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A Comprehensive Analysis of Fibromyalgia

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ABSTRACT

Fibromyalgia (FM) is a chronic and debilitating health disorder characterized by widespread musculoskeletal pain, frequently accompanied by fatigue, sleep disturbances, cognitive dysfunction ("fibro fog"), and mood disorders. Affecting approximately 2-4% of the global population predominantly women the precise etiology of FM remains undetermined. However, contemporary pathophysiology frames the condition primarily as a central sensitivity syndrome. Driven by neurobiological alterations, autonomic nervous system dysfunction, and neurotransmitter imbalances, this central sensitization results in an amplified sensory "volume control" and decreased pain threshold. This comprehensive analysis explores the multifaceted nature of fibromyalgia, detailing the underlying structural and functional brain modifications that contribute to its pathology. Furthermore, the review traces the historical evolution of FM, highlighting the critical diagnostic shift from the traditional localized "tender points" examination to modern, comprehensive criteria focusing on broad symptom severity and widespread pain indices. Effective management of fibromyalgia requires a highly individualized, multidisciplinary approach. This paper outlines the current treatment paradigms, emphasizing the integration of nonpharmacological strategies such as patient education, cognitive behavioral therapy (CBT), and graded physical activity with targeted pharmacological interventions, including α-2 ligands (pregabalin), SNRIs (duloxetine), and TCAs. Ultimately, recognizing fibromyalgia as a legitimate, neurologically-based condition is crucial for mitigating patient stigma and implementing holistic, symptom-based treatment plans that enhance overall quality of life.

Keyword: Fibromyalgia, Paradigms, Emphasizing, Fatigue.

I. INTRODUCTION

Fibromyalgia (FM) is a chronic health disorder that causes widespread discomfort. The current diagnosis also needs an above-threshold severity score for one of six extra symptoms: exhaustion, difficulty thinking or remembering, waking up weary (unrefreshed), pain or cramping in the lower abdomen, depression, or headache. Other symptoms may also occur. Fibromyalgia's aetiology are unknown, but various pathologies have been hypothesised.Fibromyalgia is believed to affect 2-4% of the population. Women are disproportionately harmed compared to men. Rates appear to be similar in many parts of the world and civilizations. Fibromyalgia was first identified in the 1950s, then defined in 1990, with updated criteria in 2011, 2016, and 2019.Fibromyalgia is treated using symptomatic and interdisciplinary approaches. Aerobic and strengthening exercises are advised. Duloxetine, milnacipran, and pregabalin can provide short-term pain relief to some FM patients. Fibromyalgia symptoms last for a long time in most people. Fibromyalgia is connected with a considerable economic and societal burden, and it can result in significant functional impairment in those who have it. Fibromyalgia patients may face severe stigma and mistrust regarding the validity of their symptoms, particularly inside the healthcare system. FM is connected with a rather high suicide risk.

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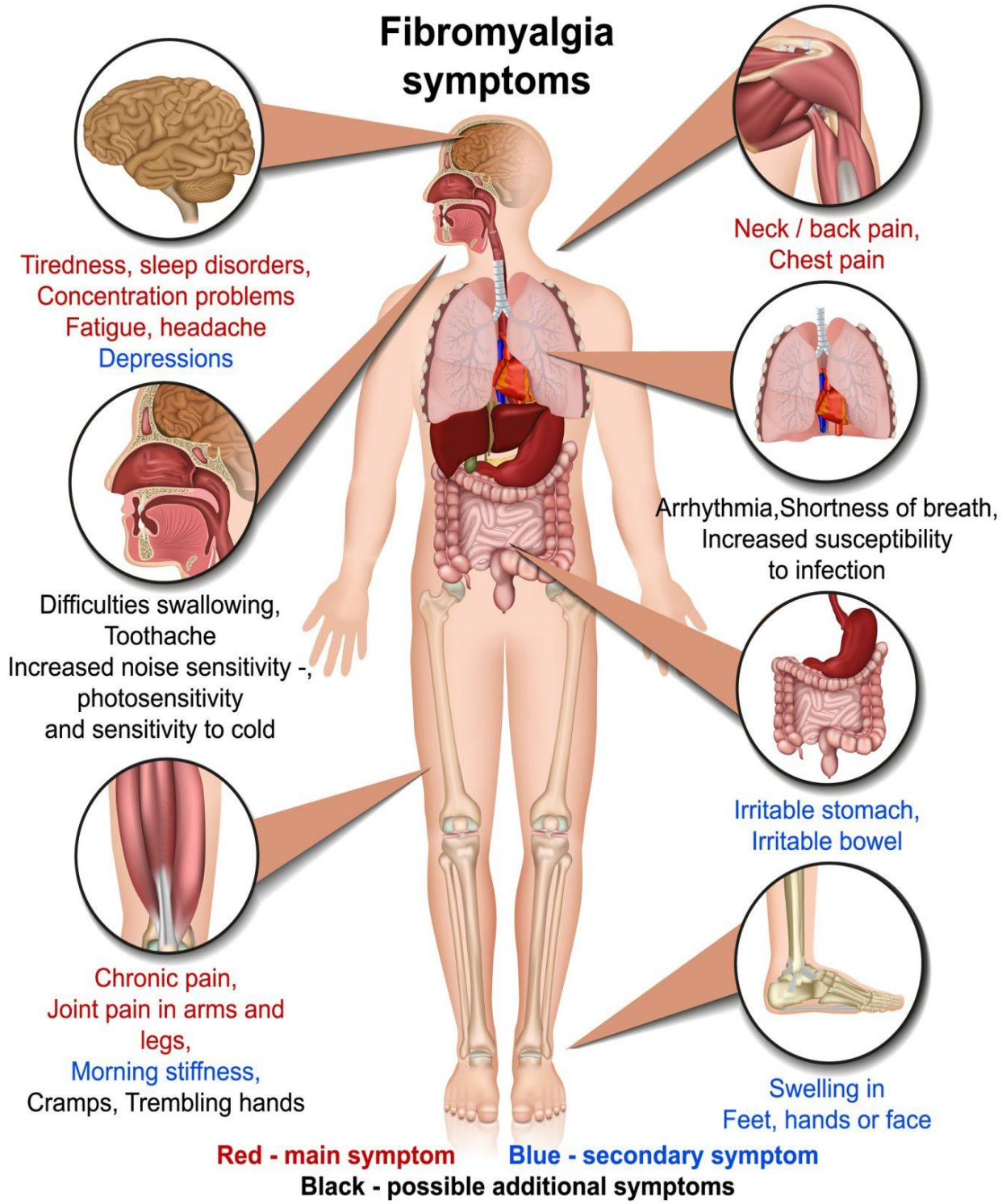

