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Physical Activity as a Means of Improving Quality of Life in Individuals with Chronic Pain

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Background

- According to the 2016 National Health Interview Survey, over 20% of individuals in the United States report chronic pain, with a disproportionate number of these individuals coming from vulnerable populations such ethnic and racial minorities, the unemployed and uninsured, those living in poverty, and those living in rural areas with limited access to care.[1,2]
- Chronic pain has been linked to mental health disorders like depression and anxiety, opioid abuse and addiction, decreased physical function and independence, and reduced quality of life.[1]
- Chronic pain is notoriously difficult to treat due to its variety in etiology, pathogenesis, and presentation, with several conditions having no clear underlying pathologic cause.

Purpose

- Explore the shared molecular and psychological mechanisms underlying chronic pain and mental health disorders by analyzing 1) classification of chronic pain types, 2) classification of chronic pain perception, 3) molecular markers correlated with pain onset, 4) molecular markers present in chronic pain syndromes, and 5) the relationship between chronic pain and mental health
- Analyze the influence of exercise on each of these factors to propose the use of physical activity and exercise (used interchangeably hereafter) as a means of improving quality of life in individuals experiencing chronic pain

Methods

PubMed terms	"chronic pain classification," "chronic pain biology," "chronic pain etiology," "chronic pain cytokine," "chronic pain inflammation," "chronic pain endocannabinoid," "chronic pain exercise," "chronic pain mental health," "chronic pain quality of life," "exercise mental health," "exercise inflammation," "exercise depression."
Inclusion criteria and study types	English-written articles- including literature reviews, systematic reviews, randomized controlled trials, retrospective analyses, and basic science research
Participants	participants with chronic pain syndromes and comorbid mental health disorders
Outcome measures	•Self-reported pain, depression, anxiety, and substance use scores •Quantitative analysis of inflammatory markers under normal conditions, pain disorders, mental health disorders, exercise
Data extraction	Research design, primary outcomes, qualitative and qualitative data
Data analysis	Qualitative analysis

Results

Pathogenic Disease	***Idiopathic Disease***
Arthritis (OA and RA)	Fibromyalgia
Inflammatory/autoimmune	Complex regional pain syndrome
Peripheral neuropathy	Low back pain
Post herpetic neuralgia	

Basic Science	
Pain types	chronic primary, chronic cancer-related, chronic postsurgical, chronic neuropathic, chronic secondary headache, chronic secondary visceral, chronic secondary musculoskeletal[3]
Neural pathways of pain perception	neuropathic, nociceptive, central sensitization[5,6]
Pro-inflammatory cytokines	IL-1β, IL-6, and TNF-α[9,10]
Anti-inflammatory cytokines	IL-10[6,19-21]

Pain and Mental Health	
Associated mental health disorders	Depression, anxiety, loss of sleep[22]
Bidirectionality	increase in pain predicts increase in depression, change in depression severity predicts pain severity[23]
Shared pharmacological management	Tricyclic antidepressants (TCAs) and serotonin norepinephrine reuptake inhibitors (SNRIs)[24]
Opioid abuse	•patients with comorbid mental health and pain disorders more likely to be prescribed opioids for chronic pain mgmt despite increased risk of opioid abuse[24,26] •Tx of anxiety and depression reduces opioid use in patients with chronic pain[28]

Exercise as a Prescription for Chronic Pain	
Molecular	•Decrease in IL-1β, IL-6, TNF-α, and CRP[32] •Reduced visceral fat decreases inflammatory adipokine effects[31] •Contracting muscle stimulates IL-10 and IL-1 receptor antagonist[31]
Psychological	•Decreased depression, elevated mood[30,33] •Decreased pain and improved function[29] •nociceptive pain reduced via stim of endocannabinoid receptors in the periaqueductal brain region[37] •cortisol and anandamide reduce stress and improve sleep via GABA[34]
Exercise type	•Benefits seen with aerobic, strength, flexibility, balance, and yoga training[30] •Intensity: Marathon runners report more energy and less depression than joggers[40] •in comparison to non-runners, runners have higher levels of self-identification and self-esteem, lower levels of depression, and positive psychological coping mechanisms[41]

Discussion

- Diseases associated with chronic pain have varying degrees of association with proinflammatory cytokines.[6,19-21]
- IL-1β, IL-6, and TNF-α are implicated in the development, perpetuation, and hypersensitization of chronic pain.[9,10,14,18]
- Individuals with chronic pain disorders report higher levels of depression and anxiety and have higher suicide rates than their healthy counterparts.[22]
- A bidirectional relationship between pain and mental health has been established, with a rise in pain severity negatively correlating to stable mental health, and individuals with psychological disorders reporting higher levels of pain.[23]
- Those with chronic pain and comorbid mental health disorders are more likely to be prescribed opioids for pain relief but are also more likely to suffer from substance abuse disorders and opioid addiction.[27]
- physical activity can reduce the production of proinflammatory cytokines IL-1β, IL-6, and TNF-α and increase production of the anti-inflammatory cytokine IL-10.[29-33]
- aerobic, strength, and yoga training improve pain, function, mood, and fatigue while decreasing depression and anxiety

Conclusion

- Pharmacologic management of chronic pain has variable results, sometimes resorting to ineffective and dangerous opioids that can potentiate substance abuse in a vulnerable population.[24,26,27]
- Exercise is unique in its ability to positively impact both the molecular and psychological aspects of chronic pain. Its role in decreasing inflammation as well as improving mental health make it an excellent option for improving quality of life.
- Physicians should work with their patients to develop a patient-centered exercise plan to manage chronic pain.

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