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Chronic Low Back Pain: Investigating the Influence of Lifestyle and Physical Activity on Factors that Exacerbate or Enhance Patient Outcomes

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Abstract

Introduction and Purpose:

Low back pain (LBP) is a widespread condition and often leading to chronic low back pain (CLBP) in many cases. Although physical activity has shown significant benefits in reducing pain and improving functionality, additional elements such as mental health and social factors may play an essential role in CLBP management. This review examines the influence of

lifestyle modifications on CLBP management, with the aim of providing evidence-based recommendations for clinical practice.

Material and Methods:
This review was conducted through an extensive search of peer-reviewed literature in PubMed, focusing on studies published from 2020 to 2024. The search included terms like "chronic low back pain,", "lifestyle," "exercise," and others. Studies were included if they evaluated the effects of physical activity and lifestyle interventions on pain relief and functional outcomes in LBP patients.

Results:
The results indicate that exercise treatment is more effective compared to no treatment, usual care, or placebo, particularly in reducing pain intensity. Lifestyle modifications, such as improving sleep quality, adopting healthy dietary habits and managing obesity, may further enhance patient outcomes by addressing additional factors contributing to the complexity of CLBP.

Conclusions:
Exercise appears to be moderately effective in managing chronic low back pain compared to no treatment, usual care, or placebo. These findings suggest that while exercise can be beneficial, its overall impact may vary depending on the treatment context. The integration of lifestyle factors such as mental health support, addressing sleep disturbances, promoting healthy dietary habits, and managing obesity could significantly enhance the overall effectiveness of CLBP management. Cannabinoids show potential as an alternative or adjunct treatment for CLBP. Physiotherapy interventions support an active lifestyle and enhance physical function in patients.

Keywords: low back pain, chronic low back pain, physical activity, insomnia, dietary habits, obesity, overweight

Introduction

Low back pain (LBP) is a prevalent condition, affecting up to 84% of individuals during their lifetime, with 23% progressing to chronic low back pain (CLBP) [1]. CLBP, defined as pain persisting for more than 12 weeks, is a leading cause of disability worldwide and imposes a significant burden on healthcare systems and economies due to high treatment costs and productivity losses. Despite its prevalence, effective management of CLBP remains challenging, particularly in cases of chronic non-specific LBP where no identifiable nociceptive source is apparent. Exercise therapy has become a cornerstone of conservative treatment for CLBP, demonstrating potential in reducing pain intensity and improving functional outcomes [2]. However, variations in study methodologies and exercise protocols complicate the identification of optimal interventions.

Psychological factors, such as pain catastrophizing and kinesiophobia, have been recognized as critical mediators of treatment outcomes, suggesting the need for integrated therapeutic approaches addressing both physical and psychological dimensions [3,4]. Integrating psychological interventions like cognitive-behavioral therapy (CBT), acceptance and commitment therapy (ACT), and pain education with physiotherapy has been shown to improve outcomes, including pain reduction, functional improvement, and treatment adherence. CBT combined with exercise therapy is particularly effective for enhancing physical function and reducing fear-avoidance, while behavioral therapy demonstrates the most sustained effects on pain intensity. Despite these benefits, current guidelines primarily emphasize CBT, often neglecting other evidence-based approaches. Expanding recommendations to include diverse psychological therapies and exploring their long-term effectiveness could improve patient care. Addressing both physical and psychosocial dimensions is essential for optimizing outcomes in CLBP management [5]. Despite advancements in understanding CLBP, diagnostic methods lack specificity, and treatment practices vary significantly across international guidelines, underscoring the need for further research to refine evidence-based strategies.

This review synthesizes current evidence on exercise therapy for chronic non-specific LBP, emphasizing its role in pain relief and functional improvement. Given the complex interplay

of physical and psychological factors in CLBP. This review aims to provide clinicians with practical insights to optimize patient care.

