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Mechanisms of Chronic Pain Related to Traumatic Experiences and Emotions

Travmatik Yaşantılar ve Duygular Bağlamında Kronik Ağrı Mekanizmaları

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ABSTRACT

Chronic pain, which is widespread worldwide, has negative physical and psychological effects and can cause serious decreases in quality of life. There are various types of chronic pain such as musculoskeletal pain, neuropathic pain, head-facial pain and it is caused by different factors. However, it is one of the issues that should be taken into consideration that chronic pain that manifests itself on the body is not only caused by biological reasons, but may also have a psychological background. In this context, there is a lot of evidence that psychological trauma plays an important role in the onset of chronic pain by increasing pain sensitivity and severity. In the light of this information, how different types of trauma such as 'psychological trauma', 'post-traumatic stress disorder', 'childhood traumas' affect chronic pain has been mentioned in detail. In addition, emotional factors also play a role in chronic pain, and even pain and emotions share a common neurobiology. Research findings on how the relationship between different types of emotions and chronic pain has been revealed. In the literature, there are many studies on the connection of emotions and psychological trauma history with the body. However, especially in Turkey, studies examining these variables in chronic pain are insufficient and it is thought that more research is needed. Accordingly, the aim of this article is to review the existing theories and research on the relationship between chronic pain, trauma and emotions.

Keywords: Chronic pain, traumatic experiences, emotions

ÖZ

Dünya çapında yaygın bir şekilde görülmekte olan kronik ağrının bedensel ve psikolojik açıdan olumsuz etkileri söz konusudur ve hayat kalitesinde ciddi düşüşlere neden olabilmektedir. Kronik ağrının kas-iskelet ağrısı, nöropatik ağrı, baş-yüz ağrısı gibi çeşitli türleri bulunmakta ve farklı etkenlerden kaynaklı olarak ortaya çıkmaktadır. Bununla birlikte, beden üzerinde kendini gösteren kronik ağrının yalnızca biyolojik sebeplerden kaynaklanmadığı, psikolojik arka planının da bulunabileceği göz önünde bulundurulması gereken konulardan biridir. Bu bağlamda ruhsal travmanın ağrı duyarlılığını ve şiddetini artırarak kronik ağrının başlangıcında önemli bir rol oynadığına dair birçok kanıt bulunmaktadır. Bu bilgiler ışığında travmanın 'psikolojik travma', 'travma sonrası stres bozukluğu' 'çocukluk çağı travmaları' olmak üzere farklı türlerinin kronik ağrıya ne şekilde etki ettiğinden ayrıntılı bahsedilmiştir. Bunun yanı sıra duygusal faktörlerin de kronik ağrıda rolü bulunmakta, hatta ağrı ve duygular ortak bir nörobiyolojiyi paylaşmaktadırlar. Farklı duygu türlerinin de kronik ağrı ile ilişkisinin ne şekilde olduğuna dair araştırma bulguları ortaya konulmuştur. Alan yazında duyguların ve ruhsal travma öyküsünün beden ile olan bağlantısı noktasında birçok çalışma bulunmaktadır. Fakat özellikle Türkiye'de kronik ağrı özelinde bu değişkenlerin incelendiği çalışmalar yetersiz olup daha fazla araştırmaya ihtiyaç olduğu düşünülmektedir. Bu doğrultuda bu makalenin amacı kronik ağrı, travma ve duygular arasındaki ilişkiye dair mevcut kuramlar ve araştırmaları gözden geçirmektir.

Anahtar sözcükler: Kronik ağrı, travmatik yaşantılar, duygular

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Introduction

According to the International Association for the Study of Pain (IASP), pain is defined as 'an unpleasant sensory and emotional experience associated with actual or potential tissue damage'. While pain can be seen as a phenomenon that serves the continuity of life in terms of being a sign that warns the person against a possible danger in the body, when it becomes chronic, the pain becomes a threat rather than a warning (Ertekin 2017).

Chronic pain is a pervasive disorder worldwide, and one in every nine young adults has chronic pain, regardless of region of residence and gender (Murray et al. 2022). However, its negative effects on the individual and society are quite significant. It is known to impose a significant financial burden on society as it negatively affects physical and mental functioning, quality of life, social life, and productivity. According to one finding, chronic pain in adults costs billions of dollars annually, including health expenditures and loss of labor force (Institute of Medicine 2011, Önen-Sertöz 2017). Looking at recent years, it is seen that the COVID-19 period, which has continued for a long time worldwide, has had a great impact on people with chronic pain along with other vulnerable groups. Moreover, chronic pain is recognized as one of the most important reflections of the COVID-19 period (Shanthanna et al. 2022).