PATHOPHYSIOLOGY

As of right now, fibromyalgia is thought to be either a central sensitivity syndrome or a dysfunction of central pain processing. Studies have shown that the brain's pain processing system has changed chemical and functional connections. According to Clauw, the illness is characterised by a broad issue with sensory "volume control," which

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causes patients to have a decreased tolerance for pain as well as other stimuli like heat, noise, and strong smells. Clauw further speculates that patients may experience hypersensitivity due to expectation or hypervigilance, which may be associated with psychological variables, or due to neurobiologic alterations that impact the sense of pain.

Research reveals biochemical, metabolic, and immunoregulatory problems, despite the fact that the pathophysiology of fibromyalgia remains unclear. These support the idea that fibromyalgia is no longer a condition involving subjective pain. The processing and integration of nociceptive signals from the spinal cord to different brain "hubs," in addition to input from somatic reflex pathways and regions linked to the emotional, motivational, and cognitive aspects of pain, constitute the subjective experience of pain. Additionally important are the two main regulators of the stress response: the sympathetic nervous system (SNS) and the hypothalamic-pituitary-adrenocortical (HPA) axis. Neurochemical balances within the pain-processing system and functional brain connections are disrupted in fibromyalgia patients.

Autonomic Nervous System Dysfunction

Many experts think that pain, sleep disturbances, mood, and cognitive symptoms are related to autonomic nervous system dysfunction, which is characterised by decreased heart rate variability (HRV) and changes in skin conductance, along with an overactive stress response and dysregulation of the HPA axis. Lower basal cortisol levels, reduced 24-hour urinary free cortisol excretion, and a slowed cortisol response to stimulation tests like the corticotropin-releasing hormone test have all been seen in a number of studies. A recent meta-analysis, however, indicates that while there is evidence linking fibromyalgia to HPA-axis malfunction, the results are rather conflicting and dependent on patient groups, study designs, and analytical techniques. Therefore, there is insufficient data to conclude that fibromyalgia patients have aberrant HPA-axis function. Reduced HRV, which indicates increased sympathetic nervous system activity, as well as variations in skin conductance and perspiration, are physical indicators of autonomic dysfunction.

Central Nervous System Dysfunction

Modifications to the structure and function of the brain: Studies using magnetic resonance imaging (MRI) in fibromyalgia patients have shown several alterations in brain morphology, such as:

- The anterior cingulate cortex and prefrontal cortex have the greatest reduction in total grey matter.
- A three-fold increase in age-associated grey matter loss is indicative of premature brain ageing.
- reduced rostral anterior cingulate cortex cortical thickness, brain volume, and regional functional connectivity.

These changes tend to worsen with the duration of the disease.

Neurotransmitter alterations: The ventral tegmental region, which controls sensory, emotional, cognitive, and pain-modulatory processes in healthy people, is engaged when pain is anticipated and stimulated and deactivated when pain alleviation is anticipated. A functional MRI (fMRI) research, however, reveals decreased activation in this region in fibromyalgia patients, indicating altered GABAergic and dopaminergic neurotransmission. A lower pain threshold is linked to elevated glutamate levels in the right posterior insular area. Deficits in intracortical GABAergic and glutamatergic regulation are also revealed by transcranial magnetic stimulation of the motor cortex. In comparison to healthy individuals, additional research reveals elevated neuronal activity in pain-processing and pain-sensitive brain regions. The brain is composed of interconnected hubs, or highly connected regions, which combine information from different brain regions and route it to the right places. Information from different sections of the brain is integrated and directed to the appropriate areas by interconnected hubs, or highly connected regions. This hub structure is different in fibromyalgia patients. Fibromyalgia individuals have a different hub configuration.

Fibromyalgia pain severity is associated with changes in the insular hub's architecture. In general, patients' neural hub stability is less stable than that of healthy controls. Patients with fibromyalgia not only have deficiencies in GABAergic and glutamatergic regulation, but they also have higher levels of inositol in the right amygdala and right thalamus, which is correlated with sensations of pain, exhaustion, and sadness.