The Role of Leisure-Time Physical Activity in Managing CLBP in Older Adults

Leisure-time physical activity shows a U-shaped relationship with non-specific chronic low back pain (CLBP) in older adults. While some studies suggest that active older adults have a lower risk of developing CLBP compared to inactive individuals, the benefits may also be influenced by physical activity outside of leisure time. Moderate levels of leisure-time activity appear to reduce CLBP risk [6]. The prevalence of LBP increased with age for both genders, with a notable rise in women in their 50s, potentially linked to social activities and stress. Among various factors, pelvic incidence-lumbar lordosis (PI-LL) mismatch emerged as an independent contributor to LBP, suggesting its importance in early detection and treatment [7]. Exercises offer numerous advantages for older adults, including reducing muscle loss, improving posture, enhancing self-efficacy, and alleviating psychological factors such as anxiety, depression, and pain catastrophizing. Regular physical activity is recommended for older adults regardless of their CLBP status. Future research could utilize wearable technology to better understand how different types and intensities of physical activity impact CLBP in this population [6].

The Role of Physical Activity in Managing and Preventing Chronic Low Back Pain

Exercise has been identified as a potentially effective intervention for chronic low back pain (LBP), with moderate-certainty evidence supporting significant reductions in pain intensity and improvements in functional limitations compared to no treatment, usual care, or placebo. While the reduction in pain intensity achieved through exercise is clinically meaningful, the observed improvements in functional limitations, although statistically significant, did not meet the threshold for minimal clinically important difference [1]. Compared to other conservative treatments, exercise demonstrated consistent, albeit modest, benefits in both pain management and functional outcomes, though these effects did not reach a clinically significant level. Furthermore, exercise showed greater efficacy than education alone or non-exercise physical therapies, with variability in patient response depending on study population and treatment protocols. The long-term effects of therapeutic aquatic exercise in the

management of chronic low back pain were evaluated in a randomized clinical trial, revealing significant improvements in both disability and pain management. Over a 12-month period, the therapeutic aquatic exercise group showed more substantial reductions in disability, as measured by the Roland-Morris Disability Questionnaire, compared to the physical therapy modalities group. Notably, participants in the aquatic exercise group experienced greater pain alleviation and improvements in quality of life, with a higher proportion meeting the minimal clinically important difference in both pain and disability scores [2]. These findings suggest that therapeutic exercise, including aquatic exercises, may offer sustainable and effective benefits for the management of chronic low back pain, providing a viable alternative to more passive treatment approaches.

Core stabilization exercises (CSE), which enhance neuromuscular control and spinal stability, are therapeutic interventions designed to target the deep trunk muscles such as the transversus abdominis and lumbar multifidus. These muscles play a crucial role in stabilizing the lumbar spine through the co-activation of the thoracolumbar fascia, increasing intra-abdominal pressure and providing segmental stability. CSE has been shown to improve proprioception, postural control, and balance, and reduce pain and functional disability in patients with low back pain (LBP). When compared to general strengthening exercises, CSE demonstrated superior efficacy in improving these outcomes, particularly in patients with subacute nonspecific LBP [4]. While various therapeutic exercise regimens, including core strengthening and aerobic exercise, have shown beneficial effects on LBP, core stabilization exercises remain particularly effective for enhancing spinal stability and alleviating pain. Although exercise interventions generally result in moderate improvements in pain and disability, the effects are contingent upon the type, duration, and delivery method of therapy.

Moderate-quality evidence indicates that exercise programs can effectively reduce the intensity of LBP in the short term, while combining exercise with education appears to reduce long-term disability associated with LBP. However, interventions such as education alone, ergonomics, or their combination have not demonstrated significant benefits in reducing LBP intensity or related disability. Additionally, the impact of prevention programs on quality of life and workability remains unclear due to the low quality of existing evidence [8]. The long-term benefits of exercise therapy for chronic LBP are promising, supporting its incorporation as a cornerstone of non-invasive treatment strategies for patients with this prevalent and debilitating condition [1,2].

