalgia are presently being treated by experts in the United States, irrespective of the fact that rheumatologist considered it as the second most common disorder after osteoarthritis. [5]

One of the most notable mechanisms in the pathogenesis and progression of FMS is central sensitization. The central nervous system's ability to imbalance both inhibitory and excitatory

neurotransmissions and disruption in pain modulation are the explanations for central sensitization. Progress in FM therapeutic approaches is hampered by pathophysiology uncertainties and a lack of valid and reliable objective disease activity markers. It can occasionally be so severe that it interferes with a person's ability to function, job, and everyday routines. [6, 7]

The most widely accepted FM symptom is chronic and diffuse pain. Other than pain, postural instability and greater incidence of falls are significantly present in such patients. While other symptoms include fatigue, headache, and improper sleep, mental trauma and cognitive deficits are usually present and can have a major effect on a person's emotional and bodily function as well as overall health related quality of life. Moreover, increase redness on the skin (hyperemia) and discoloration are noted on the trigger areas in FM patients.[8]

Fibromyalgia directly impact 1.3% to 8% of the overall population, while it's prevalence (across all age groups) is 3.4% in females, 2 % in males. To treat the various FM symptoms, a wide range of treatments are used, including a combination of pharmaceutical and non-pharmaceutical techniques. Physical therapy is essential for reducing FM symptoms and enhancing quality of life for patient. [9, 10]

These therapies primarily influence neurophysiologic function, are more often utilized in a variety of combinations. Pharmaceutical treatments, however, are insufficient for controlling fibromyalgia symptoms. So many types of activities such as exercises are more often recommended for non-pharmacological treatment. However, more studies are required. Physical therapy is essential for reducing FM symptoms and enhancing quality of life for patient. [9, 10]

Exercise techniques has been greatly used in the management of fibromyalgia and has been studied since 1970 to determine the most appropriate type, intensity, and frequency of exercise for people with FM.[11, 12] Exercise makes a significant contribution to pain producing from micro trauma of muscles, restoration and reimaging processes afflicted with both intense exercise and exercise training.

Stretching program for people with fibromyalgia has been found to reduce pain and improve daily life activities. However, negligible importance was being paid on reviewing the impact and the effectiveness of stretching exercise remains questionable. According to some studies, kinesio-therapy and stretching exercise techniques improves the flexibility level and general well-being of FM patients. [13] Clinical studies of usually mixed exercise (aerobic and stretching) offer concrete evidence that FM clients who complete the intervention methods can improve their aerobic fitness, muscle strength and diminishes their disease symptoms [14] According to various analyses, a muscle - strengthening exercise plan is beneficial in easing pain and its sensitivity at tender points, boosting patient's life quality and managing symptoms in various diseases. [15]i

Walking is an easy, accessible, and low-musculoskeletal impact exercise which has been broadly described as a predictive marker in coronary heart disease but is also connected to bodily function in chronic musculoskeletal pain due to its low muscular impact and its positive influence. [16] Even though walking is good for FMS, but it is unclear how frequently such an advice is followed. Based on some research findings, patients felt secure about walking easily in both 30- and 60-minute sessions ($\alpha = .97$), executing daily physical activities ($\alpha = .93$) and attempting to engage in moderate physical activity ($\alpha = .95$).[17] Given that the fibromyalgia population is predominantly physically inactive, it is particularly recommended that they should began walking gradually.

Benefit of this study is to give people more awareness about muscular issues that are limiting their daily life activities and their treatments with simple walking and easy to perform active stretching exercises on their own or by slight assistance of someone by finding out which is better for treatment purpose. It will aid in the investigation and evaluation of strategies for enhancing the ease and life quality of individuals struggling from this disease through supportive care. However, there have been few or no studies that compare the effectiveness of these exercises. Furthermore, no research has been conducted to compare segmental stretching and walking.

MATERIAL AND METHODS

A randomized controlled trail with simple random probability sampling was carried out with approval from the research committee of University of Lahore. Women with 20 to 65 years of age with fibromyalgia in outpatient/inpatient clinics or by America College of Rheumatology Criteria[18] were included in our study, while, patient with joint disorders (Grade 4 arthritis, hip or knee arthroplasty, rheumatoid arthritis) that can cause hindrance in the exercise program[12], respiratory diseases or cardiovascular diseases that would prevent physical exercise[19], pregnant and post-partum women [20] and recent modifications to FM therapy (complementary therapies such as psychotherapy) were excluded.

