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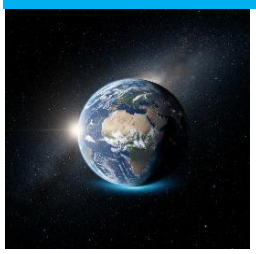

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Synergistic role of anti-inflammatory diet and physical activity in modulating chronic pain syndromes – a narrative review

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Abstract
Background: Chronic pain (CP) affects approximately 20–30% of the adult population and is associated with a substantial reduction in quality of life and high economic costs. In the ICD-11 classification, CP has been recognized as a disease entity rather than merely a symptom of other disorders. Growing evidence suggests that low-grade systemic inflammation and central sensitization are key mechanisms in the pathophysiology of CP. Lifestyle modification – in particular implementation of an anti-inflammatory dietary pattern and regular physical activity

– may modulate inflammatory and neurobiological processes underlying chronic pain syndromes.
Aim: To present the current state of knowledge on the role of anti-inflammatory diet and physical activity in the modulation of chronic pain syndromes, with particular emphasis on clinical trials and systematic reviews indexed in PubMed.
Material and methods: A narrative literature review was performed using PubMed, Web of Science and Google Scholar up to November 2025. The following keywords were used in various combinations: chronic pain, non-cancer chronic pain, diet, anti-inflammatory diet, Mediterranean diet, dietary inflammatory index, neuropathic pain, fibromyalgia, chronic low back pain, osteoarthritis, physical activity, exercise therapy, lifestyle intervention. Priority was given to randomized trials, cohort studies, systematic reviews, meta-analyses and narrative reviews focused on the impact of diet and/or physical activity on pain intensity, inflammatory markers and quality of life in adults.
Results: Systematic reviews indicate that improving diet quality towards an anti- inflammatory pattern – rich in vegetables, fruit, whole grains, plant-based sources of protein and omega-3 fatty acids – is associated with reductions in low-grade inflammation and with moderate improvements in pain symptoms and quality of life in patients with non-cancer chronic pain, including rheumatic pain, osteoarthritis and low back pain. The use of indices such as the Dietary Inflammatory Index (DII) allows a quantitative assessment of the inflammatory potential of the diet; high (pro-inflammatory) DII scores correlate with greater systemic inflammation, higher risk of chronic disease and poorer health status. At the same time, numerous meta-analyses confirm the beneficial effects of various forms of physical activity (aerobic, resistance, motor control- based exercises, walking, aquatic exercise) on pain intensity, physical function and quality of life in patients with chronic low back pain and fibromyalgia. Programs that combine dietary interventions with physical exercise and patient education appear particularly promising.
Conclusions: Available evidence indicates that both an anti-inflammatory diet and regular physical activity constitute important, mutually complementary components of non-pharmacological management of chronic pain syndromes. However, further well-designed randomized controlled trials are needed to evaluate integrated lifestyle-modification programs that take into account different pain phenotypes (nociceptive, neuropathic, nociplastic) as well as psychosocial factors.

Keywords: chronic pain; anti-inflammatory diet; mediterranean diet; physical activity; fibromyalgia; low back pain; Dietary Inflammatory Index.

1. Introduction

Chronic pain is most commonly defined as pain persisting for at least three months or recurring over time. In the latest IASP/ICD-11 classification, primary and secondary chronic pain are distinguished, emphasizing its status as an independent disease entity [1]. Chronic pain impairs physical, social and emotional functioning and contributes to depression, anxiety, sleep disturbances and work absenteeism. It is estimated that

various forms of chronic pain—including low back pain, osteoarthritis, fibromyalgia and neuropathic pain— affect up to 20–30% of the adult population [1,5].

Contemporary models conceptualize chronic pain as a complex phenomenon arising from the interaction of biological factors (peripheral and central sensitization, neuroinflammation, dysfunction of the hypothalamic–pituitary–adrenal axis), psychological factors (catastrophizing, activity avoidance, depression, anxiety) and social factors (stress, social support, working conditions) [2–4]. In many chronic pain syndromes (e.g., fibromyalgia, chronic low back pain, chronic pelvic pain), central sensitization—defined as a persistent hyperexcitability of pain-processing structures within the central nervous system—plays a key role [2–4].

