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# INTEGRATIVE AYURVEDA AND PHYSIOTHERAPY INTERVENTIONS FOR CHRONIC MUSCULOSKELETAL PAIN: A COMPREHENSIVE REVIEW

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## ABSTRACT

Chronic musculoskeletal pain is a chronic and disabling condition that is affected by inflammatory, neuroimmune, biomechanical, psychological and functional processes. Symptomatic treatment is frequently used, and more comprehensive, patient-oriented, treatment strategies are required, incorporating both pain mechanisms and long-term functional recovery. This comprehensive review examines the role of integrative Ayurveda and physiotherapy interventions in the management of chronic musculoskeletal pain. The review synthesizes evidence on biomedical and Ayurvedic perspectives of pain, Ayurveda-based interventions such as Panchakarma, Basti, Kati Basti, herbal formulations, yoga, and lifestyle regulation, alongside physiotherapy approaches including therapeutic exercise, pain neuroscience education, postural correction, neuromuscular rehabilitation, electrotherapy, and psychologically informed care. Current evidence suggests that Ayurveda may support systemic regulation, inflammation control, pain relief, and holistic restoration, while physiotherapy provides structured rehabilitation aimed at movement recovery, strength, function, and self-management. Their integration offers a clinically relevant model for chronic low back pain, osteoarthritis, cervical pain syndromes, and inflammatory musculoskeletal disorders. However, the evidence base remains limited by clinical heterogeneity, variable treatment protocols, small-scale studies, and insufficient long-term outcome data. Further studies are needed on standardized, individualized protocols; pragmatic clinical trials; safety monitoring; cost effectiveness; and implementation frameworks involving multiple disciplines. Integrative Ayurveda–physiotherapy care could be a viable approach to enhance pain, function and quality of life, as well as ensure long-term recovery in chronic musculoskeletal pain.

**KEYWORDS:** Chronic musculoskeletal pain, Ayurveda, Physiotherapy, Integrative medicine, Rehabilitation

## 1. INTRODUCTION

Chronic musculoskeletal pain (CMP) is regarded as one of the main causes of disability globally and is a significant public health problem. MSDs are a major cause of YLDs, loss in productivity, poor quality of life, and additional health care costs in both developed and developing countries. Chronic musculoskeletal pain disorders have become more common, and therefore, the need to manage these conditions effectively and sustainably has grown, with the aim of meeting the chronic care needs of patients and decreasing the burden of chronic musculoskeletal pain on society [1]. The management of CMP is also complex as the persistence of pain is the result of a combination of biological, psychological and social factors. Common approaches are drug therapy, physical therapy, lifestyle modification, and rarely interventions. These therapies are useful for symptom relief; however, a lot of patients experience pain, loss of function and repeated episodes of disability even after the therapy. It is evident that nowadays, pain management becomes more complicated and requires taking into account several factors associated with chronic pain rather than its symptoms only [2].

Scientific advances in the field of pain resulted in identification of the mechanisms behind chronic musculoskeletal disorders. Chronic pain is recognized as a complex phenomenon that consists of peripheral and central sensitization, inflammation, altered pathways of pain modulation, and maladaptive behavioral responses. The intricacy of these interactions has made it very difficult to develop interventions that might address physiologic dysfunction and overall health with one treatment, and this has led to chronic pain and functional limitations [3]. More recently, a multidisciplinary/integrative approach has been among the models that has emerged as an important direction to enhance the patient's outcomes in pain management. Modern pain management systems promote interdisciplinary working and have a holistic approach to chronic pain, taking into consideration the physical, psychological and functional dimensions.

This has led to growing interest in such models that have the potential to improve the effectiveness of treatment and facilitate long-term rehabilitation [4].

In complementary and integrative healthcare systems, Ayurveda is at the center of increasing scientific attention for its application in the management of chronic pain. Ayurveda is a traditional medicine and has a holistic approach towards health and disease; it involves multiple non-pharmacological approaches such as manual therapies, herbal preparations, lifestyle changes and marma therapy techniques. More recent studies indicate that these interventions could have effects on pain perception and play a role in symptom reduction via a number of physiological pathways, thus being of interest to current pain management treatment approaches [5].

