



## Chronic Pain Management and Its Relationship to Physiological Variables

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### Introduction

Chronic pain (CP) is defined as pain lasting more than 3 months. It affects thousands of Canadians daily through biological, psychological and social factors. Not only are physiological factors affected in those who experience chronic pain but also sleep, mood, and general quality of life. We do not yet know the exact biological mechanisms through which acute pain and injury develop into chronic pain, however, in this article; we discuss a dominant hypothesis that might offer an explanation: Central Sensitization. Chronic pain (CP) is defined as pain lasting  $\geq 3$  months and its subjective perception is complex: it is comprised of interacting biological, psychological and social factors. CP continues to be an ongoing challenge in Canada, affecting as many as 20% to 29% individuals nationwide. For those living with a CP condition, it can provoke significant long-term debilitation and suffering. In particular, CP can negatively affect many domains of a patient's health including sleep, cardiovascular fitness, mood, sexual functionality and overall quality of life. Among Canadians waiting for effective intervention to relieve their CP, over two thirds reported 'severe pain' (i.e.,  $\geq 7$  out of 10 on a Likert scale) that considerably impacted their quality of life and daily functioning. CP also poses enormous economic burden on individual and societal levels. For example, Canadians with CP awaiting treatment reported an average median monthly cost of \$1,462 (CDN) for care. In a newly publicized population-based study, they found that the incremental healthcare costs amounted to 50% higher in patients managing CP than their healthy control counterparts. From a broader perspective, Canada spends approximately \$6 billion annually on direct CP expenditure, and \$37 billion annually on indirect costs (i.e., loss of job productivity, loss of jobs, employee sick days etc.). Evidently, more resources and research should be directed at combatting this pressing health concern.

In addition, the purpose of this article is to explore the biological mechanisms of chronic pain and the importance of using physiological measures to assess the outcomes of pain management programs. It has been established that CP may develop as a result of a dysfunctional stress response. Normal functioning, interdependent systems (i.e., nervous, endocrine and immune) interact to adaptively respond to an acute stressor or injury. This bodily response is known as allostasis and is necessary to maintain homeostasis, thereby protecting vital internal processes. When presented with a stressor, allostatic systems such as the hypothalamic-pituitary-adrenal (HPA) axis and autonomic nervous system (ANS) promote a 'fight or flight' response so that individuals can effectively respond to the homeostatic imbalance. In many cases, the HPA axis facilitates the

release of cortisol into the blood stream, which is a glucocorticoid that can be metabolized to provide one with sufficient energy to combat the stressor. Concurrently, the sympathetic nervous system of the ANS elevates heart rate and blood pressure, respiration rate, muscle tension and other sympathetic responses to achieve the same goal of recovery. In his original General Adaptation Syndrome theory, Selye postulated that people are in the 'alarm stage' when initially reacting to a stressor. In the second phase, the 'resistance stage', an individual maintains their arousal to overcome the stress.

This paper draws attention to the importance of having further research conducted in order to understand the underlying biological causes of chronic pain as well as identifying specific biomarkers that can be used to measure treatment outcomes. This will allow us to design effective and innovative pain management programs in order to improve the quality of life for CP patients. CP has been theorized to persist as a result of this faulty stress response. In particular, CP continues via bio psychosocial factors even after the original painful stimulus is removed. This effect has been extensively studied in individuals living with fibromyalgia (FM). FM is characterized by widespread pain throughout the body, disordered sleep, fatigue and depressed affect. Adverse ANS and HPA axis functioning have been theorized to contribute greatly to the pathogenesis of FM in that it disrupts, or is a consequence of, the normal functioning stress response. Studies have frequently reported that individuals with FM demonstrate hypocortisolemia, an important marker for HPA dysfunction, compared to those living without CP. As well, individuals with FM have abnormal circadian rhythms and consistent sympathetic hyperactivity during night-time hours, compared to a healthy population. It is reasonable that this dysfunction in stress systems may be present in a variety of CP conditions due to CP being labelled as a global condition for its similarities in response to treatment. Morley discusses how simply telling patients certain treatments "work" is not enough, patients deserve to know how and what objective changes are being observed before and after treatments. Although it is important to note self-report measures have their own benefits, (e.g how participants feel about their chronic pain after treatment), objective measures such as biomarkers hold the promise of diminishing inconsistent results that are associated with subjective scoring, patients will be able to better understand and conceptualize the benefits of chronic pain programs. Therefore, it is imperative that research continues to evaluate the underlying biological mechanisms of CP conditions, especially in large, population-based studies. This will allow us to explore and utilize standardized biomarkers that will in

turn allow us to identify MRP benefits more effectively and accurately. As it stands, there is still a degree of uncertainty in the extent to which biological dysfunction precedes or proceeds a CP condition and exactly what physiological factors are the most principal to CP. Recently, a study was conducted to explore how mindfulness meditation can impact physiological neural mechanisms associated with CP . The investigators were able to successfully display, for the first time, that meditation involved endogenous opioid pathways, and that it had beneficial analgesic effects on pain

**Keywords:** Chronic pain; Stress response; Central sensitization; Pain management; Physiological measures