At the same time, increasing attention is being drawn to the role of chronic low-grade inflammation and dysregulation of immunometabolic responses as common denominators across numerous chronic diseases—from cardiometabolic conditions to chronic pain syndromes [20–22,30]. Diet and physical activity are among the most important modifiable environmental factors influencing inflammatory processes, oxidative stress, gut microbiota and neuroplasticity, and thus pain perception [5,14–18,20–22]. Integrated lifestyle interventions—within the framework of so-called "precision pain medicine"—are therefore gaining increasing recognition [3,17].

2. Aim of the study

The aims of this review are to:

Discuss the pathophysiological foundations of chronic pain, with particular emphasis on the role of inflammation and central sensitization.

Present the concept of an "anti-inflammatory diet" and quantitative tools such as the Dietary Inflammatory Index (DII).

Summarize clinical evidence regarding the effects of an anti-inflammatory diet on chronic pain intensity and quality of life.

Review data on the effects of physical activity in chronic pain syndromes (including low back pain, fibromyalgia and osteoarthritis).

Discuss the potential synergy between dietary interventions and physical activity, as well as practical implications for health education and physiotherapy.

3. Materials and Methods

This narrative review was based on a literature search in PubMed (MEDLINE), Web of Science and, secondarily, Google Scholar up to November 2025. The following search terms were used in different combinations: chronic pain, non-cancer chronic pain, diet, anti- inflammatory diet, Mediterranean diet, dietary inflammatory index, neuropathic pain, fibromyalgia, chronic low back pain, osteoarthritis, physical activity, exercise therapy, lifestyle intervention. The search was limited to human studies and articles published in English.

Inclusion criteria were as follows: (1) randomized controlled trials, cohort studies, systematic reviews, meta-analyses or narrative reviews; (2) adult populations with chronic non-cancer pain; (3) interventions or exposures related to dietary patterns, specific anti- inflammatory dietary strategies and/or physical activity or exercise therapy; (4) clearly defined pain-related outcomes (pain intensity, pain sensitivity, functional status) and/or biomarkers of inflammation and quality of life. Priority was given to large systematic reviews and meta-analyses on exercise therapy in CP [6–8,10–13,29] and on dietary patterns/anti-inflammatory diets and DII [14–16,19–22,23–27].

Given its narrative design, this review does not meet the formal criteria of a systematic review (no registered protocol, no duplicate independent screening and risk-of-bias assessment). Nevertheless, it aims to provide an integrative synthesis of the most important findings of the last decade.

4. Pathophysiology of Chronic Pain: Central Sensitization and Low-Grade Inflammation

Central sensitization

Central sensitization (CS) refers to a long-lasting increase in the excitability of neurons within the central nervous system, leading to an exaggerated pain response (hyperalgesia) and the perception of pain in response to normally non-painful stimuli (allodynia) [2–4]. The key mechanisms underlying CS include:

enhanced glutamatergic transmission (NMDA receptor involvement),

reduced activity of inhibitory systems (GABA, glycine) within the dorsal horn,

the "wind-up" phenomenon—a progressively increasing response of dorsal horn neurons to repeated C-fiber stimulation,

neuroinflammation involving glial cell activation and the release of pro-inflammatory cytokines (IL-1β, IL-6, TNF-α),

long-term transcriptional and epigenetic alterations in neurons and glial cells [2–4].

CS is particularly prevalent in pain syndromes such as fibromyalgia, chronic pelvic pain, migraine and irritable bowel syndrome [2–4]. Review articles emphasize that recognizing the presence of CS is crucial for selecting appropriate non-pharmacological interventions, including education, cognitive-behavioral therapy, activation strategies and physical activity [3,4].

Low-grade systemic inflammation

Chronic pain is associated with a systemic, low-grade inflammatory state. Elevated concentrations of C-reactive protein (CRP), IL-6 and TNF-α are observed not only in traditionally inflammatory conditions (e.g., rheumatoid arthritis), but also in osteoarthritis, low back pain and fibromyalgia [20–22,30,31].