Physiotherapy continues to play a key role in evidence-based rehabilitation of chronic musculoskeletal diseases. Modern physiotherapy is more than just a prescription of exercise, and encompasses a range of interventions that aim to restore movement, improve physical function, develop self-management strategies and identify and decrease psychosocial factors that contribute to pain. As specialist physiotherapy services become more important, there is a greater focus on holistic rehabilitation relating to individual patient needs [6]. Rehabilitation through exercise has been consistently shown to have positive effects in reducing pain, improving physical performance and enhancing overall well-being in people experiencing chronic musculoskeletal conditions. All this is good evidence for its efficacy, and further evidence of the need for active, therapeutic approaches to encourage recovery and prevent long term disability [7]. Also, it is becoming clear that the person receiving pain care must be treated as a whole person, addressing both physical, emotional and social health, and achieving significant, permanent functional and quality of life benefits in modern pain management [8].

While Ayurveda and physiotherapy are employed as solo treatments for chronic musculoskeletal pain, there is not a lot of evidence that allows for the synthesis of these therapies in a combined form. Existing literature examines these methods separately, and does not study how they can complement and synergize with each other. This detailed review will critically assess current evidence on the role of Ayurveda and physiotherapy interventions in chronic musculoskeletal pain, the underlying mechanism of action and clinical applications, along with the potential of implementing integrative approaches to enhance pain management and functional recovery in chronic musculoskeletal pain.

## 2. REVIEW METHODOLOGY

The literature search and review of this comprehensive review have been carried out using a narrative synthesis method. Articles from peer review publications, systematic review, clinical trials, case reports, narrative review and authoritative institutional documentations regarding pain mechanisms, ayurvedic approach, physiotherapy approach, integrative approach, clinical applications and research gaps were selected. Studies were included if they focused on chronic musculoskeletal pain, low back pain, osteoarthritis, cervical disorders, inflammatory musculoskeletal conditions, rehabilitation, Ayurveda, yoga, Panchakarma, herbal therapies or multidisciplinary pain care. The retrieved evidence was themed and compared with biomedical and Ayurvedic points to conclude on the therapeutic interventions and to identify the clinical relevance.

## 3. Pathophysiological Basis of Chronic Musculoskeletal Pain: Biomedical and Ayurvedic Perspectives

Chronic musculoskeletal pain (CMP) is an intricate condition involving multiple interacting biological mechanisms and persisting beyond the time of normal tissue healing. Current knowledge has evolved beyond the perspective that CMP is a direct result of structural tissue changes, as pain persistence can also be due to changed nociceptive processing, peripheral sensitization, central nervous system changes and dysfunctional pathways of pain modulation. These changes lead to an increased awareness of pain, decreased pain threshold and increased length of disability, even when the tissue is not being damaged [9]. Chronic musculoskeletal pain is believed to be mediated by inflammation. The continued inflammation leads to the release of cytokines, chemokines and other mediators, which sensitize nociceptors and increase the pain signal. Chronic inflammatory states can also have a systemic effect on physiological responses, which has been shown to be interdependent with inflammation and pain, and therefore is an ongoing process that can lead to disease and symptom persistence [10]. Neuroimmune mechanisms that include interactions between neural pathways, glial cells, and immune cells are becoming increasingly associated with the shift from acute to chronic pain. The shift from acute to chronic pain is now being correlated with neuroimmune mechanisms involving interactions between neural pathways, glial cells and immune cells. Neuroinflammation can lead to changes in neuronal excitability and sensitize the central nervous system, leading to the maintenance of chronic pain states. These mechanisms can account for the fact that many patients have chronic pain that is out of proportion to any physical damage that can be seen [11]. There is increasing evidence that links the brain and immune system in chronic pain diseases. Immune mediators can have direct effects on the peripheral nerves and central nervous system structures, and activation of the nervous system can affect inflammatory responses. This reciprocal communication ultimately leads to neurogenic inflammation (chronic pain and functional impairments) and sustained hypersensitivity [12].

Chronic musculoskeletal disorders are defined in Ayurveda in an integrated way, including physiological, functional and systemic abnormalities. Health is regarded as a balance of biological regulatory principles, while disease occurs when there are imbalances. The tissue nourishment, metabolism and physiological homeostasis are often deranged in chronic pain conditions, causing pain, stiffness, decreased mobility and functional capacity [13]. One of the important Ayurvedic principles that is applicable to chronic musculoskeletal ailments is Ama, or the buildup of metabolic waste products in the body that are not properly digested. Ama is thought to block the physiological pathways and to trigger pathological processes which lead to inflammation, pain and tissue dysfunction. Amavata is an example of a musculoskeletal condition with various clinical characteristics that are similar to inflammatory conditions, and from the Ayurvedic point of view, reaffirms the relationship between metabolic imbalance and inflammation in the pathogenesis of chronic pain [14]. In

recent years, there have been some attempts to explain traditional ayurvedic science in light of modern scientific knowledge, and there have been significant conceptual similarities. Both agree that systemicity, inflammation, immune responses and personalized treatments are essential to good health and the management of chronic disease. Through such convergence, integrative strategies that bring together complementary mechanisms of action to deal with the multifactoriality of chronic MSK pain are explored [15].