About 70 females were diagnosed with FM in Orthopedic department of Aziz Bhatti THQ hospital, Gujrat (from Aug to Nov in 2022), out of them 8 didn't

fulfilled the inclusion criteria, thus exclude from our study. Data of the 62 participants was collected for our study, with patients arbitrarily placed into active stretching (n=32) and walking (n=32) groups with 6 week follow up. Demographic data was obtained at baseline. After getting consent forms, subjects were enrolled depending on our study criteria.

Experimental group: Participants undergone through a 6-week supervised exercise program involving active segmental stretching of muscles mostly involving large muscles. Each exercise was held for 30 second and done for three times per week. In start of the session, patients performed three repetitions; after that from fourth to sixth week, four repetitions were done.

These exercises are carried out on a firm surface (such as mattress) or chair with a 30 second hold for each.

1. Paravertebral stretch: Sustain your head on a folded sheet while lying supine. Bring your knees and hips to your chest and hold them with your hands.
2. Gluteus stretch: Hip flexed with the knee brining close to chest and hold it with your hands in supine lying. Repeat this with alternate limb.
3. Quadriceps stretch: Stand straight with feet on ground than bend your knee and grab the foot with one hand while other hand supporting on a wall or back of chair. repeat the same with your other limbs.
4. Hip adductors stretch: Sit with your feet on ground than bring it close to groin of other leg with hip abducted and knee bend. Hold your ankle with hand and push your knee toward ground with your elbow of the same side leg. Keep your back straight and hold this position. Repeat the same for other leg.
5. Latissimus dorsi stretch: Hips and knees in flexed position in supine lying, with feet on the mattress. Then, flex your both arms as far as possible with keeping elbows extended and palms open at the same time.
6. Pectoralis stretch: Flex both hip and knee, with feet resting on the mattress in supine lying than place both arms at about 45° of abduction with head straight.
7. Trapezius stretch: Flex the arm to 90^{o} in sitting position with back aligned straight on mattress. Push the arms and shoulder backward with your own force by maintaining the normal back alignment.
8. Calf, paravertebral and gluteus stretch: In sitting position, keep the trunk and head straight against the wall or chair than proceed the movement by extending knees, and doing dorsiflexion of the ankles with your knees in proper alignment.

Control group: Participants had not performed any characteristic intervention, they just undergo a 30-minutes brisk walking in bouts of 15 minutes for three times per week for first 3-week and from fourth to sixth week repetitions will be increased to four times per week.

Outcome Measures: Pain intensity, severity and intensity of symptoms and life's quality were assessed and recorded at baseline, third and sixth weeks. For this, the main outcome measures were Fibromyalgia Impact Questionnaire-revised (FIQ-R) while the other measures were numeric pain rating scale (NPRS) and SF-12 Health survey Form. All outcome measures were reassessed and re-documented at 3rd week and 6th week for the interventional protocol in fibromyalgia patients.

The FIQ-R was used to assess fibromyalgia symptoms in participants. High score indicated that FMS had a major impact. It has a complicated factor structure and high validity and reliability (Cronbach alpha = 0.95). [21]

Numeric pain rating scale (NPRS) was needed to check out either the patient's pain is severe or not over the prior weeks. The NPRS is reliable and highly correlated (ICC coefficient= 0.95) with other forms of assessment of pain. [22]

The SF-12 health survey was required to determine the patient's quality of life over the previous weeks. The SF-12 is an eight-domain multidimensional tools. Scores for domains range between 0 to 100, with higher scores reflecting better physical and mental health performance. SF-12 had excellent psychodynamic properties including validity and reliability (ICC = 0.73 for PCS and 0.80 for MCS).[23]

Statistical analysis: The statistical package for social sciences (SPSS) version 25 was implemented to enter and analyze the data. Data was assessed at baseline for outcome measures to check normality by using Shapiro Wilk Test. For descriptive analysis, mean and standard deviation was calculated for numerical normal data. For inferential statistics, two-way repeated measure MANOVA was applied for checking significance. Moreover, Bofferroni corrections for multiple comparison was used. The effect size was measured with partial eta squared parameters. All results were calculated at a confidence level of 95% and p-value < 0.05 was considered as significance value.