Diet, visceral adiposity, physical inactivity, sleep disturbances, stress and other lifestyle factors modulate the activity of the hypothalamic–pituitary–adrenal axis and the release of pro-inflammatory cytokines. Viewing chronic pain as a systemic disorder underscores the importance of whole-person interventions, including nutritional and physical-activity-based strategies [5,14–18,20–22].

5. Anti-inflammatory Diet: Concepts, Indices and Mechanisms

Concept of an anti-inflammatory diet

There is no single, officially defined "anti-inflammatory diet". In the literature, dietary patterns with documented anti-inflammatory properties most commonly include:

the Mediterranean diet (MD) – rich in vegetables, fruit, whole grains, legumes, nuts, olive oil and fish, with limited consumption of red and highly processed meat and added sugars;

plant-based or minimally processed dietary patterns, typically lower in saturated fats and added sugars;

diets high in antioxidants and omega-3 fatty acids (e.g., modified low-carbohydrate diets with a high intake of vegetables, fish and olive oil) [14–16,19–22,28].

Meta-analyses indicate that MD and related dietary patterns lead to significant reductions in CRP, IL-6, IL-1β and other inflammatory markers, as well as improvements in metabolic parameters such as lipid profile, blood pressure and insulin resistance [20–22,30].

Conversely, diets high in ultra-processed foods, trans fats, excessive simple sugars and red meat promote increased inflammatory activity [20–22].

Dietary Inflammatory Index (DII) and related indices

The Dietary Inflammatory Index (DII) was developed on the basis of a systematic review of the literature assessing the effects of 45 nutrients and food components on inflammatory markers (IL-1β, IL-4, IL-6, IL-10, TNF-α, CRP) [23]. The DII score is calculated using dietary intake data (from food records, FFQs or nutrition databases), which are standardized against global reference values and then weighted according to whether a given component exerts a pro- or anti-inflammatory effect and the magnitude of that effect. A negative DII score is considered anti-inflammatory, whereas a positive score reflects a pro-inflammatory dietary pattern [23–25].

The DII has been validated in numerous observational studies, where higher, pro-inflammatory scores were associated with increased concentrations of CRP, IL-6 and TNF-α, as well as a higher risk of cardiometabolic diseases [24–27]. In the SUN and PREDIMED cohorts, higher pro-inflammatory DII values were linked to an increased incidence of cardiovascular events [26,27].

Although relatively few studies have examined the direct relationship between DII and chronic pain syndromes, review articles suggest that individuals with chronic pain tend to consume diets of lower quality and higher inflammatory potential [14–16]. This may translate into increased pain sensitivity and a higher risk of comorbid conditions.

Potential mechanisms of pain modulation by diet

The potential mechanisms through which diet may modulate chronic pain include:

Modulation of low-grade inflammation – increased intake of vegetables, fruit, fiber, polyunsaturated fatty acids and polyphenols leads to reductions in CRP, IL-6 and TNF-α levels and to improvements in lipid profile [20–22,30].

Reduction of oxidative stress – antioxidants (vitamins C and E, carotenoids, polyphenols) neutralize free radicals, thereby reducing tissue damage and the activation of pain pathways [20–22].

Influence on gut microbiota – diets rich in fiber and plant-based foods promote the production of short-chain fatty acids (SCFAs), which modulate immune responses and may reduce inflammatory activity [14–16,20].

Effects on body weight and visceral adiposity – weight reduction decreases mechanical load on joints and lowers the secretion of pro-inflammatory adipokines (e.g., leptin, resistin), which is particularly relevant in osteoarthritis [19,21,31].

Effects on the HPA axis and neurotransmission – components such as omega-3 fatty acids, vitamin D and magnesium may influence neuroplasticity, cortisol levels and the expression of serotonergic and dopaminergic receptors, thereby indirectly

affecting pain perception and mood [14–16,30–32].

6. Evidence on Anti-inflammatory Diet and Chronic Pain

Brain et al. conducted an extensive review of diet in chronic non-cancer pain, encompassing dozens of interventional and observational studies [14]. The authors concluded that higher diet quality, approximating a Mediterranean pattern, is associated with lower chronic pain intensity and better quality of life.