Chronic musculoskeletal pain is now recognized as a multifactorial process that involves inflammatory, neural, immune and functional processes. The biomedical research points are neuroinflammation, sensitization and neuro-immune dysregulation; and systemic imbalance and metabolic dysfunction are the key Ayurvedic points that contribute to the chronicity of pain. These angles help to give a more complete picture of the mechanisms of the disease and help to establish the need for integrative approaches to pain management and rehabilitation. The major biomedical mechanisms, with its ayurvedic interpretation is summarized as in Table 1.

**Table 1. Biomedical–Ayurvedic Correlates in Chronic Musculoskeletal Pain**

| Biomedical mechanism | Clinical relevance in CMP | Ayurvedic correlate | Integrative interpretation |
|---|---|---|---|
| Peripheral sensitization | Local pain hypersensitivity and tenderness | Vata aggravation | Altered pain signaling and tissue irritability |
| Chronic inflammation | Swelling, stiffness, and pain persistence | Ama and inflammatory pathology | Metabolic and immune dysregulation |
| Central sensitization | Disproportionate pain and widespread sensitivity | Systemic imbalance | Nervous system amplification of pain |
| Neuro-immune interaction | Sustained pain despite tissue healing | Dhatu and srotas dysfunction | Immune–neural crosstalk maintaining chronicity |
| Functional deconditioning | Weakness, disability, fear of movement | Reduced balance and impaired mobility | Physical decline reinforces pain persistence |

**4. Evidence-Based Ayurveda Interventions for Chronic Musculoskeletal Pain**

Ayurveda gives a holistic system of therapy for chronic musculoskeletal pain (CMP) emphasizing individualized therapy according to the nature of the disease, constitution and the causative factors. Based on the present study results, it can be concluded that Ayurveda treatment can reduce the level of pain, improve the functional outcome and enhance quality of life in chronic musculoskeletal disease patients. In chronic pain management set-up, the clinical observations have demonstrated that there are considerable enhancements in the level of pain, range of motion and functioning in everyday life after a structured protocol of ayurvedic treatment, which indicates the potentiality of traditional treatment in chronic pain management settings [16]. In Ayurveda, there are various therapeutic procedures, but parasurgical procedures have been highlighted in regard to pain. The interventions aim to relieve pain, enhance circulation, decrease stiffness, and restore the function of the musculoskeletal system by direct and indirect effects on the involved tissues and systems. The clinical studies have stated favorable results in other musculoskeletal ailments, which indicates that the protocol-based Ayurvedic procedures are useful as complementary treatments for chronic pain and disability [17]. In Ayurvedic medicine, Panchakarma therapies are one of the most distinctive and widely used therapies in musculoskeletal disorders. In the context of Janu Sandhigata Vata (knee osteoarthritis), studies have shown that Panchakarma therapies can be helpful in alleviating pain, improving function, and enhancing joint mobility. It is believed these benefits are due to the purification, physiological balance and metabolic regulation, which are all found to be helpful in both symptoms and underlying disease processes [18].

Basti therapy plays an important role in the treatment of pain, stiffness and decreased mobility that is linked with vata imbalance and is regarded as a prominent cause of these issues. Basti's therapeutic effect is not just on the gastrointestinal system; it also has a systemic therapeutic effect on the regulation of physiological functions relevant to musculoskeletal health. In review of the Vatavyadhi management, Basti therapy might have a significant role in the reduction of chronic pain and improvement of functional outcome in musculoskeletal disorders with degenerative and neurological features [19]. Herbal and nutraceutical treatments are another aspect of pain management that is important in Ayurvedic medicine. Multi-herbal formulations prepared for the treatment of joint disorders have been shown to have anti-inflammatory, chondroprotective and analgesic properties. Clinical trials of herbal nutraceuticals have shown that these have beneficial effects on joint function and symptom severity, suggesting they could be used as complementary therapies for chronic degenerative and inflammatory conditions of the musculoskeletal system [20]. Rasaushadha formulations are also employed in traditional Ayurvedic pharmaceutics and are currently employed to promote musculoskeletal disorders management for better therapeutic efficacy and symptom control. Traditionally, these preparations are used for pain and inflammation, tissue degeneration and functional impairment, especially in chronic and refractory conditions, which are long-term conditions that require chronic management [21].