Impact of Sleep Disturbances on Chronic Low Back Pain

Insomnia is an important contributor to the development of chronic low back pain (CLBP), with genetic studies indicating a direct causal connection. However, there is no evidence to support that CLBP contributes to the onset of insomnia. Furthermore, no causal relationship was observed between daytime sleepiness and CLBP. These results suggest that insomnia should be considered a treatable factor in managing CLBP. Potential mechanisms, such as immune system disruptions, increased inflammatory markers, and changes in pain sensitivity pathways, including the dopaminergic and adenosinergic systems, may be involved in this relationship [9]. The study also suggests that the rate of biological aging plays a key role in this relationship. It appears that individuals with more severe insomnia experience faster biological aging, which is associated with increased pain and reduced functional abilities. These findings highlight the importance of addressing insomnia as part of the treatment for chronic low back pain (CLBP) to help reduce its impact, improve patient outcomes, and enhance overall function [10]. Higher levels of hsCRP (High-Sensitivity C-Reactive Protein), a marker of inflammation, do not seem to strengthen the connection between insomnia and chronic low back pain, including mild to severe pain, or pain in the lower limbs. However, additional research is needed to explore the timing and relationship between insomnia, chronic pain, and inflammation. This will help provide a clearer understanding of the underlying mechanisms that link sleep issues, pain, and inflammation [11]. The findings from the studies are varied, highlighting the need for further research to better understand the complex relationship between insomnia, biological aging, and chronic low back pain, as well as their impact on patient functioning.

The Influence of Psychological Well-being and Social Support on Chronic Low Back Pain

Based on the available evidence, cognitive behavioral therapy (CBT) provides small but significant benefits in managing chronic pain in adults by reducing pain intensity, disability, and psychological distress. These effects persist beyond the completion of therapy and are supported by a substantial body of research. However, other psychological approaches, such as acceptance and commitment therapy (ACT) and behavioral therapy (BT), lack sufficient high-quality evidence to confirm their effectiveness. While CBT remains the most well-

documented psychological intervention for chronic pain, further research is needed to explore alternative therapeutic strategies and assess their efficacy. Future studies should focus on well-designed, multicenter clinical trials to identify the mechanisms underlying psychological interventions and determine which patient groups may benefit the most. Additionally, more comprehensive reporting of adverse effects and long-term treatment outcomes is essential to optimize therapeutic strategies and improve clinical decision-making [12].A brief pain relief intervention demonstrates comparable effectiveness to extended cognitive behavioral therapy (CBT) in reducing pain-related distress, intensity, and interference in chronic low back pain. While not a substitute for full-length CBT, such interventions offer a scalable and accessible alternative for pain management. Further research is needed to validate their efficacy across diverse populations, assess long-term outcomes, and explore integration into routine care [13].

Dietary Habits and Their Contribution to the Development and Management of Chronic Low Back Pain

Alcohol

There is a complex, bidirectional relationship between alcohol consumption and chronic back pain (CBP). On the one hand, excessive alcohol use may contribute to the development or worsening of CBP, suggesting that alcohol can be a risk factor for chronic pain. On the other hand, individuals experiencing CBP may increase their alcohol intake in an attempt to manage or alleviate their pain, further exacerbating the condition. This interaction between alcohol use and CBP may create a reinforcing cycle, where each condition influences and intensifies the other. Addressing alcohol consumption could, therefore, be an important aspect of both managing chronic back pain and preventing its progression [14].

Nicotine

Research has consistently shown that smoking and nicotine dependence are significant risk factors for the development and exacerbation of chronic pain, including conditions like low back pain (LBP) and neuropathic pain. Smokers tend to report more severe pain, particularly in areas such as the lower limbs, with pain often radiating distally. Higher levels of nicotine dependence, measured through tools like the Fagerström score, are associated with an increased likelihood of experiencing chronic pain, including neuropathic types.