Xu Lou et al., in a systematic review addressing nutritional aspects of chronic pain, highlighted the importance of consuming vegetables, fruit, whole grains and omega-3 fatty acids, as well as reducing simple sugars, in modulating pain and co-occurring symptoms such as fatigue and depression [15].

Elma et al., in a narrative review, emphasized that high diet quality and an anti-inflammatory nutrient profile are beneficial in chronic pain, whereas diets high in added sugars, trans fats, red meat and ultra-processed foods contribute to worsening pain symptoms [16]. Reviews by Nijs and Reis and by Lahousse et al. point out that diet constitutes one of the key lifestyle determinants influencing the course of chronic pain, including pain in cancer survivors [17,18].

Reviews concerning adherence to the Mediterranean diet and health-related quality of life (including the work of Mantzorou et al.) confirm that the closer one's eating habits align with Mediterranean diet principles, the better the quality of life observed across various clinical populations, including those with musculoskeletal disorders [19,28].

Osteoarthritis and low back pain

In osteoarthritis, the Mediterranean diet and related dietary patterns have been shown to improve both metabolic parameters and pain symptoms. Analyses from the Osteoarthritis Initiative indicate that higher adherence to the Mediterranean diet is associated with less knee pain and improved joint function [19].

Although data regarding low back pain are limited, reviews suggest that patients with chronic low back pain tend to consume lower-quality diets with higher pro-

inflammatory potential compared with healthy individuals [14–16]. This may indirectly exacerbate pain perception by promoting systemic inflammation and visceral obesity.

Inflammatory rheumatic diseases and nociplastic pain

In rheumatoid arthritis (RA), both inflammatory processes and environmental factors play a key role. The review by Raad et al. suggests that diets rich in omega-3 fatty acids, antioxidants and Mediterranean-style foods—often combined with omega-3 supplementation—may reduce disease activity and pain intensity, although isolating the effect of diet from concurrent pharmacotherapy remains challenging [31].

Emerging evidence also suggests that diet may play a role in nociplastic pain conditions such as fibromyalgia. Although research in this field remains limited, improvements in pain, fatigue and sleep quality have been reported following plant-based diets, Mediterranean- style diets and vitamin D supplementation [14–16,32]. The meta-analysis by Lombardo et al. indicates that vitamin D supplementation may provide benefits in chronic musculoskeletal pain, including in some patients with fibromyalgia, particularly when baseline deficiency is present [32].

Table 1. Key clinical evidence on dietary interventions and chronic non-cancer pain

Author (year)	**Population / condition**	**Intervention (diet)**	**Duration**	**Main findings – pain outcomes**
Brain et al. (2021)	Adults with chronic non-cancer pain	Higher diet quality / Mediterranean-style patterns	Varied (weeks–years)	Better diet quality consistently associated with

				lower pain and better QoL.
Lou et al. (2022)	Adults with chronic non-cancer pain	Mediterranean-style diets, hypocaloric diets, improved diet quality	6–24 weeks	Anti-inflammatory patterns linked to reduced pain and fatigue; single-food interventions inconsistent.
Elma et al. (2022)	Adults with chronic pain	Anti-inflammatory vs. Western diet (review)	N/A	High diet quality associated with lower pain; Western diet worsens symptoms.
Veronese et al. (2016)	OA participants (Osteoarthritis Initiative)	Mediterranean diet adherence (observational)	Years	Higher adherence associated with less knee pain and better function.
Raad et al. (2021)	Rheumatoid arthritis	Mediterranean, vegan/vegetarian, omega-3 rich diets	6–24 weeks	Reductions in joint pain and stiffness; benefits often adjunctive to pharmacotherapy.

Lombardo et al. (2022)	Fibromyalgia & chronic musculoskeletal pain	Vitamin D supplementation	8–24 weeks	Supplementation reduces pain in individuals with deficiency.

Limitations of dietary studies

It is important to emphasize several limitations inherent to nutritional research:

heterogeneity of interventions (different definitions of an "anti-inflammatory diet" and various methods of assessing dietary intake),

small sample sizes and short intervention durations (often 8–12 weeks),

difficulties in maintaining high adherence to dietary protocols,

concurrent changes in body weight, physical activity and other health behaviors,

the subjective nature of many pain and quality-of-life measures.