In Ayuherd, lifestyle and mind–body interventions are often used in conjunction with the therapeutic process in conventional medicine. A randomized controlled trial found greater improvement in pain and functional status for the yoga-based treatment of chronic low back pain with the addition of Kati Basti. This study indicates that using local Ayurvedic treatments in combination with active approaches to rehabilitation may have synergistic clinical effects for patients with chronic musculoskeletal symptoms [22].

Also supported was systematic evidence of the therapeutic use of yoga in Ayurvedic and integrative health care practice. People with chronic musculoskeletal diseases have been seen to experience reduced pain, increased physical functioning,

and enhanced quality of life with the practice of yoga. The findings suggest the importance of using movement-based as well as self-management approaches to manage chronic pain [23]. Dietary and botanical remedies are now an ongoing topic of interest as a means to manage musco of disease. Plant extracts have also been shown to be beneficial in alleviating persistent discomfort in the cervix and back region, which, again, can be attributed to the Ayurvedic principle of using natural ingredients to promote pain alleviation and tissue health via anti-inflammatory and restorative effects [24]. In this regard, the growing body of literature regarding natural remedies also indicates the therapeutic value of medicinal plants and traditional therapies for the treatment of arthritis, osteoarthritis, rheumatoid arthritis and other musculoskeletal diseases [25].

Based on the current available evidence, there are various ways of managing chronic musculoskeletal pain by employing Panchakarma procedures, Basti therapy, herbal formulations, Rasaushadha preparations, yoga, and diet management in Ayurveda. These therapies utilize complementary mechanisms to focus on pain, inflammation, functional impairments and well-being. While additional well-designed clinical trials are necessary, current research backs the incorporation of evidence-based Ayurvedic practices into holistic assessment and treatment for musculoskeletal pain. The main therapeutic approaches of Ayurvedic medicine and their main therapeutic objectives in chronic musculoskeletal pain are described in Fig.1.