Modifications in functional connectivity during rest: The periaqueductal gray's resting-state functional connectivity is disrupted in fibromyalgia patients, which impairs descending pain inhibition. There is also clear evidence of altered connection between the insula, a crucial area for processing pain, and the default mode network (DMN). The anterior midcingulate cortex, right parahippocampal

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gyrus, left superior parietal lobule, and left inferior temporal gyrus are also found to have changed connection with DMN elements. Interestingly, a longer duration of symptoms is linked to decreased functional connectivity between the DMN and the right parahippocampal gyrus. On the other hand, higher pain and depression scores are correlated with improved connection between the anterior midcingulate and posterior cingulate cortices. Fatigue and other physical symptoms linked to fibromyalgia may also be caused by central sensitization, which is indicated by an imbalance in activity between the ventral and dorsal cervical spinal cord.

Sleep Disturbances: Phasic α-sleep is the most prevalent type of sleep disorder associated with fibromyalgia. According to certain research, sleep disorders may occur before pain manifests. According to a Norwegian study, sleep disturbance raises the likelihood of fibromyalgia, and nonrestorative sleep is the best indicator of widespread pain. Sleep interruptions also have a major impact on pain intensity, attention, and cognition.

Additional Changes: Patients with fibromyalgia often have small fibre neuropathy, which usually manifests as hyperesthesia in a stocking distribution. Small fibre neuropathy may develop as a result of central sensitization. Increased glutamate levels in the insula can decrease intraepidermal nerve fibre density and increase pain behaviours. Patients with tiny fibre neuropathy have changed electrochemical skin conductance or decreased intraepidermal nerve fibre density in skin biopsies.

FIBROMYALGIA CAUSES AND RISK FACTORS

Although the precise cause of fibromyalgia is unknown, it appears to result from improper pain processing by the body's central and peripheral nerve systems. Physical or psychological trauma, such as a disease, surgery, infection, stressful life event, or an injury, frequently triggers the onset of fibromyalgia symptoms. The brain's real pain receptors may change, creating a sort of "memory" that causes them to respond to pain signals. Genetics might also be involved. You are more likely to get fibromyalgia if you have a family member who has the condition. Fibromyalgia can also be
more likely to develop in people with specific medical disorders, such as osteoarthritis or rheumatoid arthritis. To make matters more complicated, fibromyalgia can sometimes appear on its own without any trauma.

HOW IS FIBROMYALGIA DIAGNOSED?

In the past, a doctor would examine 18 distinct body locations to determine how many of them hurt when pushed hard in order to diagnose fibromyalgia. This examination was referred to as a "sensitive point." Nonetheless, the tender point test is becoming less used among medical professionals for diagnosing fibromyalgia. Currently, fibromyalgia is diagnosed by determining whether you have experienced broad, inexplicable pain for longer than three months. As of right now, fibromyalgia cannot be definitively diagnosed with any test. To rule out other illnesses, your doctor might suggest blood testing or imaging.

TREATMENT / MANAGEMENT

Effective treatment of fibromyalgia requires a balanced combination of pharmacological and nonpharmacological modalities. The primary focus of the treatment is symptom relief and equipping patients with strategies to manage daily life effectively. Key goals include:

- Decreasing severe symptoms such mood disorders, exhaustion, persistent pain, and sleep problems.
- Increasing patient self-efficacy with nonpharmacological therapies and education.
- Tailoring care to each patient's particular set of symptoms.
- Taking care of coexisting diseases that could affect symptoms or make it more difficult to stick to a treatment plan.

Clinicians should customise treatment plans according to each patient's symptoms, comorbidities, and preferences while taking into account specific treatment-related obstacles, such as social determinants of health, pharmaceutical costs, past treatment experiences, or drug side effects.

Nonpharmacological Therapy

Physical activity, cognitive behavioural therapy (CBT), and patient education are the mainstays of nonpharmacological treatment for fibromyalgia:

Patient education: Important components of patient education include reassuring patients that fibromyalgia is a legitimate disorder and validating their symptoms. By distinguishing between nociceptive pain, which is brought on by tissue damage and inflammation, and centralised pain, which is brought on by increased signals in the central nervous system, clinicians can assist patients in understanding their increased sensitivity to pain. Patients should also be aware that peripheral and

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central pain can exacerbate one another; for example, fibromyalgia symptoms may worsen after a knee injury and vice versa. To reduce dissatisfaction, clinicians should have reasonable expectations for treatment results. Patients need to understand that although there is no cure, treatment can lessen symptoms. But some weariness and pain might not go away, and the symptoms will probably change over time.

Since comorbid problems including depression, anxiety, and sleep disorders can worsen one another, patients with these conditions should be urged to seek treatment. For instance, pain can exacerbate sleep disturbances, and sleep disturbances can exacerbate pain. Patients with suspected main sleep disorders should be referred to sleep medication, and clinicians should examine patients for sleep apnea and restless legs syndrome. Another important aspect of patient education is stressing the importance of good sleep hygiene.

The following list outlines recommended sleep hygiene practices:

- Sleeping in a peaceful, quiet, and dark place.
- Having a consistent bedtime and wake-up time every day.
- Avoiding caffeine after lunch.
- Avoiding drinking right before bed.
- Limiting all electronic device use to 30 to 60 minutes before to bedtime. Avoiding strenuous exercise within 2 hours of bedtime.
- Avoiding having a big dinner right before bed.