Despite these limitations, the overall consistency of findings and the documented impact of dietary interventions on inflammatory markers support the inclusion of nutritional strategies as part of comprehensive chronic pain management [14–16,19–22,31,32].

7. Physical Activity and Chronic Pain

Mechanisms of analgesic effects of physical activity

Physical activity and therapeutic exercise influence chronic pain through multiple mechanisms:

Anti-inflammatory effects – regular moderate-intensity physical activity lowers CRP and IL-6 concentrations and increases anti-inflammatory IL-10, partly through reductions in adipose tissue and increased release of myokines (e.g., IL-6 acting in an anti-inflammatory manner in the acute context) [5,20,30].

Modulation of central sensitization – aerobic and resistance exercise may reduce the excitability of pain-processing structures in the CNS, enhance descending inhibitory pathways and raise pain thresholds [2,3,5].

Improvement of musculoskeletal function – strengthening muscles and enhancing motor control and tissue flexibility reduce the mechanical load on painful structures (e.g., the lumbar spine, knee joints) [6–9].

Neuropsychological effects – physical activity improves mood, reduces depressive and anxiety symptoms and enhances self-efficacy in managing pain [5,10–13].

Chronic low back pain

The Cochrane review by Hayden et al., which included numerous clinical trials, found that exercise is likely effective in treating chronic low back pain compared with no treatment, usual care or placebo, leading to a significant reduction in pain intensity and a small improvement in function [6].

More recent research, including the systematic review and network meta-analysis by Li et al., indicates that motor control exercises, Pilates, yoga and aerobic training appear to be among the most promising approaches in chronic low back pain, although differences in effectiveness between specific exercise types are relatively small [7]. The meta-analysis by Sitthipornvorakul et al. demonstrated that walking-based interventions (e.g., moderate- intensity walking) can reduce pain and disability in patients with chronic low back pain, providing a simple and low-cost alternative to more complex exercise programs [8].

Reviews by Chou and Huffman and other guideline-oriented publications further emphasize that non-pharmacological interventions—including exercise, education and manual therapy—should be considered first-line treatments for chronic low back pain [5,6,29].

Fibromyalgia

In fibromyalgia, numerous meta-analyses confirm the beneficial effects of aerobic, resistance and combined exercise programs on pain, fatigue, sleep quality and physical functioning [10–13].

The meta-analysis by Häuser et al. shows that aerobic exercise performed 2–3 times per week for at least four weeks leads to significant pain reduction and improved quality of life [10]. A large systematic review and meta-analysis by Couto et al. showed that various exercise modalities, including aerobic, resistance, stretching, mind–body and multicomponent programs, all produce clinically relevant improvements in pain, fatigue and health-related quality of life in adults with fibromyalgia [11].

A recent meta-analysis by Niu et al. focusing on exercise dosage found that moderate-intensity exercise performed approximately two to three times per week for 30–60 minutes over at least 12 weeks was associated with the most consistent improvements in pain and function in fibromyalgia [12]. A more recent meta-analysis by Rodríguez-Almagro et al. suggests that the optimal aerobic exercise dose for individuals with fibromyalgia is 2–3 sessions per week, lasting 30–40 minutes at 60–70% of maximal heart rate, with higher volumes not necessarily producing greater benefits [13].

Other chronic pain conditions

Systematic reviews and clinical guidelines also highlight the beneficial effects of physical activity in chronic neck and shoulder pain, knee and hip osteoarthritis and chronic pelvic pain [5,6,19,29]. Programs incorporating both aerobic and resistance training, along with patient education, seem to be the most effective in the long term [5,6,10–12,29].

Barriers and facilitators to physical activity in chronic pain

Despite robust evidence for exercise efficacy, many individuals with CP remain insufficiently active. Narrative reviews report numerous barriers, including fear of pain exacerbation, low confidence in exercise benefits, low motivation, limited social support and environmental constraints (e.g. lack of safe spaces for activity) [5,29].

Ambrose and Golightly emphasize that effective exercise interventions must address not only physical impairments but also patients' beliefs, expectations and concerns, incorporating graded exposure to activity and pain neuroscience education [5].