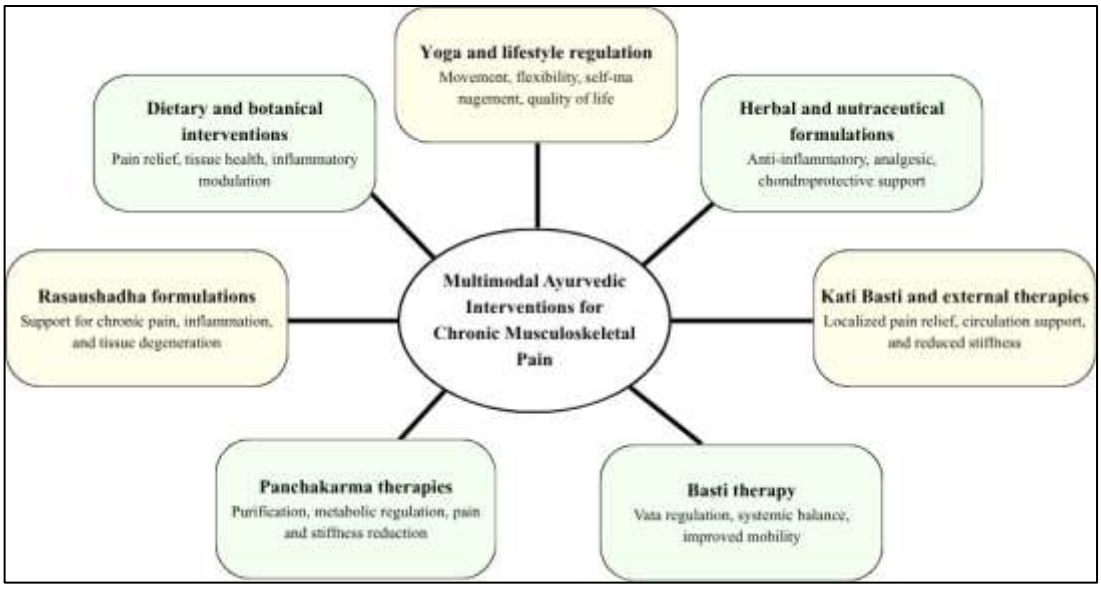


**Figure 1. Multimodal Ayurvedic Interventions for Chronic Musculoskeletal Pain**

**5. Evidence-Based Physiotherapy Interventions for Chronic Musculoskeletal Pain**

Physiotherapy plays a key role in evidence-based practice of chronic musculoskeletal pain (CMP), especially when it comes to reducing pain-related disability, physical dysfunction, deconditioning and decreased participation in daily living. Long-term follow-up data from interdisciplinary pain rehabilitation programs suggest that physiotherapy contributes to long-term physical functioning improvements when part of a comprehensive pain rehabilitation program and when its goals go beyond pain management to functional return and self-management [26]. Of particular relevance to older persons with CMP are multimodal physiotherapy programmes in the context of the presence of pain with mobility loss, frailty, balance problems and co-morbid disease. Randomized controlled trials indicate that rehabilitation exercises combined with other therapeutic elements have positive effects on pain, function and physical performance and underscore the importance of structured, individualized and comprehensive physiotherapy treatment in chronic pain groups [27].

Therapeutic exercise is one of the interventions that are consistently recommended for the treatment of CMP. Exercise is effective in enhancing musculoskeletal capacity, joint mobility, muscle strength, neuromuscular control, metabolic health, and psychological resilience and is effective in reducing fear avoidance and pain-related inactivity. It has been shown to be effective in a variety of chronic musculoskeletal conditions, making it a low-risk, patient-centered and first-line intervention for long-term pain management [28]. The use of pain neuroscience education has grown to be a crucial supplement to physiotherapy, as it has shifted patients' perception of pain from a changeable experience of the nervous system, instead of a direct sign of tissue injury. There is some evidence that PNE may result in a decrease in pain catastrophizing, fear avoidance, and disability, especially when paired with active rehabilitation strategies. This strategy enhances the patient's engagement by correcting maladaptive beliefs that can be a cause of chronic pain and functional limitation [29]. In chronic musculoskeletal problems, postural rehabilitation and/or neuromuscular rehabilitation are also applied, such as in chronic nonspecific neck pain. Global postural reeducation, therapeutic exercises, and other strategies are used to enhance postural control, efficiency, coordination, and disability outcomes. These interventions are a consequence of the increasing focus on biomechanical and neuromuscular assessments in physiotherapy practice, which is done in an individualized way [30].

Adjunctive use of electrotherapy and physical modalities may provide some short-term symptom relief as add-on therapies, but not as primary therapies. Comparative evidence on low back pain indicates that various electrotherapy techniques may be effective in decreasing pain and increasing function, but that their clinical usefulness is best when

combined with an active rehabilitation program, education, and functional restoration. This helps maintain a balance between passive modalities and exercise and behavioral strategies to aid in long-term recovery [31]. Since chronic MS pain is a problem that involves both physical and psychological factors and requires an integrated treatment of both, physical and cognitive-behavioral rehabilitation is frequently necessary. There is systematic evidence that programs that combine physical therapy with components of cognitive-behavioral therapy (CBT) can enhance pain, disability, and psychosocial outcomes. These results highlight the importance of physiotherapy models focusing on more than just impairment at the tissue level, to include movement, confidence, coping behavior and participation [32]. The implementation of evidence-based physiotherapy is still difficult due to the influence of patient beliefs, the provider's training, the organization of physiotherapy services, resources, and the health care context on clinical outcomes. Flexible pathways of care, multi-professional interaction, culturally responsive education and systems to ensure access to and continuity of individualized, sustained rehabilitation for individuals with CMP are essential for effective translation of clinical recommendations [33].

The exercise therapy, education, the use of neuromuscular rehabilitation techniques, adjunctive modalities, and psychologically informed care offer a solid evidence-based base for the management of chronic musculoskeletal pain, which is provided by physiotherapy. It is most useful to restore function, improve self-management and minimize disability, using active, individual and multimodal rehabilitation. Incorporation of Ayurveda could additionally widen the scope of care by integrating patient-centered and holistic therapeutic approaches with functional rehabilitation. The following is a list of core Ayurveda and physiotherapy interventions that are used to manage chronic musculoskeletal pain. In chronic musculoskeletal pain management, core Ayurveda and physiotherapy interventions are listed below in Table 2.