Physical activity: Exercise can help fibromyalgia sufferers feel less tired, get better sleep, and experience less pain. Training for cardiovascular fitness, resistance training, and movement therapies like tai chi have proven to be quite effective. Exercise regimens should be customised for each patient and should include low-impact aerobic activities like swimming, biking, brisk walking, or water aerobics unless the patient is ill tolerant or contraindicated. At least thirty minutes of aerobic exercise three times a week is the recommended level of cardiovascular fitness training. Patients should be urged to continue exercising at a level they can sustain, though, if they are unable to reach this goal. Patients should be advised that when they begin an activity regimen, their level of discomfort and exhaustion may initially increase. One way to lessen these effects is to gradually increase activity levels.

Cognitive therapy: CBT, mindfulness-based stress reduction, meditation, and relaxation techniques are all possible components of cognitive therapy. Pain, sleep issues, and anxiety and depression symptoms have all been demonstrated to be lessened by CBT, particularly when paired with patient education. Cost and restricted access, however, may be obstacles to therapy. Patients' accessibility can be enhanced by telephone-based and online CBT programmes.

Pharmacological Therapy

Patients with moderate-to-severe symptoms or those with mild symptoms who do not improve with nonpharmacological treatments should be evaluated for pharmacological therapy. Patients need to be aware that about half of the time, drugs are only modestly helpful. First-line therapies include α-2 ligands like pregabalin and gabapentin, selective norepinephrine reuptake inhibitors (SNRIs) like duloxetine and milnacipran, and tricyclic antidepressants (TCAs) like amitriptyline. Furthermore, the tricyclic drug cyclobenzaprine has demonstrated effectiveness in treating fibromyalgia symptoms. Comorbidities and related symptoms should inform medication selection. A TCA, such as amitriptyline, should be started by patients with extensive diffuse pain who do not have severe mood symptoms. The dosage should start at 5 to 10 mg before bed. Take the medication one to three hours before bed. If necessary, increase the dosage by five milligrammes every two weeks. Usually, a dose of 20 to 30 mg is effective. After a year of treatment, a weaning study should be conducted. While some patients might be able to stop treatment, others would need to continue. An appropriate substitute is cyclobenzaprine, which should be started at 5 mg prior to bedtime and progressively increased to 10 to 20 mg as needed.

SNRIs like milnacipran and duloxetine are suitable for fibromyalgia patients who experience severe depression or fatigue. The starting dosage for these drugs is listed below.

- **Duloxetine:**Adolescents with fibromyalgia who are 13 years of age or older may use this medication. 20 to 30 mg/d in the morning with meals is the recommended dosage for adults and adolescents. Up to a maximum of 60 mg/d, the dose may be increased by 20 mg every few weeks. Based on clinical investigations, the typical daily dosage is 60 mg. Antidepressants may raise the risk of suicide thoughts and behaviour in children and young adults,

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thus caregivers and patients should be aware of this. If this happens, you should get medical help right away.

- **Milnacipran:**Starting at 12.5 mg per day, the dosage is raised by 12.5 mg every few weeks until it reaches a maximum of 50 to 100 mg, which can be taken once or twice a day. The average effective dose, according to clinical research, is 100 mg/d.

Pregabalin should be used as a first-line treatment for patients who have severe sleep problems and extensive discomfort. When pregabalin use is restricted due to cost or availability, gabapentin is a good substitute. The dosage for adults is listed below.

- **Pregabalin:**This medication's initial dosage is 25 to 50 mg at bedtime, which is then increased by 25 to 50 mg every two to four weeks. The dosage can be split into two equal doses twice a day or given once in the evening. Although some people may respond to lesser doses, the usual suggested dosage, based on clinical research, is 300 to 450 mg/d.
- **Gabapentin:**Starting with a dose of 100 mg at bedtime, this medication should be gradually titrated in 100 mg increments every few weeks. Up to three dosages of 1200–2400 mg per day are advised.

Pregabalin and gabapentin are used off-label in children and adolescents and may be effective. However, further research is needed to establish specific recommendations regarding their safety and efficacy in juvenile patients with fibromyalgia.

Treatment for Persistent Symptoms

If the first pharmacological treatment does not offer sufficient relief, it is fair for clinicians to go to a new class of medications. To avoid withdrawal symptoms, doctors should gradually reduce moderate-to-high dosages of fibromyalgia drugs. Combination therapy utilising lower doses from other drug classes may be suitable if monotherapy with diverse drugs is still ineffective. Comorbid conditions, availability, and cost should all be taken into account when selecting a combination therapy. A low-dose SNRI in the morning with a low-dose TCA at bedtime or a low-dose SNRI in the morning with a low-dose α-2 ligand at bedtime are typical combinations.