Table 2. Key clinical evidence on exercise therapy in chronic pain syndromes

Author (year)	**Population / condition**	**Intervention (physical activity)**	**Duration**	**Main findings – pain outcomes**
Ambrose & Golightly (2015)	Adults with chronic pain	Aerobic, resistance, mixed programs (review)	Varied	Exercise reduces pain and disability; requires gradual progression.
Hayden et al. (2021)	Chronic low back pain	Exercise therapy (aerobic, strengthening, stabilisation)	6–12 weeks	Moderate-certainty evidence for pain reduction vs. usual care.
Li et al. (2023)	Chronic low back pain	Motor control, Pilates, yoga, aerobic (network meta-analysis)	6–12 weeks	Most modalities reduce pain; motor control often shows strongest effects.

Sitthipornvorakul et al. (2018)	Chronic low back pain	Walking-based interventions	6–12 weeks	Walking as effective as other non-pharmacological therapies.
Häuser et al. (2010)	Fibromyalgia	Aerobic exercise 2–3x/week	≥4 weeks (commonly 6–12)	Significant reductions in pain and improved wellbeing.
Couto et al. (2022)	Fibromyalgia	Aerobic, resistance, stretching, combined programs	8–24 weeks	Aerobic & resistance training reduce pain; stretching mainly improves QoL.
Rodríguez-Almagro et al. (2023)	Fibromyalgia	Dose–response analysis of exercise volume	Optimal: 2–3 sessions/week, 30–40 min	Moderate-intensity exercise best for pain reduction; higher volumes not superior.

8. Synergy Between Anti-inflammatory Diet and Physical Activity

In clinical practice, diet and physical activity rarely act in isolation: individuals who improve their diet quality often increase their physical activity and vice versa. Several reviews and observational studies suggest that combined lifestyle strategies may provide greater benefits than either intervention alone [14–18]. Brain et al. and Elma et al. argue that comprehensive lifestyle programs integrating education, dietary

counselling and graded exercise are more likely to produce sustained improvements in pain, function and quality of life than single-modality interventions [14,16]. Nijs and Reis propose a "lifestyle-based precision pain medicine" framework in which dietary and exercise prescriptions are tailored to pain phenotype, CS, and concomitant metabolic and psychological comorbidities [3,17].

From a mechanistic perspective, the synergy between diet and physical activity is plausible:

anti-inflammatory diets reduce systemic inflammation and oxidative stress, creating a favorable milieu for exercise-induced adaptations;

physical activity improves insulin sensitivity, lipid profile and body composition, reducing mechanical load and inflammatory adipokine secretion;

both interventions positively influence gut microbiota, gut–brain axis signaling, stress regulation and mood [5,14–18,20–22,30–32].

9. Practical Implications for Education and Rehabilitation

Dietary recommendations for patients with chronic pain

Based on current evidence, the following practical dietary recommendations can be suggested for adults with CP:

Shift towards a Mediterranean-style pattern

- at least five servings of vegetables and fruit per day, including green leafy vegetables and berries;
- whole-grain products as the main carbohydrate sources;
- 2–3 servings of legumes per week;
- regular intake of nuts and seeds;
- fish, particularly oily fish, 1–2 times per week;
- olive oil as the principal added fat;

limited intake of red and processed meat, processed foods, sugar-sweetened beverages and sweets [19–22,28,31].

Reduce pro-inflammatory dietary components:

avoid trans fats and minimize saturated fat from processed foods;

limit added sugars and refined grains;

moderate alcohol consumption, if any [20–27].

Aim for healthy body weight:

gradual weight loss in overweight and obese individuals, particularly reduction of visceral adiposity, may reduce joint load and adipokine-driven inflammation [19,21,31].

Individualize nutritional counselling:

consider patient preferences, cultural context, comorbidities (e.g. diabetes, celiac disease, chronic kidney disease) and socioeconomic conditions;

interdisciplinary collaboration between physicians, physiotherapists and dietitians is recommended [14–18,31,32].