These findings suggest that smoking and nicotine dependence contribute not only to the onset of chronic pain but also to the severity and persistence of such conditions. Addressing smoking and managing nicotine dependence may improve outcomes in pain management. Further studies could focus on the impact of smoking cessation and explore psychological factors that mediate the relationship between smoking and chronic pain [15].

Salt

Excessive intake of sodium chloride seems to play a significant role in the development and worsening of chronic low back pain (LBP), possibly acting as a link between LBP and several other health conditions. Studies have shown that high salt consumption is connected to problems like high blood pressure, heart disease, and kidney issues, all of which are also linked to LBP. One possible factor linking these conditions is subcutaneous oedema in the lower back, which may help explain how high salt intake contributes to LBP.

Further research is needed to better understand this connection, particularly by looking at whether reducing salt in the diet could help prevent or treat both LBP and related health problems. Understanding the role of salt in causing LBP could lead to new ways of preventing and treating this pain, ultimately improving outcomes for patients and reducing the global impact of chronic pain [16].

Lack of vitamin D

The findings suggest that vitamin D deficiency may play a significant role in the severity of chronic low back pain (cLBP), with deficiencies potentially exacerbating pain levels. This relationship seems to be especially notable among certain populations, indicating that racial, geographical, and lifestyle factors may influence vitamin D status and its impact on pain. As vitamin D is crucial for various body functions, including immune system regulation, its deficiency may contribute to increased inflammation and pain sensitivity [17].The study suggests that addressing vitamin D deficiency through supplementation could be a promising approach for managing low back pain (LBP), especially in populations at higher risk. However, due to the limited number of participants with sufficient vitamin D levels in our study, further research with a larger sample size and adequate vitamin D levels is needed to better understand the relationship between vitamin D status and low back pain in pediatric populations. By expanding our understanding of these factors, we can develop more targeted interventions to prevent and treat chronic low back pain in children and adolescents [18].

Vegeterian Diet

The relationship between vegetarian diets and chronic back pain (CBP) suggests a potential positive impact of plant-based eating habits in reducing pain symptoms. A vegetarian diet, rich in fruits, vegetables, whole grains, and low in saturated fats and meat, may help reduce inflammation in the body, which is one of the primary factors contributing to chronic pain. Many studies indicate that an anti-inflammatory diet, such as a plant-based diet, may alleviate chronic back pain symptoms. Reducing the intake of foods high in trans fats and processed meats, which often contribute to increased inflammation, could further support the improvement of health in individuals suffering from CBP. However, more research is needed to thoroughly assess the impact of vegetarian diets on chronic back pain and confirm their effectiveness in managing this condition [19].The conclusions should be drawn with a limited scope.

Potential Association Between Coffee Consumption and Low Back Pain: Inconclusive Evidence and Future Directions

The relationship between coffee consumption and low back pain (LBP) remains inconclusive due to inconsistent findings across studies. Some research indicates a potential link, such as a study reporting that consuming six or more cups of coffee daily significantly increases the risk of non-specific LBP recurrence. Similarly, an association between coffee consumption and LBP was observed in postmenopausal women. In contrast, other studies, including research on undergraduate students, found no relationship between coffee intake and LBP. These discrepancies may stem from variations in study design, dose-dependent effects of coffee, or indirect mechanisms, such as its impact on bone health. Further longitudinal research with standardized methods for measuring coffee and caffeine consumption is needed to elucidate this relationship more definitively [20]. The findings imply a possible association between coffee consumption and chronic low back pain through inflammatory pathways, but the evidence remains inconclusive. Further research is needed to determine the dose-dependent effects and underlying mechanisms of coffee intake in relation to chronic LBP [21].

Overweight and Obesity: The Link Between Excess Weight and the Severity of Chronic Low Back Pain

There is a potential influence of obesity on the increasing prevalence of chronic back pain (CBP) in European adolescents. While the findings indicate a modest association between sedentary screen time and obesity with CBP, the relatively small contribution of these factors suggests that other variables also play a significant role in the development of CBP. Given the potential long-term consequences for both adolescents and adults, it is essential to continue investigating the complex factors that contribute to chronic back pain [22].