Alternative Therapeutic Considerations

- **Selective serotonin reuptake inhibitors:** The selective serotonin reuptake inhibitors fluoxetine, paroxetine, and fluvoxamine may be useful in the treatment of fibromyalgia, according to scant data. Patients who are unable to tolerate or do not receive sufficient relief from first-line therapy may be candidates for these drugs.
- **Nonsteroidal anti-inflammatory drugs:**The substantial advantages of NSAIDs in treating fibromyalgia symptoms are not supported by the available data.
- **Opioids:** In general, doctors shouldn't prescribe opioids to treat fibromyalgia. On the other hand, tramadol, a mild opioid, decreases serotonin and norepinephrine reuptake by acting as a μ-receptor agonist. According to studies, tramadol may be useful in treating fibromyalgia, especially in individuals whose symptoms are resistant.
- **Low-dose naltrexone:** By increasing endogenous opioid synthesis, low-dose naltrexone usually given at 5 mg is used to treat chronic pain.
- **Nutrition:**There is currently no recognised dietary recommendation for the treatment of fibromyalgia. However, weight loss has been demonstrated to alleviate fibromyalgia-related pain and sadness, and there is a direct correlation between fibromyalgia symptoms and rising BMI. The greatest benefits are typically experienced by obese patients who drop 10% or more of their body weight. Although further research is required to validate these results, plant-based diets and low FODMAP (fermentable oligosaccharides, disaccharides, monosaccharides, and polyols) diets may also help alleviate symptoms.
- **Acupuncture:**Acupuncture is an effective treatment for fibromyalgia, according to moderate evidence.
- **Neuromodulation:**Patients with fibromyalgia have exhibited improvements in pain and fatigue when peripheral nerve stimulation using a transcutaneous electrical nerve stimulation (TENS) unit is delivered at high intensity across several sessions. Furthermore, it has been discovered that transcranial magnetic stimulation and transcranial direct current stimulation lessen fibromyalgia sufferers' experience of pain and weariness.

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- **Trigger point injections:** Trigger point injections may help manage the symptoms of fibromyalgia, according to small research.
- **Massage therapy:** It has been demonstrated that regular massage therapy helps control the symptoms of fibromyalgia.

Modifications to Lifestyle for Fibromyalgia

There are many lifestyle changes that can help improve fibromyalgia symptoms.

Get Regular Exercise

One useful strategy for controlling the symptoms of fibromyalgia is physical activity. In addition to preventing deconditioning or weakening from inactivity, gentle stretching and cardiovascular exercise can alleviate discomfort. Additionally, it can enhance sleep.Exercise may seem like the last thing on your mind while you're in excruciating pain from fibromyalgia, but it might actually exacerbate your discomfort. When you have fibromyalgia, the greatest way to engage in physical activity is to start out slowly. To put it another way, to enhance your strength and endurance, start with a few minutes of exercise and work your way up over a few weeks or months. Doing a bit less than you are capable of is preferable than pushing yourself too much and causing a flare-up of fibromyalgia. Reduce the duration and intensity of your workouts if you're experiencing a flare-up, but don't stop exercising entirely.

Follow a Healthy Diet

Fibromyalgia sufferers should eat foods that nourish their bodies, just like everyone else. In example, the Mediterranean diet has been demonstrated to alleviate certain symptoms associated with fibromyalgia. This entails eating a diet rich in fruits, vegetables, whole grains, low-fat dairy, legumes, healthy oils, and low-fat protein sources like chicken and fish (unless you have food sensitivities to any of these). Reducing processed, fatty, and sugary foods is another aspect of it. You can identify the ideal eating pattern for your needs by talking to your doctor or a qualified dietitian-nutritionist about your diet.

HISTORY

Evolution of Understanding

Era	Dominant Theory	Treatment Focus
Early 1900s	Physical inflammation of tissues (Fibrositis)	Rest and topical treatments

Widespread physical pain, exhaustion, and cognitive problems are the hallmarks of fibromyalgia, a chronic illness (often called "fibro fog"). Reports of identical symptoms trace back centuries, with accounts of "muscular rheumatism" dating back to the 16th and 17th centuries, despite the fact that it was officially defined in 1976 and acknowledged as a separate disease by the American Medical Association in 1987.

Historical Timeline

- **Pre-19th Century**: The French physician Guillaume de Baillou first used the term "rheumatism" to refer to non-injury-related muscle discomfort in historical documents from 1592.
- **1800s**: Scientists defined the condition as a rheumatic disorder that causes stiffness and sleep difficulties after they started to discover "tender points"—specific locations susceptible to pressure.
- **1904**: Sir William Richard Gowers, a British neurologist, first introduced the word "fibrositis," thinking that inflammation in fibrous tissues was the source of the discomfort.
- **1976**: After examinations revealed no real signs of inflammation, researcher P.K. Hench came up with the term "fibromyalgia" (fibro for connective tissue, my for muscle, and algia for pain).
- **1987**: Fibromyalgia was formally acknowledged as a legitimate medical condition by the American Medical Association (AMA).
- **1990**: The initial official diagnostic criteria, issued by the American College of Rheumatology (ACR), required that at least 11 of the 18 designated "sensitive spots" be painful.
- **2010**: The "Widespread Pain Index" (WPI) and "Symptom Severity Scale," which focus on the patient's entire experience of pain, exhaustion, and cognitive problems, replaced tender spots in the diagnosis.

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Mid-1900s	Psychological or "psychogenic" origin	Psychiatric support or dismissal
Modern Day	Central Nervous System "volume control" (Central Sensitization)	Neuro-modulators, exercise, and Cognitive Behavioral Therapy (CBT)

According to recent studies, the central nervous system amplifies pain signals, hence increasing the "volume" of sensory data. This has significantly shifted the medical community's view of the illness from psychological explanations to a neurological one.