**Table 2. Evidence-Based Ayurveda and Physiotherapy Interventions for CMP**

| Intervention domain | Ayurveda approach | Physiotherapy approach | Primary therapeutic target |
|---|---|---|---|
| Pain modulation | Marma therapy, Kati Basti, Abhyanga | Pain neuroscience education, graded activity | Pain perception and coping |
| Inflammation control | Panchakarma, herbal formulations, Basti | Therapeutic exercise, activity modification | Local and systemic inflammatory burden |
| Mobility restoration | Swedana, external oil therapies | Stretching, joint mobility, and postural correction | Stiffness and restricted movement |
| Functional rehabilitation | Yoga, lifestyle regulation | Strengthening, motor control, and balance training | Daily function and independence |
| Long-term self-management | Diet, routine, Rasayana, yoga | Home exercise, education, behavioral strategies | Recurrence prevention and quality of life |

**6. Integrative Ayurveda–Physiotherapy Models: Mechanisms, Synergies, and Clinical Evidence**

Integrative Ayurveda–physiotherapy models are a new approach that allows for the management of chronic musculoskeletal pain by combining Ayurvedic principles of systemic balance, nourishment of tissues and personalized care with physiotherapy techniques of movement restoration, functional capacity, and self-management. It is clinically significant that chronic musculoskeletal pain typically does not occur from one mechanism alone, but is often a result of a combination of factors, including deconditioning, pain sensitization, inflammation, and psychosocial factors. A combined model may thus represent a more comprehensive therapeutic option than either model alone, but there are still challenges regarding the need for the models to be standardized, the need for collaboration between the professions and the quality of evidence [34]. Based on clinical evidence, it is concluded that both Ayurvedic Panchakarma and conventional physiotherapy can be beneficial in both lines of treatment for the alleviation of pain and functional improvement in chronic low back pain. The interventions of Panchakarma are directed towards metabolic regulation, reduction of stiffness, and recovery of physiological balance, whereas physiotherapy is directed towards exercises, mobility, strengthening, correcting posture and functional recovery. They may be particularly helpful when applied in combination with mechanical-functional impairment and with systemic dysregulatory changes that are correlated with pain [35].

There is also clinical evidence that suggests the feasibility of combining Ayurveda and physiotherapy in musculoskeletal rehabilitation. Acute LAS treatments with a combination of Ayurvedic treatment and physical therapy-based rehabilitation have demonstrated potential in reducing pain, swelling and functional limitation while promoting the recovery of tissue and restoration of mobility. While this evidence is still in its infancy, it shows the potential for incorporating local Ayurvedic treatments with sequential physiotherapy management to support pain control, reduction of inflammation, range of motion, proprioception and return to activity [36]. Increasing focus on central sensitization as a mechanism by which musculoskeletal pain persists also supports the mechanistic basis for integration as a mechanism of persistent musculoskeletal pain, especially in osteoarthritis. Traditional and complementary methods could act via anti-inflammatory, neuromodulatory, mind–body, and lifestyle-mediated mechanisms, and physiotherapy should help diminish the sensitization-related disability through graded activity, education, strengthening, and movement retraining. This peripheral and central targeting complements models that develop in chronic pain phenotypes that do not respond well to tissue-only treatments [37]. In addition, the discussion of inflammatory musculoskeletal diseases like Amavata, which is often associated with rheumatoid arthritis in Ayurvedic literature, is also applicable in this regard. The Ayurvedic and therapeutic yoga may help to alleviate pain, stiffness, increase mobility, and offer systemic regulation, whilst

physiotherapy may help to protect joints, condition muscles, correct posture, improve aerobic capacity and restore functional independence. These models are likely to be more successful when treatments are individualized to sequence, including anti-inflammatory, restorative and rehabilitative therapies and goals, with a coordinated clinical pathway. [38] Integrative Ayurveda–physiotherapy care is a potential multidimensional approach to chronic musculoskeletal pain which integrates systemic regulation, local pain-relieving therapies, movement rehabilitation and patient self-management. There is currently evidence for feasibility and therapeutic potential, but there is a need for high-quality trials, standardization of protocols, safety monitoring and comparative effectiveness studies before definitive clinical recommendations are made. As seen in figure 2, the complementary way in which Ayurveda and physiotherapy can interact in influencing the chronic musculoskeletal pain outcome.