Substances Use

The Effects of Cannabinoids on Chronic Low Back Pain

Cannabis has emerged as a potential alternative or adjunct treatment for chronic back pain (CBP), particularly in light of its suggested opiate-sparing effects observed in preclinical studies. However, the evidence from human clinical trials remains limited and inconclusive. While animal studies have shown promising results, the translation of these findings to human applications is not yet well-established. The scarcity of well-designed randomized controlled trials (RCTs), especially those comparing cannabis with other active analgesics, further complicates the evaluation of its effectiveness as a treatment option for CBP.

A significant challenge in this field is the stigma surrounding cannabis use, which has historically hindered comprehensive research efforts. As a result, most existing studies focus on comparing cannabis to placebo, making it difficult to draw clear conclusions regarding its superiority over other pain management therapies. Furthermore, while many RCTs assess the therapeutic potential of cannabis, they often fail to provide detailed information on its side effects and long-term safety profile [23]. There is a point that medical cannabis (MC) may play a significant role in reducing opioid prescriptions among patients with chronic musculoskeletal noncancer back pain. Following MC certification, patients exhibited a notable reduction in opioid use, particularly among those with lower baseline opioid consumption, some of whom ceased opioid use entirely. Moreover, patients reported improvements in pain and daily functioning following MC certification, highlighting its

potential as an effective alternative pain management option. The combination of multiple routes of MC administration may enhance its efficacy in further reducing opioid utilization.

These results point to the potential benefits of MC as part of a comprehensive pain management strategy, particularly in individuals seeking to minimize opioid dependency. Further studies are required to confirm these findings and evaluate the long-term effects of MC on pain management and opioid use [24].In light of these limitations, further research is necessary to fully understand the therapeutic benefits and risks of cannabis for managing chronic back pain. Until more robust evidence is available, cannabis may be considered a treatment option for patients with CBP who have exhausted other pain management strategies, including opioids. However, its role in pain management should be carefully evaluated in the context of individualized patient care, with a focus on both efficacy and safety [23].

The role of duloxetine

Duloxetine, a serotonin-norepinephrine reuptake inhibitor (SNRI), is commonly prescribed for major depressive disorder (MDD) and generalized anxiety disorder (GAD). More recently, it has shown promise in managing chronic neuropathic pain and fibromyalgia. Given these findings, several randomized controlled trials have assessed its effectiveness in treating chronic low back pain (CLBP), with positive results reported [25]. There is a connection between supporting the efficacy of duloxetine in reducing pain and improving the quality of life in patients with chronic low back pain (CLBP). Duloxetine demonstrated significant pain reduction, as assessed by various scales, and was superior to placebo in enhancing patients' overall well-being. However, variations in individual study outcomes highlight the influence of factors such as dosage, patient characteristics, and study design. These differences underscore the need for future studies focusing on specific subpopulations and long-term effects to further solidify duloxetine's role in CLBP management. Despite these limitations, the findings affirm duloxetine as an effective treatment option, especially in patients with comorbid depression, and suggest its potential for broader application in clinical practice. Further research is needed to address the existing methodological inconsistencies and expand on the long-term benefits of duloxetine for CLBP patients [26]. These results highlight the potential of duloxetine as a valuable therapeutic intervention in CLBP management.