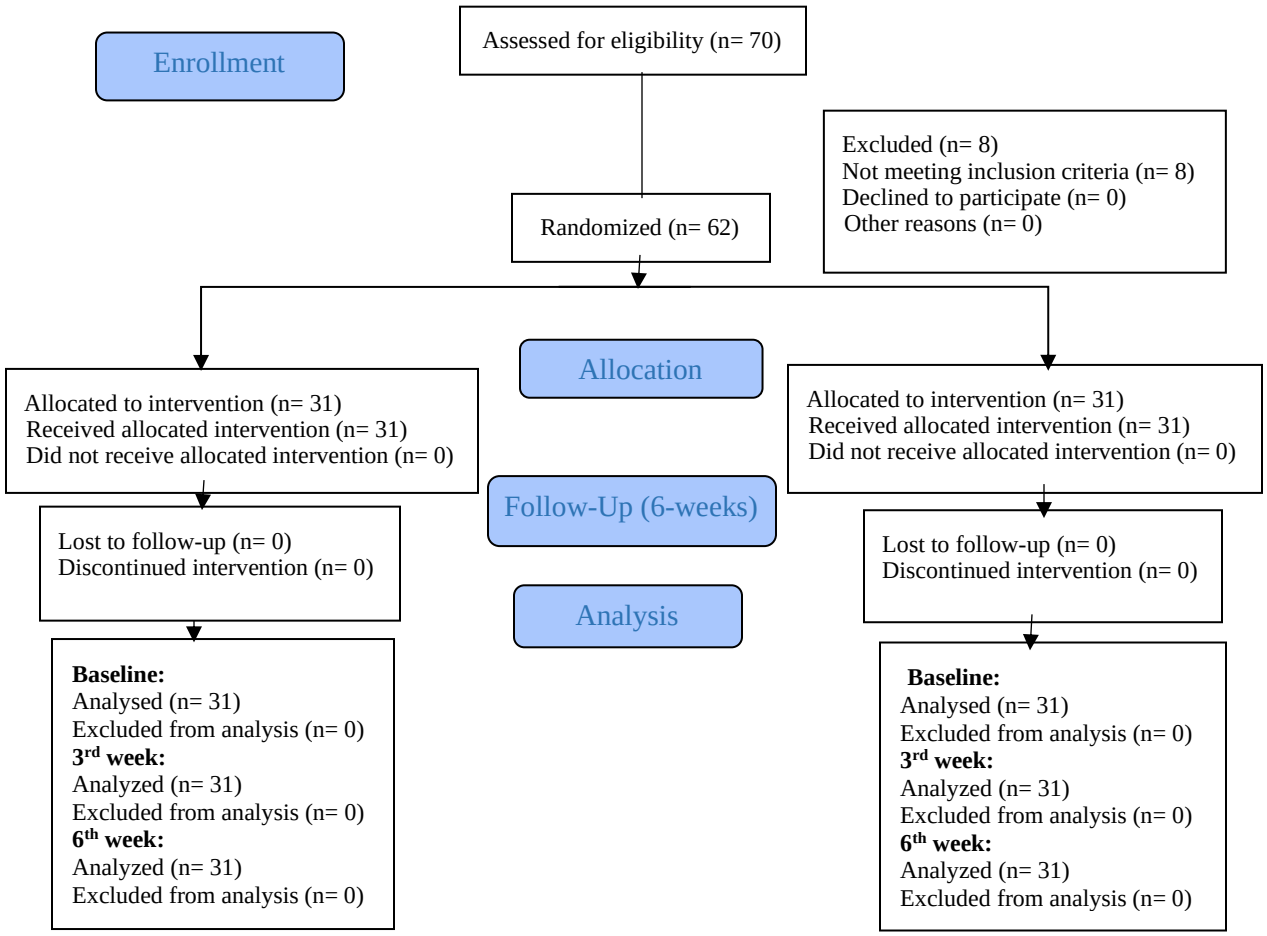

Figure: Consort Diagram for FM patients outflow through 6-weeks period

RESULTS

According to random sampling, 62 females with age of 20 to 65 years diagnosed with FM were considered eligible for our study. In categorical data, out of 62 participants more patients were housewife (53.2%) and married (72.6%) between the age group 20-28 (32.3%) shown in table 1.