It is important to address the etiology of chronic pain, which is quite common worldwide, not only in terms of physical but also in the context of psychological effects. Chronic pain is generally thought to be caused by psychological reasons when it is not due to known physiological tissue damage (Merksey and Bogduk 1994). In the literature, there is increasing scientific evidence that stressful life events, and especially a history of psychological trauma can lead to a predisposition to chronic pain (Lumley et al. 2012). According to various studies, musculoskeletal pain and neurological complaints are more common in people with a history of trauma compared to those without a history of trauma (McFarlane et al. 1994, Karşıkaya et al. 2013), and one of the most commonly reported complaints in people with post-traumatic stress disorder (PTSD) is the experience of pain (Gasperi et al. 2021). In connection with this, there are findings that psychological trauma leads to high pain sensitivity and low pain threshold in the body (Tesarz et al. 2015).

In addition to trauma, it has been proven by various studies that emotions have an effect on physical health, and especially negative emotions are associated with complaints about pain. The onset of chronic pain is likely to be accompanied by negative emotions. In addition, studies show that negative mood and emotions can lead to and/or exacerbate pain (Wiech and Tracey 2009).

When the studies on chronic pain in Turkey are examined, it is seen that pain is associated with childhood traumas (Sinani 2012, Bayram and Erol 2014, Karaş et al. 2017, Ertekin 2017), posttraumatic stress disorder (Karşıkaya et al. 2013), depression (Tütüncü and Günay 2011, Baykal 2014, Bayram and Erol 2014, Karaş et al. 2017, Cengiz and Aykın-Yığman 2022,) and alexithymia (Kaya et al. 2010, Karşıkaya et al. 2013, Garip et al. 2015, Acar and Acar 2018).

However, traumatic experiences and emotions, which may play a crucial role in chronic pain mechanisms, are not adequately addressed in these studies. As a result, proposed solutions often remain insufficient. To bridge this gap, this study aims to examine the issue through the lens of existing theories and research. Therefore, the study is expected to contribute to the literature by providing a new perspective on the mechanisms of chronic pain. At the same time, it is also expected to guide clinical practitioners in the field on the treatment of chronic pain.

Pain

Pain is an unpleasant and highly subjective experience regardless of which part of the body it affects (Merksey and Bogduk 1994). It is called 'acute pain' when it is caused by a harmful stimulus arising from a disease, injury, or abnormally functioning muscle/internal organ, and 'chronic pain' when it persists for more than 3 to 6 months beyond the expected course of a disease process (Merksey and Bogduk 1994, Russo and Brose 1998, Gonzales et al. 2000). Chonic pain is among the most common causes of doctor

visits and medication use throughout the lifespan and causes significant loss of labor force (Institute of Medicine 2011).

Chronic pain can be caused by several reasons. In the 11th version of the International Classification of Diseases (ICD-11) published by the World Health Organisation (WHO), the most common types of chronic pain are divided into 7 groups: 1) primary chronic pain, 2) cancer pain, 3) post-traumatic and post-surgical pain, 4) neuropathic pain, 5) head, mouth and face pain, 6) visceral pain and 7) musculoskeletal pain (WHO 2021).

At the same time, it should be taken into consideration that -regardless of the cause- chronic pain may have a psychological background. Therefore, psychological evaluations are also important in treatment (Gonzales et al. 2000, Sertel-Berk and Bahadır 2007). However, the fact that pain has become chronic is a source of distress for the person in itself. Therefore, it is often resistant to ordinary treatment approaches and requires special care. Treatments that include not only body-oriented treatments (e.g. medication, physiotherapy) but also psychiatric interventions targeting the patient's reactions to pain in daily life have generally been found more successful (Gonzales et al. 2000, Treede et al. 2015, Önen-Sertöz 2017).

Theories Explaining the Causes of Pain and Its Management

Biomedical Model

In the 1960s, the dominant perspective was the biomedical model, which overlooked the psychological, behavioral, and social dimensions of illness. This model defined illness solely in terms of 'abnormal bodily variables' that were considered entirely measurable and independent of these factors. Rooted in the philosophy of reductionism, which stems from the mind-body dualism that views the mind and body as entirely separate entities, this model conceptualizes disease as distinct from the individual. Consequently, disease-related behaviors are explained solely through biochemical and neurophysiological processes.

Psychodynamic Theory

The work of George Engel (1959) contributed to the development of psychosomatic medicine and is particularly important in terms of analyzing pain from a psychoanalytic perspective. In his article, Engel proposes a definition of a 'pain-prone patient' based on his observations of people who experience pain. Accordingly, he argued that people suffering from pain may have certain characteristics. Emphasizing that these characteristics can be influenced by psychological and social factors as well as physical, he showed an approach that the factors affecting the experience of pain should be examined holistically. Emotional and social components such as childhood experiences or unconscious conflicts of patients may cause pain experience, pain may occur in a 'punitive' nature as a result of the sense of guilt in the person, emotional and social components such as modeling another person in the family who suffers from pain or turning pain into a 'reward' by receiving attention from relatives due to pain are considered as examples of the characteristics of the 'pain-prone patient'.