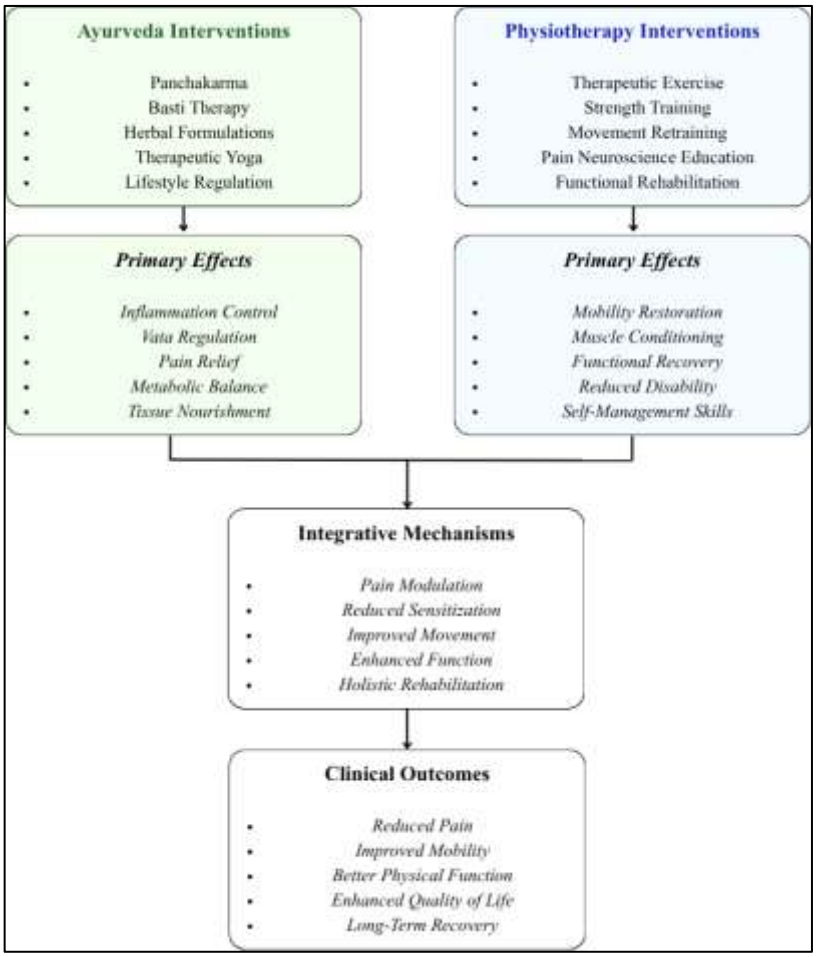


**Figure 2. Integrative Ayurveda–Physiotherapy Model for Chronic Musculoskeletal Pain Management**

**7. Clinical Applications and Practice Frameworks**

In chronic musculoskeletal pain conditions, the most relevant clinical application of integrative Ayurveda physiotherapy care is when the pain persists for a longer period, the patient has a functional limitation or stiffness and has a reduced quality of life. For chronic LBP, there is evidence from hospitals that integrative pain management strategies can improve patient-perceived outcomes, pain intensity and functional ability, as compared to symptom-focused treatment, along with rehabilitation-focused strategies [39]. The other major integrative application that is important is for knee OA, where chronic approaches to pain management, joint mobility, muscle strength and function are frequently needed. Interdisciplinary treatment that incorporates traditional therapeutic concepts and rehabilitative services can be beneficial in decreasing pain, increasing movement tolerances and improving functional independence, especially if treatment is tailored based on symptom level and patient capacity [40]. When stiffness, abnormal posture, pain and movement restriction are present, the coordinated care of cervical pain syndromes and neuromuscular conditions may also be beneficial. In the case of cervical dystonia, there is evidence to suggest that Ayurvedic medicine can help with symptom control and improve function, and physiotherapy can also help by helping to correct posture, improve mobility, strengthen muscles, and help with neuromuscular re-education [41].

The structured framework of practice must have clear roles and competencies, patient assessment processes and referral pathways. A benchmark by the World Health Organization on education for Ayurveda training is the need for standardized education, safe practice, clinical competency, and appropriate integration in health care systems for the establishment of credible models of cooperation among the Ayurveda practitioners and physiotherapists [42]. Safety and acceptability need to be at the heart of clinical implementation. The need for evidence-based practice, quality control of interventions, patient education, adverse-event monitoring, and culturally sensitive care is mentioned in the global discussions about Ayurveda. In the case of combined interventions, screening for contraindications, documenting outcomes, engaging in shared

decision making and coordinating follow-up are all necessary components of an integrative model that can ensure that combined interventions are clinically effective and ethically delivered [43].
Function-oriented, individualized, and monitored, integrative ayurveda–physiotherapy approaches may be clinically helpful in chronic low back pain, knee osteoarthritis, cervical disorders, and other chronic musculoskeletal conditions. The best practice model is the combination of symptom regulation via the Ayurvedic approach, holistic care and movement restoration, self-management and long-term functional rehabilitation by physiotherapy. Table 3 presents a clinical pathway for integrative care for chronic musculoskeletal pain that could be implemented in a clinic setting.