Table 1. Demographic analysis of participants

Variables	Responses	n (%)
Age group of participants in years	20-28	20 (32.30)
	29-37	8 (12.90)
	38-46	9 (14.50)
	47-55	16 (25.80)
	56-64	9 (14.50)
Occupation of participants	Student	14 (22.60)
	Job holder	15 (24.20)
	Housewife	33 (53.20)
Marital status of participants	Married	45 (72.60)
	Unmarried	17 (27.40)
Total		62(100)

According to descriptive analysis, the average age of the patients in stretching and walking group were 38.35 ± 14.56 and 40.16 ± 12.43. For SF-12 their average values for PCS12 and MCS12 increases at 3rd to 6th week in both groups with more improvement in physical component as compared to mental component, but better response was shown in stretching group. For FIQR and NPRS their average value decreases from baseline to 3rd and more efficient decline was shown at 6th week in stretching group as compared to walking group because intensity While by independent t-test, there was significant difference between groups at baseline for FIQR with minimum effect size ($\eta 2$= 0.013), while for NPRS, the between group p-value was remarkably significant ($p<0.001$) at baseline and 6th week with minimum effect size ($\eta 2$= 0.001), along with, more lowered values for both outcome measures in stretching group. For SF-12, there was more statistically significant ($p <0.001$) between group difference at 6th week for PCS12 with minimum effect size ($\eta 2$= 0.066), while

for MCS12, the between group p-value was significant at baseline and 3rd week with minimum effect size ($\eta 2$= 0.068), as shown in table 2 and 3.

According to Bonferroni correction for multiple comparisons, the pairwise comparison between stretching and walking groups showed significant effects for PCS12 and MCS12 ($p<0.04$), while the pairwise comparisons between time intervals from baseline to 3rd week, 3rd to 6th week and baseline to 6th week for FIQR, SF-12 and NPRS had shown statistically significant effects on improvement of FM symptoms, life quality and reduction of pain ($p<0.001$) shown in figure 4 and 5.

The graph 1 below shows the estimated margin means of FIQR, PCS12, MCS12 and NPRS at different time interval showing significant difference for both groups , but better results shown in stretching group, respectively.

Table 2. Descriptive analysis and Independent t-test with 95% confidence intervals

Measures		Time	Interventional protocol				P-Value ᵠ
			Stretching exercises		30-min walking		
			Mean ± Std. Deviation	95% CI LB-UB	Mean ± Std. Deviation	95% CI LL-UL	
FIQ-R		Baseline	49.07 ± 6.53	46.49-51.66	44.13 ± 7.82	41.54-46.71	0.009 *
		3rd-week	44.75 ± 6.03	42.27-47.24	42.38 ± 7.69	39.90-44.87	0.182
		6th-week	36.6 ± 5.71	34.23-38.97	39.29 ± 7.37	36.92-41.66	0.113
S12-12	PCS12	Baseline	37.13 ± 7.92	34.59-39.68	36.18 ± 6.15	33.63-38.72	0.598
		3rd-week	40.43 ± 7.52	37.98-42.89	37.5 ± 6.08	35.04-39.96	0.96
		6th-week	47.16 ± 6.77	44.85-49.47	40.61 ± 6.05	38.31-42.92	< 0.001*
	MCS12	Baseline	40.26 ± 8.09	37.24-43.28	45.11 ± 8.69	42.09-48.13	0.026 *
		3rd-week	41.06 ± 7.70	38.14-43.98	45.52 ± 8.53	42.60-48.44	0.035 *
		6th-week	42.86 ± 7.42	40.05-45.68	46.41 ± 8.25	43.59-49.23	0.08
NPRS		Baseline	5.77 ± 1.31	5.29-6.26	4.74 ± 1.37	4.26-5.22	0.004 *
		3rd-week	4.19 ± 1.11	3.79-4.60	4.16 ± 1.16	3.75-4.57	0.911
		6th-week	1.87 ± 1.20	1.44-2.31	3.19 ± 1.22	2.75-3.63	<0.001*

*****significant effect ($p<0.05$), ᵠ = between groups

FIQR, Fibromyalgia impact questionnaire revised; SF-12, Short form-12 health survey; PCS12, physical component score 12; MCS12, mental component score; NPRS, Numeric pain rating scale.