Physical activity recommendations for patients with chronic pain

General physical activity recommendations for adults with CP can be adapted as follows:

Aerobic activity:

aim for at least 150–300 minutes per week of moderate-intensity aerobic activity (e.g. brisk walking, cycling, swimming), distributed over several sessions;

in conditions such as fibromyalgia, it is often necessary to start with shorter, more frequent bouts (e.g. 10–15 minutes) and gradually increase duration [5–

8,10–13].

Resistance training:

perform resistance exercises 2–3 times per week targeting major muscle groups, at low- to-moderate intensity;

focus on trunk stabilizers and pelvic/shoulder girdle muscles in low back pain and osteoarthritis [5–8,10–13].

Motor control and proprioceptive training:

incorporate Pilates, yoga or functional exercises based on everyday movement patterns, especially in spinal and peripheral joint pain [7,9].

Graded activity:

avoid abrupt increases in volume or intensity that may provoke symptom flares;

use graded exposure and pacing strategies, adjusting the progression according to symptom response [5–8,29].

Integrate physical activity into daily life:

promote active transport (walking, cycling), regular breaks from prolonged sitting, and active leisure time;

this is particularly important for individuals with limited access to structured rehabilitation programs [5,8,29].

10. Limitations of This Review

This review has several limitations. It is a narrative, not a systematic, review and therefore does not include a registered protocol, duplicate independent screening or formal risk-of- bias assessment. Most available studies address specific diagnostic entities (e.g. rheumatoid arthritis, osteoarthritis, fibromyalgia), limiting generalizability to other pain syndromes.

Data on strictly defined "anti-inflammatory diets" in CP are still scarce; many studies focus on overall diet quality or MD adherence. It is also difficult to isolate the effects of diet from those of weight loss, increased PA, improved sleep and other concomitant lifestyle changes.

11. Conclusions

Chronic pain syndromes are closely linked to low-grade systemic inflammation and central sensitization. Lifestyle factors, particularly diet and PA, play crucial roles in modulating these processes [1–5,14–18,20–22].

Evidence from reviews and meta-analyses suggests that anti-inflammatory dietary patterns, especially those resembling the Mediterranean diet, reduce inflammatory markers, improve metabolic parameters and are associated with modest reductions in pain and improved quality of life across various conditions [14–16,19–22,28,31,32].

Indices such as the Dietary Inflammatory Index provide quantitative estimates of the inflammatory potential of diets and are associated with systemic inflammation and risk of chronic diseases. People with CP often exhibit more pro-inflammatory dietary profiles [20– 27].

Physical activity is one of the most evidence-based non-pharmacological interventions for CP. Aerobic, resistance, motor control-based and combined exercise programs reduce pain and improve function in chronic low back pain, fibromyalgia and other pain syndromes [5–13,29].

The best clinical outcomes are likely achieved by combining dietary modification (towards an anti-inflammatory pattern) with structured physical activity and education on pain mechanisms, while addressing patient-specific barriers, motivations and preferences [5,14–18,29–32].

High-quality randomized controlled trials are needed to evaluate integrated lifestyle interventions tailored to different pain phenotypes (nociceptive, neuropathic, nociplastic) and to assess the long-term sustainability of benefits.

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Author Contributions

Conceptualization, M.P and D.S.; methodology, M.P.; validation, D.S., A.H.; formal analysis, M.P., F.B.; investigation, H.R.; resources, M.P., D.S. and O.P.; data curation, K.O., F.B.; writing-original draft preparation, O.P.; writing-review and editing, M.P., N.N. and A.H.; visualization, K.O., H.R.; supervision, M.P., I.M. and N.N.; project administration, M.P., I.M. All authors have read and agreed to the published version of the manuscript .

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Informed Consent Statement

Not applicable.

Data Availability Statement

No new data were created or analyzed in this study. Data sharing is not applicable to this article.

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Conflicts of Interest

The authors declare no conflict of interest.

Declaration of the Use of Generative AI and AI-Assisted Technologies in the Writing Process

During the preparation of this manuscript, the author used ChatGPT (OpenAI) to assist in drafting and language editing of the text and streamline the organization of some sections. After using this tool, the author thoroughly reviewed and edited the content and takes full responsibility for the substantive content of the publication.

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