Physiotherapeutic Approaches in the Management of Musculoskeletal Pain

Dry needling (DN)

Dry needling (DN) has gained attention as a potential therapeutic option for managing musculoskeletal pain, particularly in conditions like lower back pain (LBP). DN involves the insertion of thin needles into myofascial trigger points to alleviate pain and improve muscle function. While several studies have reported positive short-term effects, such as pain reduction and improved range of motion, the long-term efficacy of DN remains uncertain. One of the challenges in assessing the overall effectiveness of DN is the variability in treatment protocols, including the number of sessions and the specific techniques used [27]. In conclusion, dry needling (DN) has shown potential as a therapeutic technique for managing musculoskeletal pain and improving function. By targeting myofascial trigger points, DN can help alleviate pain, enhance range of motion, and reduce hypersensitivity. While immediate pain relief is often observed, the long-term effectiveness of DN requires further investigation. The presence of local twitch responses (LTRs) during treatment may be linked to better outcomes, but the evidence remains inconsistent. Despite this, DN continues to be a valuable option in pain management, warranting further research to refine its application and optimize patient results [28]. Despite promising results, some studies have highlighted the need for more rigorous research to confirm the benefits of DN, especially in comparison to other established treatments. Additionally, the lack of consistent reporting on long-term outcomes and potential side effects further complicates its clinical application. To fully understand the role of DN in pain management, future research should focus on standardized protocols, long-term follow-up, and comprehensive assessments of both efficacy and safety [27].

Short-wave diathermy

Some studies highlight the beneficial effects of combining exercise therapy with SWD (continuous or pulsed) on pain reduction in patients with chronic low back pain (CBP). Both treatment approaches led to improvements in pain perception, with the combination of continuous SWD and exercise showing the most significant outcomes. Additionally, while no significant differences in depressive symptoms were observed between groups, a noticeable reduction in depression scores was recorded in those receiving SWD therapy. These findings suggest that addressing both pain and depression in patients with CBP may be essential for

enhancing overall treatment outcomes. Further research is needed to explore the long-term effects of these therapies on both pain management and mood improvement in CBP [29].

Conclusion

Chronic low back pain (CLBP) remains a significant global health issue, with substantial economic and personal costs. The complexity of CLBP is underscored by its multifactorial nature, encompassing both physical and psychological factors that influence its onset, progression, and management. The evidence reviewed highlights the importance of a multifaceted treatment approach, combining exercise therapy with psychological interventions such as cognitive-behavioral therapy (CBT), acceptance and commitment therapy (ACT), and other behavioral therapies. While exercise therapy has shown consistent benefits in reducing pain and improving function, its effects can be enhanced when integrated with psychological strategies. This combination helps address both the physical and psychological components of CLBP, such as fear-avoidance behavior, catastrophizing, and depression, which are known to significantly impact patient outcomes.

Psychological well-being and social support also play crucial roles in managing CLBP, as individuals with stronger psychological resilience and better social networks tend to experience improved pain management and functional recovery. The effectiveness of psychological interventions like CBT is well-documented, though other approaches, such as ACT, still require further research to confirm their long-term benefits. The integration of these psychological therapies into routine clinical practice could potentially lead to better patient outcomes, especially for those with more complex, long-standing pain conditions.

Furthermore, lifestyle factors, such as diet and substance use, have been shown to influence the severity of CLBP. For example, smoking, alcohol consumption, and excessive sodium intake can exacerbate pain, while a balanced diet, including adequate vitamin D levels and anti-inflammatory foods, may support better outcomes. The relationship between nutrition and CLBP underscores the need for a holistic approach to treatment that considers all aspects of a patient's health, not just their musculoskeletal system.

Finally, advances in physiotherapeutic techniques, including dry needling and short-wave diathermy, show promise as adjuncts to traditional treatments, providing additional avenues for managing CLBP. However, the need for more standardized research in these areas remains

essential for improving clinical practice. Medications like duloxetine and cannabinoids may serve as valuable adjuncts to traditional therapies, though more robust clinical trials are necessary to confirm their long-term effectiveness. In summary, addressing chronic low back pain requires a comprehensive, multidisciplinary approach that integrates physical therapy, psychological support, lifestyle modifications, and, where appropriate, pharmacological interventions. By optimizing these strategies, clinicians can significantly improve the quality of life for individuals suffering from CLBP.

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