Table 3. Multivariate test

Effects			Value	F	Df	Error df	P-Value	Partial η^2
Between Subjects	Intercept	Wilks' Λ	0.004	4031	4	53	<0.001*	0.996
	Intervention	Wilks' Λ	0.803	3.5	4	53	0.013*	0.197
Within Subjects	Time	Wilks' Λ	0.048	131	8	57	<0.001*	0.952
	Time * Intervention	Wilks' Λ	0.214	24.3	8	57	<0.001*	0.786

*= remarkably significant effects; Λ= lambda; η^2 = eta squared

Table 4. Pairwise comparison of interventions

Measures	Interventions		Mean Diff. (I-J)	P-value	95% CI
	I	J			LL-UL
FIQR	Stretching	walking	1.54	0.375	-1.91- 4.99
PCS-12	Stretching	walking	3.48	0.04*	0.09-6.87
MCS-12	Stretching	walking	-4.29	0.04*	-8.40-(-0.17)
NPRS	Stretching	walking	-0.09	0.77	-0.68-0.51

Table 5. Pairwise comparison of time periods

Measure	Time interval		Mean Diff. (I-J)	P-Value	95% CI
	I	J			LL-UL
FIQR	Baseline	3rd week	3.03	<0.001*	2.66-3.41
	3rd week	6th week	5.62	<0.001*	5.02-6.22
	6th week	Baseline	8.65	<0.001*	7.76-9.54
PCS12	Baseline	3rd week	-2.31	<0.001*	-2.67-(-1.96)
	3rd week	6th week	-5.62	<0.001*	-6.22-(-5.02)
	6th week	Baseline	-7.23	<0.001*	-8.15-(-6.32)
MCS12	Baseline	3rd week	-.604	<0.001*	-0.78-(-0.43)
	3rd week	6th week	-1.35	<0.001*	-1.70-(-0.99)
	6th week	Baseline	-1.95	<0.001*	-2.42-(-1.49)
NPRS	Baseline	3rd week	1.08	< 0.001*	0.92-1.24
	3rd week	6th week	1.65	<0.001*	-1.47-1.83
	6th week	Baseline	2.73	<0.001*	2.48-2.98

--Bonferroni comparisons, * remarkably significant effects (p<0.001)