REFERENCES

[1]. Bansal D. Personalized medicine in oncology: advancements, difficulties, and prospects. International Journal of Therapeutic Innovation. 2025 Aug 30;3(4):11–21. doi:10.55522/ijti.v3i4.0121

[2]. Kumar A, Raj R, Prakash A, Singh U, Khandagare K, Rk Y, et al. Green Synthesized Monometallic And Bimetallic Nanoparticles: A Sustainable Approach To Controlled Drug Delivery. Int J Drug Deliv Technol. 2026;16(28s):451–4. doi:10.25258/ijddt.16.28s.53

[3]. Patidar D, Jain S, Kumar A, Raj R, Pandey S. Assessment and management of Chagas disease: a comprehensive analysis. International Journal of Pharmaceutical Research and Applications. 2025 Feb;10(2):672–85. doi:10.35629/4494-1002672685

[4]. Kumar Giri A, Patidar D, Jain S, Kumar A, Raj R, Prasad C. Therapeutic Potential of Quercetin in Chronic Diseases.

[5]. Kushwaha N, Raikwar R, Jain S, Patidar D, Raj R, Kumar A. QUANTITATIVE ANALYSIS OF THE DRUG NORFLOXACIN BY USING U.V. VISIBLE SPECTROSCOPY.

[6]. Patidar D, Jain J, Kumar A, Raj R, Yadav P, Sariya D. Using UV-visible spectroscopy to quantitatively estimate the amount of ciprofloxacin in marketed dosage form. International Journal of Pharmaceutical Research and Applications. 2025 Feb;10(2):1504–15. doi:10.35629/4494-100215041515

[7]. Namdev S, Jain S, Patidar D, Kumar A, Raj R. Recent Advances in Pharmaceutical Formulations for the Treatment of Various Diseases: a Review. International Journal of Pharmaceutical Research and Applications. 2025 Jan;10(1):389–94. doi:10.35629/4494-1001389394

[8]. Raj R, Jain S, Patidar D, Kumar A, Yadav P, Yogesh. Phytochemical screening, pharmacognostics, and biological activity of Myristicafragrans. International Journal of Pharmaceutical Research and Applications. 2025 Feb;10(2):1563–76. doi:10.35629/4494-100215631576

[9]. Kumar A, Jain S, Patidar D, Raj R, V. Patil. T. Way To Digital Pharmacy With Thelepharmacy. International Journal of Pharmaceutical Research and Applications. 2025 Feb;10(2):686–90. doi:10.35629/4494-1002686690

[10]. Yadav P, Jain S, Patidar D, Raj R, Kuma A, Yadav R. An innovative method for transdermal medication delivery: Ethosomes. International Journal of Pharmaceutical Research and Applications. 2025 Feb;10(2):1552–62. doi:10.35629/4494-100215521562

[11]. Raj R, Jain S, Patidar D, Kumar A, Meena S. Pharmacognostic, Extraction, Phytochemical screening and Pharmacological study of Senna Leaves. International Journal of Pharmaceutical Research and Applications. 2025 Feb;10(2):744–57. doi:10.35629/4494-1002744757

[12]. Kumar Shukl S, Kumar S, Patidar D, Dr. Jain S, Kumar A, Raj R. Improvement of Aqueous solubility of Poorly Water-Soluble Drug (Ibuprofen) Using Mixed Solvency Technique. International Journal of Pharmaceutical Research and Applications. 2025 Jan;10(1):407–16. doi:10.35629/4494-1001407416

[13]. Kumar A, Jain S, Patidar D, Raj R, Dhakad S. A Detailed Review on Biodegradable Drug Delivery Systems. International Journal of Pharmaceutical Research and Applications. 2025 Feb;10(2):663–71. doi:10.35629/4494-1002663671

[14]. Raj R, Jain S, Patidar D, Kumar A, Yadav P, Lodhi. S. Hydrogel Containing Fluconazole: Preparation and Assessment for Antifungal Properties". International Journal of Pharmaceutical Research and Applications. 2025 Feb;10(2):758–68. doi:10.35629/4494-1002758768

[15]. Kushwaha A, Jain S, Kumar A, Raj R, Singh Yaduwanshi P, Patidar D. An Overall Review of Different Derivatives That Activate Glucokinase Enzyme Having Multiple Actions to Treat Type 2 Diabetes. International Journal of Pharmaceutical Research and Applications. 2025 Jan;10(1):358–67. doi:10.35629/4494-1001358367

[16]. Kumar A, Jain S, Patidar D, Raj R, Shah SK. A Synopsis of Developing Diagnosis and Treatment for Gonorrhoea: Takeaways. International Journal of Pharmaceutical Research and Applications. 2025 Feb;10(2):640–52. doi:10.35629/4494-1002640652

[17]. Kumar A, Sharma R, Chandra Rathi J. DEVELOPMENT AND EVALUATION OF GASTRORETENTIVE FLOATING BEADS OF SIMVASTATIN. Certified Journal | Ajay et al World Journal of Pharmaceutical Research. 2021;10(5):1337. doi:10.20959/wjpr20215-20266

[18]. Patidar D, Jain S, Kumar A, Raj R, Yadav P. A Comprehensive Analysis of Alkaptonuria. International Journal of Pharmaceutical Research and Applications. 2025 Feb;10(2):653–62. doi:10.35629/4494-1002653662