**Table 3. Proposed Integrative Practice Framework for Chronic Musculoskeletal Pain**

| Care phase | Clinical focus | Ayurveda contribution | Physiotherapy contribution | Expected outcome |
|---|---|---|---|---|
| Initial assessment | Pain type, function, chronicity | Prakriti, dosha, ama, disease stage assessment | Functional testing, mobility, strength, and disability screening | Individualized care plan |
| Symptom regulation | Pain, stiffness, inflammation | Panchakarma, Basti, Kati Basti, herbal support | Education, gentle mobility, adjunct modalities | Reduced pain and irritability |
| Functional restoration | Movement and capacity building | Yoga, lifestyle correction, supportive therapies | Exercise progression, strengthening, motor control | Improved function and confidence |
| Self-management | Long-term disease control | Diet, daily routine, Rasayana, mind–body care | Home program, pacing, relapse prevention | Sustained recovery |
| Monitoring and referral | Safety and outcomes | Adverse-event monitoring, treatment modification | Outcome tracking, escalation when needed | Safe, coordinated care |

## 8. Research Gaps, Methodological Challenges, and Future Directions

The body of evidence for traditional medicine interventions in chronic musculoskeletal pain is growing, but with a mix of quality, breadth and generalizability of the research. Many studies, although promising for the therapeutic potential for chronic joint pain for Ayurvedic and other traditional formulations, lack adequate sample size, duration of follow-up, blinding, or reporting of the standardization of intervention. These restrictions make it hard to assess comparative effectiveness, dose–response relationships, long-term safety, and applicability across a variety of musculoskeletal pain conditions [44]. One of the other challenges is the variability in clinical practice of Ayurveda. The strength of Ayurveda is individualized diagnosis and treatment; however, it also makes it difficult to make it reproducible, design trials and develop guidelines. There are few widely accepted clinical practice guidelines for many musculoskeletal conditions, which reduces consistency and uniformity in the selection of interventions, reporting of outcomes, practitioner training, and linking with rehabilitation services. Therefore, guidelines based on evidence and tailored to the specific disease are needed to enhance clinical reliability and the comparability of research [45].
Practical multicenter trials, standardized but flexible treatment schedules, validated patient-reported outcome measures, long-term follow-up and safety monitoring are areas where further research should be focused. The cost-effectiveness of integrative Ayurveda–physiotherapy care, the feasibility of its implementation, models of interdisciplinary training and its global scalability are also in need of evaluation. An evidence-based wellness and integrative health service may provide more opportunities for the public health and the economy, though this will demand improvements in research infrastructure, regulation, quality assurance and internationally acceptable clinical evidence [46]. The main goal is to shift from small-scale, isolated studies to well-designed, repeatable and clinically viable research models. New integrative Ayurveda–physiotherapy schemes need to maintain individuality without compromising on standardization, safety, and outcomes. This balance is critical if credible evidence is to be built and the use of this knowledge is to be expanded to the clinical setting.

## 9. CONCLUSION

Chronic musculoskeletal pain must be managed in addition to functional limitation, inflammation, sensitization and long-term self-management, which are several mechanisms that underlie chronic musculoskeletal pain. In the present review, the complementary benefits of Ayurveda and physiotherapy towards chronic musculoskeletal pain care have been highlighted. Although Ayurveda provides a customized, whole-person care and a science of systemic regulation, pain, inflammation and balance, physiotherapy provides a science-based approach to rehabilitation, through exercise, education and movement retraining, functional restoration and a psychologically informed approach. The systems can be coupled and serve as a clinically relevant model of chronic low back pain, osteoarthritis, cervical pain syndromes and inflammatory musculoskeletal disorders. A combination of these interventions may have better results by addressing the bio-functional aspects of chronic pain. At present, there is evidence to support the therapeutic potential and feasibility of incorporating Ayurveda and physiotherapy, but it is necessary to have more studies with larger patient cohorts, standardized procedures, safety monitoring and reproducible outcome measures to enable greater implementation. An integrative patient-centered approach that adheres to the principles of Ayurveda, utilizes a holistic approach to treatment and reinforces the

physiotherapy approach to rehabilitation could be a viable, practical approach for enhancing long-term outcomes, quality of life and functional ability in chronic musculoskeletal pain.

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