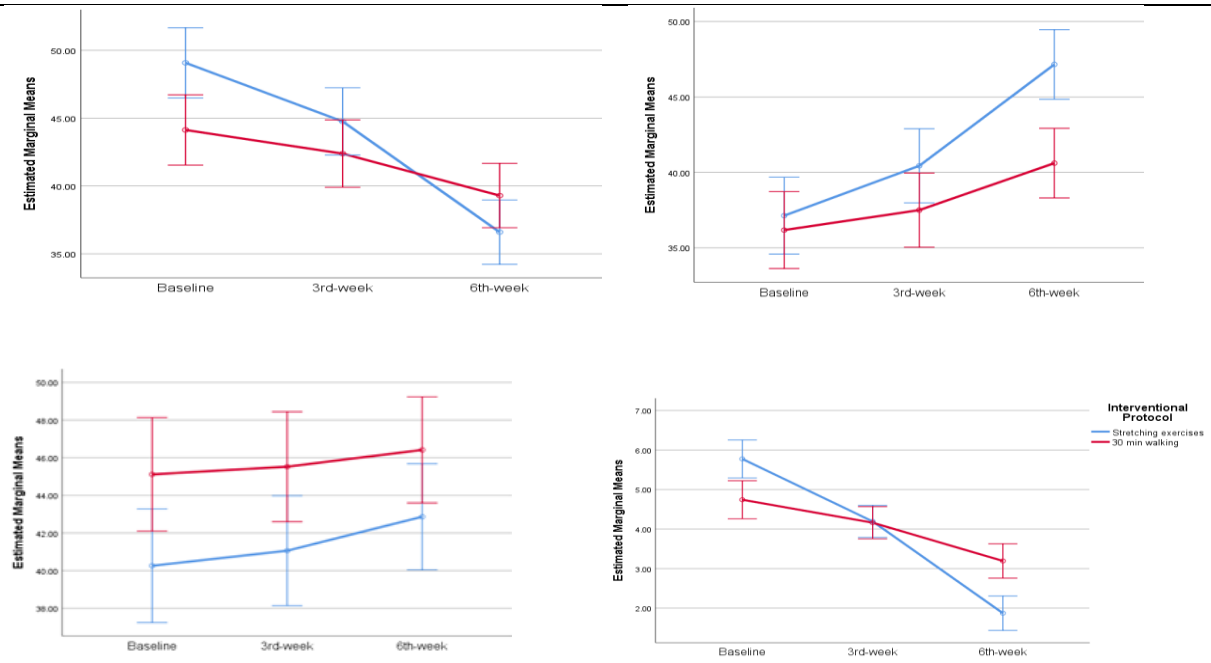

Figure 2. Estimated margin means of FIQR, PCS-12, MCS-12 and NPRS

DISCUSSION

In this study, FIQR shows that stretching is effective for reducing impact of FM by reducing symptoms and improving functional abilities of patients during within subject effects. These findings are consistent with previous research indicating that aerobic exercise applications, flexibility exercises [8,12] regime and mixed initiatives mitigate the severity of fibromyalgia on patients' quality of life.[24,25] It can be encourage that both walking along with segmental stretching will have quick and beneficial effect on FM. However, a previous survey did not discover any improvements regarding a stretching program. This might be as a result of the study's high attrition rate, which made it difficult to reach the necessary sample size.[26]

In contrast, since López-Rodrguez used a stretching regime while a combined regime has been used in this analysis, the findings might have been impacted by variations in the courses. In this investigation, the experimental group's Fibromyalgia Impact Questionnaire ratings were significantly lower than those of the groups. Moreover, most of literature considered FIQ more validated for looking FM symptoms and showed significant results in stretching and combined group in some previous studies.[27, 28] While in our study we used FIQR, which had significant within group effects between time and interaction of time with interventions ($p<0.001$) as compared to between groups.

In a study conducted by researchers found that stretching and aerobic exercises both done hand in hand for 6 weeks had better effects on muscles pain (VAS) in FM patients.[29] This research work showed little resemblance with our study because both groups stretching and walking had proven significantly effective for pain relieving in FM, but stretching was encouraged in our study. Moreover, aerobic exercise including walking was considered efficient for improving FM impacts on patients.[30] In our study both stretching and walking showed a significant drop in pain at 3rd week, further stretching had efficient effects on decreasing pain at 6th week according to NPRS while in most previous studies VAS was frequently used.

According to a research[31], aerobic exercises had found better effects on SF-36 domains as compared to stretching group, while in our study both between and within group effects showed significant results in stretching and walking by using SF-12, which was used little in previous studies according to my knowledge. Besides, stretching regime still have more availability for applications due to their less

disadvantage and easy to perform with cost-effectiveness.[32]

Recommendation: It is recommended that self-stretching exercises at home should be considered preferable in FM patients. Besides that, awareness about simple active stretches and walk should be given to general population (students and housewife), moreover, one should try to stay more active in their daily routine works. Besides that, more experimental researches related to physiotherapy effects on improving FM should be carried in other cities of Pakistan. Because, according to my knowledge, little work on exercise therapy was found in previous literature in our country. Such researches should be conducted on both male and females with fibromyalgia.

Limitation: The limitation of this study is that it was not carried out in a larger scale, it was just done on patient related to this disease in Gujrat. Moreover, a lengthier exercise regime with larger follow-up duration should resulted in more improved outcomes. Subsequently, because large percentage of FM patient populations are women, the present study has been conducted on women just, which can sometimes sway the study results, that could not be extrapolated to the regular populace.