[19]. Yadav P, Tiwari M, Ak Y, Singh A, Mk A, Prajapati R, et al. Nanoparticles In Topical Drug Delivery Systems: Advances, Mechanisms, And Therapeutic Applications. Int J Drug Deliv Technol. 2026;16(28s):485–91. doi:10.25258/ijddt.16.28s.59

[20]. Tiwari M, Yadav P, Saifi J, Kushwah A, Verma A, Verma S, et al. Advancing Phytoconstituent Delivery Through Phospholipid Complexation: Mechanisms, Formulation Strategies, and Therapeutic Implications. Int J Drug Deliv Technol. 2026;16(44s):6–11. doi:10.25258/ijddt.16.44s.2

[21]. Raj R, Kumar A, Sahu A, Mandlekar R, Chaturvedi P, Uikey L, et al. Development and Optimization of Solid Lipid Nanoparticles for Improved Antifungal Efficacy. Int J Drug Deliv Technol. 2026;16(44s):1–5. doi:10.25258/ijddt.16.44s.1

[22]. Roach K, Roberts J. A comprehensive summary of disease variants implicated in metal allergy. J Toxicol Environ Health B Crit Rev. 2022;25(6):279–341. doi:10.1080/10937404.2022.2104981 PubMed PMID: 35975293.

[23]. Pinto AM, Luís M, Geenen R, Palavra F, Lumley MA, Ablin JN, et al. Neurophysiological and psychosocial mechanisms of fibromyalgia: A comprehensive review and call for an integrative model. NeurosciBiobehav Rev. 2023 Aug 1;151. doi:10.1016/j.neubiorev.2023.105235 PubMed PMID: 37207842.

[24]. Yepez D, Grandes XA, TalankiManjunatha R, Habib S, Sangaraju SL. Fibromyalgia and Depression: A Literature Review of Their Shared Aspects. Cureus. 2022 May 11;14(5). doi:10.7759/cureus.24909 PubMed PMID: 35698706.

[25]. Filipovic T, Filipović A, Nikolic D, Gimigliano F, Stevanov J, Hrkovic M, et al. Fibromyalgia: Understanding, Diagnosis and Modern Approaches to Treatment. J Clin Med. 2025 Feb 1;14(3):955. doi:10.3390/jcm14030955 PubMed PMID: 39941626.

[26]. Goldberg N, Tamam S, Weintraub AY. The association between overactive bladder and fibromyalgia: A systematic review and meta-analysis. International Journal of Gynaecology and Obstetrics. 2022 Dec 1;159(3):630–41. doi:10.1002/ijgo.14290 PubMed PMID: 35641437.

[27]. Padhan P, Maikap D, Pathak M. Restless leg syndrome in rheumatic conditions: Its prevalence and risk factors, a meta-analysis. Int J Rheum Dis. 2023 Jun 1;26(6):1111–9. doi:10.1111/1756-185X.14710 PubMed PMID: 37137528.

[28]. He J, Chen M, Huang N, Wang B. Fibromyalgia in obstructive sleep apnea-hypopnea syndrome: a systematic review and meta-analysis. Front Physiol. 2024;15. doi:10.3389/fphys.2024.1394865 PubMed PMID: 38831795.

[29]. Schmidt-Wilcke T, Clauw DJ. Fibromyalgia: from pathophysiology to therapy. Nat Rev Rheumatol. 2011 Sep;7(9):518–27. doi:10.1038/nrrheum.2011.98 PubMed PMID: 21769128.

[30]. Kocyigit BF, Akyol A. Coexistence of fibromyalgia syndrome and inflammatory rheumatic diseases, and autonomic cardiovascular system involvement in fibromyalgia syndrome. ClinRheumatol. 2023 Mar 1;42(3):645–52.

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doi:10.1007/s10067-022-06385-8 PubMed PMID: 36151442.

[31]. D'Onghia M, Ciaffi J, Lisi L, Mancarella L, Ricci S, Stefanelli N, et al. Fibromyalgia and obesity: A comprehensive systematic review and meta-analysis. Semin Arthritis Rheum. 2021 Apr 1;51(2):409–24. doi:10.1016/j.semarthrit.2021.02.007 PubMed PMID: 33676126.

[32]. Alsiri N, Alhadhoud M, Alkatefi T, Palmer S. The concomitant diagnosis of fibromyalgia and connective tissue disorders: A systematic review. Semin Arthritis Rheum. 2023 Feb 1;58. doi:10.1016/j.semarthrit.2022.152127 PubMed PMID: 36462303.

[33]. Kleykamp BA, Ferguson MC, McNicol E, Bixho I, Arnold LM, Edwards RR, et al. The Prevalence of Psychiatric and Chronic Pain Comorbidities in Fibromyalgia: an ACTTION systematic review. Semin Arthritis Rheum. 2021 Feb 1;51(1):166–74. doi:10.1016/j.semarthrit.2020.10.006 PubMed PMID: 33383293.

[34]. Valencia C, Fatima H, Nwankwo I, Anam M, Maharjan S, Amjad Z, et al. A Correlation Between the Pathogenic Processes of Fibromyalgia and Irritable Bowel Syndrome in the Middle-Aged Population: A Systematic Review. Cureus. 2022 Oct 5;14(10). doi:10.7759/cureus.29923 PubMed PMID: 36381861.

[35]. Gorzewski AM, Heisler AC, Neogi T, Muhammad LN, Song J, Dunlop D, et al. Predicting Disease Activity in Rheumatoid Arthritis With the Fibromyalgia Survey Questionnaire: Does the Severity of Fibromyalgia Symptoms Matter? J Rheumatol. 2023 May 16;50(5):684–9. doi:10.3899/jrheum.220507 PubMed PMID: 36521924.

[36]. Macfarlane GJ, Pathan E, Siebert S, Packham J, Gaffney K, Choy E, et al. AxSpA patients who also meet criteria for fibromyalgia: identifying distinct patient clusters using data from a UK national register (BSRBR-AS). BMC Rheumatol. 2019 May 20;3(1). doi:10.1186/s41927-019-0066-7 PubMed PMID: 31143851.

[37]. Goldenberg DL. How to understand the overlap of long COVID, chronic fatigue syndrome/myalgic encephalomyelitis, fibromyalgia and irritable bowel syndromes. Semin Arthritis Rheum. 2024 Aug 1;67. doi:10.1016/j.semarthrit.2024.152455 PubMed PMID: 38761526.

[38]. Anderson G, Maes M. Mitochondria and immunity in chronic fatigue syndrome. ProgNeuropsychopharmacolBiol Psychiatry. 2020 Dec 20;103. doi:10.1016/j.pnpbp.2020.109976 PubMed PMID: 32470498.

[39]. Ramírez-Morales R, Bermúdez-Benítez E, Martínez-Martínez LA, Martínez-Lavín M. Clinical overlap between fibromyalgia and myalgic encephalomyelitis. A systematic review and meta-analysis. Autoimmun Rev. 2022 Aug 1;21(8). doi:10.1016/j.autrev.2022.103129 PubMed PMID: 35690247.

[40]. Berwick RJ, Siew S, Andersson DA, Marshall A, Goebel A. A Systematic Review Into the Influence of Temperature on Fibromyalgia Pain: Meteorological Studies and Quantitative Sensory Testing. J Pain. 2021 May 1;22(5):473–86. doi:10.1016/j.jpain.2020.12.005 PubMed PMID: 33421589.

[41]. Besiroglu MDH, Dursun MDM. The association between fibromyalgia and female sexual dysfunction: a systematic review and meta-analysis of observational studies. Int J Impot Res. 2019 Jul 1;31(4):288–97. doi:10.1038/s41443-018-0098-3 PubMed PMID: 30467351.

[42]. Munipalli B, Chauhan M, Morris AM, Ahmad R, Fatima M, Allman ME, et al. Recognizing and Treating Major Depression in Fibromyalgia: A Narrative Primer for the Non-Psychiatrist. J Prim Care Community Health. 2024 May 16;15. doi:10.1177/21501319241281221 PubMed PMID: 39279389.

[43]. Fitzcharles MA, Perrot S, Häuser W. Comorbid fibromyalgia: A qualitative review of prevalence and importance. European Journal of Pain. 2018 Oct 1;22(9):1565–76. doi:10.1002/ejp.1252 PubMed PMID: 29802812.

[44]. Løge-Hagen JS, Sæle A, Juhl C, Bech P, Stenager E, Mellentin AI. Prevalence of depressive disorder among patients with fibromyalgia: Systematic review and meta-analysis. J Affect Disord. 2019 Feb 15;245:1098–105. doi:10.1016/j.jad.2018.12.001 PubMed PMID: 30699852.

[45]. Zdebik N, Zdebik A, Bogusławska J, Przeździecka-Dołyk J, Turno-Kręcicka A. Fibromyalgia syndrome and the eye—A review. SurvOphthalmol. 2021 Jan 1;66(1):132–7. doi:10.1016/j.survophthal.2020.05.006 PubMed PMID: 32512032.

[46]. Yakkaphan P, Lambru G, Renton T. Impact of migraine and fibromyalgia on temporomandibular disorder: A retrospective study on pain, psychological factors and quality of life. J Oral Rehabil. 2024 May 16;51(10):2029–42. doi:10.1111/joor.13789 PubMed PMID: 38965737.

[47]. HabibiAsgarabad M, SalehiYegaei P, Jafari F, Azami-Aghdash S, Lumley MA. The relationship of alexithymia to pain and other symptoms in fibromyalgia: A systematic review and meta-analysis. European Journal of Pain. 2023 Mar 1;27(3):321–37. doi:10.1002/ejp.2064 PubMed PMID: 36471652.

[48]. Rafferty C, Ward J. Fibromyalgia and increased subjective sensory sensitivity across multiple senses. Perception. 2024 Apr 27;53(4):276–86. doi:10.1177/03010066241234037 PubMed PMID: 38410035.

[49]. Häuser W, Perrot S, Sommer C, Shir Y, Fitzcharles MA. Diagnostic confounders of chronic widespread pain: not always fibromyalgia. Pain Rep. 2017 May 1;2(3). doi:10.1097/PR9.0000000000000598 PubMed PMID: 29392213.

[50]. Doreste A, Pujol J, Penelo E, Pérez V, Blanco-Hinojo L, Martínez-Vilavella G, et al. Personality Assessment Inventory in Fibromyalgia: Links to Functional, Physical-Somatic, and Emotional Impact. Eur J Investig Health Psychol Educ. 2025 Aug 1;15(8):149. doi:10.3390/ejihpe15080149 PubMed PMID: 40863271.