CONCLUSION

Both interventions were appropriate for fibromyalgia. But, active segmental stretching exercise program showed more significant improvements in FM patient by decreasing its symptoms and reducing pain at tender points of muscles, thus improving quality of life with 6-week follow up as compared to 30-minute walking program. Thus, both interventions were considered beneficial for FM but stretching was more preferred.

Trial ID: 67238

Clinical trial registration ID:

IRCT20221205056715N1

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Financial Statement: It was a project thesis of doctor of physical therapy so funding statements were given by any authority.

Data availability: Data will be provided on the demand by corresponding author.

REFERENCES

1. Wolfe F, Smythe HA, Yunus MB, et al. The American College of Rheumatology 1990 criteria for the classification of fibromyalgia. *Arthritis & Rheumatism: Official Journal of the American College of Rheumatology* 1990; 33: 160-172.
2. Busch AJ, Barber KA, Overend TJ, et al. Exercise for treating fibromyalgia syndrome. *Cochrane Database of Systematic Reviews* 2007. DOI: 10.1002/14651858.CD003786.pub2.
3. Pastor-Mira MA, López-Roig S, Martínez-Zaragoza F, et al. Promoting unsupervised walking in women with fibromyalgia: A randomized controlled trial. *Psychology, Health & Medicine* 2021; 26: 487-498.
4. White KP, Speechley M, Harth M, et al. The London Fibromyalgia Epidemiology Study: the prevalence of fibromyalgia syndrome in London, Ontario. *The Journal of rheumatology* 1999; 26: 1570-1576.
5. Goldenberg DL, Burckhardt C and Crofford L. Management of fibromyalgia syndrome. *Jama* 2004; 292: 2388-2395.
6. Park H-K, Song M-K, Kim D-J, et al. Comparison of core muscle strengthening exercise and stretching exercise in middle-aged women with fibromyalgia: A randomized, single-blind, controlled study. *Medicine* 2021; 100.
7. Muto L, Sauer J, Yuan S, et al. Postural control and balance self-efficacy in women with fibromyalgia: are there differences? *European Journal of Physical and Rehabilitation Medicine* 2014; 51: 149-154.
8. Sevimli D, Kozanoglu E, Guzel R, et al. The effects of aquatic, isometric strength-stretching and aerobic exercise on physical and psychological parameters of female patients with fibromyalgia syndrome. *Journal of physical therapy science* 2015; 27: 1781-1786.
9. Matsutani LA, Marques A, Ferreira E, et al. Effectiveness of muscle stretching exercises with and without laser therapy at tender points for patients with fibromyalgia. *Clin Exp Rheumatol* 2007; 25: 410-415.
10. Mease P, Arnold LM, Bennett R, et al. Fibromyalgia syndrome. *The Journal of Rheumatology* 2007; 34: 1415-1425.
11. Gómez-Hernández M, Gallego-Izquierdo T, Martínez-Merinero P, et al. Benefits of adding stretching to a moderate-intensity aerobic exercise programme in women with fibromyalgia: a randomized controlled trial. *Clinical rehabilitation* 2020; 34: 242-251.
12. Assumpcao A, Matsutani LA, Yuan SL, et al. Muscle stretching exercises and resistance training in fibromyalgia: which is better? A three-arm randomized controlled trial. *European journal of physical and rehabilitation medicine* 2017; 54: 663-670.
13. Valencia M, Alonso B, Alvarez M, et al. Effects of 2 physiotherapy programs on pain perception, muscular flexibility, and illness impact in women with fibromyalgia: a pilot study. *Journal of manipulative and physiological therapeutics* 2009; 32: 84-92.
14. Jones KD, Burckhardt CS, Clark SR, et al. A randomized controlled trial of muscle strengthening versus flexibility training in fibromyalgia. *The Journal of rheumatology* 2002; 29: 1041-1048.
15. Mannerkorpi K, Nordeman L, Cider Å, et al. Does moderate-to-high intensity Nordic walking improve functional capacity and pain in fibromyalgia? A prospective randomized controlled trial. *Arthritis research & therapy* 2010; 12: 1-10.
16. O'Connor SR, Tully MA, Ryan B, et al. Walking exercise for chronic musculoskeletal pain: systematic review and meta-analysis. *Archives of physical medicine and rehabilitation* 2015; 96: 724-734. e723.
17. López-Roig S, Pastor-Mira M-Á, Núñez R, et al. Assessing Self-Efficacy for physical activity and walking exercise in women with fibromyalgia. *Pain Management Nursing* 2021; 22: 571-578.
18. Yoo S-A, Kim C-Y, Kim H-D, et al. Effects of progressive muscle relaxation therapy with home exercise on pain,

fatigue, and stress in subjects with fibromyalgia syndrome: A pilot randomized controlled trial. *Journal of Back and Musculoskeletal Rehabilitation* 2022: 1-11.
19. Busch AJ, Overend TJ and Schachter CL. Fibromyalgia treatment: the role of exercise and physical activity. *Int J Clin Rheumtol* 2009; 4: 343-380.
20. D'Amico F, Feliu-Soler A, Montero-Marín J, et al. Cost-Utility of Attachment-Based compassion therapy (ABCT) for fibromyalgia compared to relaxation: a pilot randomized controlled trial. *Journal of clinical medicine* 2020; 9: 726.
21. Luciano JV, Aguado J, Serrano-Blanco A, et al. Dimensionality, reliability, and validity of the revised fibromyalgia impact questionnaire in two Spanish samples. *Arthritis care & research* 2013; 65: 1682-1689. 2013/04/24. DOI: 10.1002/acr.22034.
22. Alghadir AH, Anwer S, Iqbal A, et al. Test-retest reliability, validity, and minimum detectable change of visual analog, numerical rating, and verbal rating scales for measurement of osteoarthritic knee pain. *Journal of pain research* 2018; 11: 851-856. 2018/05/08. DOI: 10.2147/jpr.s158847.
23. Huo T, Guo Y, Shenkman E, et al. Assessing the reliability of the short form 12 (SF-12) health survey in adults with mental health conditions: a report from the wellness incentive and navigation (WIN) study. *Health and Quality of Life Outcomes* 2018; 16: 34. DOI: 10.1186/s12955-018-0858-2.
24. Wang C, Schmid CH, Fielding RA, et al. Effect of tai chi versus aerobic exercise for fibromyalgia: comparative effectiveness randomized controlled trial. *bmj* 2018; 360.
25. Sañudo B, Galiano D, Carrasco L, et al. Aerobic exercise versus combined exercise therapy in women with fibromyalgia syndrome: a randomized controlled trial. *Archives of Physical Medicine and Rehabilitation* 2010; 91: 1838-1843.
26. del Mar López-Rodríguez M, Castro-Sánchez AM, Fernández-Martínez M, et al. Comparación entre biodanza en medio acuático y stretching en la mejora de la calidad de vida y dolor en los pacientes con fibromialgia. *Atención Primaria* 2012; 44: 641-649.
27. Williams DA and Arnold LM. Measures of fibromyalgia: Fibromyalgia impact questionnaire (FIQ), brief pain inventory (BPI), multidimensional fatigue inventory (MFI-20), medical outcomes study (MOS) sleep scale, and multiple ability self-report questionnaire (MASQ). 2011.
28. Bennett RM, Bushmakin AG, Cappelleri JC, et al. Minimal clinically important difference in the fibromyalgia impact questionnaire. *The Journal of rheumatology* 2009; 36: 1304-1311.
29. Genc A, Tur BS, Aytur YK, et al. Does aerobic exercise affect the hypothalamic-pituitary-adrenal hormonal response in patients with fibromyalgia syndrome? *Journal of Physical Therapy Science* 2015; 27: 2225-2231.
30. Busch AJ, Webber SC, Brachaniec M, et al. Exercise therapy for fibromyalgia. *Current pain and headache reports* 2011; 15: 358-367.
31. Valim V, Oliveira L, Suda A, et al. Aerobic fitness effects in fibromyalgia. *The Journal of rheumatology* 2003; 30: 1060-1069.
32. García DÁ, Nicolás IM and Hernández PJS. Clinical approach to fibromyalgia: synthesis of evidence-based recommendations, a systematic review. *Reumatología Clínica (English Edition)* 2016; 12: 65-71.

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