Biopsychosocial Model of Pain

The exclusion of social and psychological dimensions in the biomedical model has led to challenges in disease treatment. In response, the biopsychosocial model was introduced, which offers a more holistic approach to understanding illness, treatment, and well-being (Engel, 1977). This model posits that the mind and body interact rather than function as separate entities. Instead of attributing disease solely to biological factors, such as chemical and genetic processes affecting the individual from external sources, it incorporates psychological (e.g., emotions, thoughts, beliefs) and social (e.g., cultural norms, unemployment) influences (Borrell-Carrió et al. 2004, Taukeni, 2019).

Gate Control Theory

The gate control theory proposed by Melzack and Wall (1965) offers an important explanation in terms of

biopsychosocial evaluation by providing a multidimensional approach to pain. According to this theory, the dorsal horn region in the brain acts as a gate in the transmission of skin stimuli to the brain via peripheral nerves and controls the passage of these stimuli. Pain perception is realized through this gate; when the gate is open, pain perception occurs and the intensity and frequency of pain may increase, while when it is closed, the opposite situation occurs. However, the gate control mechanism controls not only the stimuli going to the brain but also the stimuli coming from the brain. This means that the mechanism is also affected by psychological and social factors without the presence of physical tissue damage that may cause pain; therefore, pain may occur not only due to physiological causes, or conversely, pain may not be felt when tissue damage occurs. For example, in the Second World War, it was observed that some American soldiers stated that they did not feel pain despite being seriously injured and refused to take medication for treatment (Melzack and Wall 1965). Within the framework of the gate control theory, this situation was explained by the closing of the door that enables the perception of pain due to the high joy experienced by the soldiers who survived the war.

Neuromatrix Theory of Chronic Pain

Melzack developed the 'neuromatrix theory of pain' based on Selye's (1950) stress theory after introducing the gate control theory, which brought significant innovations to the understanding of chronic pain. According to this model, a network system (neuromatrix) including structures such as the limbic system, thalamus, and cortex in the brain is effective in the emergence of pain experience. The neuromatrix network is activated through cognitive (attention, past experiences, anxiety, etc.), sensory (stimulation from the musculoskeletal system, internal organs, and skin), and emotional (limbic system and stress mechanism) inputs and contains a pattern of nerve stimulation with individualized and characteristic features. The interaction of these inputs creates the outputs of the neuromatrix related to pain perception, stress regulation, and behavioral patterns. Thus, thanks to the synaptic structure of the neuromatrix produced with the help of genetic and sensory factors, a personalized pain experience with a 'neurological signature' emerges. Sensory inputs and stress also affect the neurological signature. Especially due to problems in regulating stress, damage can occur in bone, muscle, and nerve tissues that can cause chronic pain (Melzack 1999).

Trauma and Chronic Pain

Psychological Trauma

A traumatic experience is an event that exceeds an individual's coping capacity, potentially altering their self-perception—either temporarily or permanently—and triggering various psychological and physical reactions (van der Kolk and van der Hart 1991). The introduction of the term 'psychological trauma' into the literature was influenced by large-scale events such as World Wars I and II, the Vietnam War, and the Gulf War, all of which had a devastating impact on human psychology (Jones and Wessely 2006). Reactions such as uncontrollable involuntary thoughts and/or images about the event, excessive arousal, and reactivity, and avoidance of situations and places that may remind the event are quite common after a traumatic experience and suggest that the person may be experiencing 'psychological trauma'.

Recently, there has been an increasing interest in studies on physiological symptoms accompanying psychological trauma. Especially in studies on pain, psychological trauma—independent of PTSD—emerges as a significant risk factor in the chronicization of pain without specific diagnosable causes. Some studies have examined whether there is a difference in the pain perceptions of chronic pain patients with and without trauma experience. In chronic pain patients with a history of trauma, lower pain thresholds and higher pain sensitivity have been observed in both painful and non-painful body regions. In contrast, in patients without a history of trauma, a lower pain threshold has been identified only in the painful area. These findings suggest that psychological trauma may play a role in the mechanisms contributing to pain exacerbation (Tesarz et al. 2015).

Post Traumatic Stress Disorder (PTSD)

Although PTSD does not necessarily occur inevitably as a result of psychological trauma (Jones and Wessely 2006), when the reactions mentioned for psychological trauma last longer than one month, it is considered 'Posttraumatic Stress Disorder' (PTSD) according to the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) (APA 2013).

Many studies have shown that PTSD is closely related to physical complaints, including chronic pain (Beckham et al. 1997, McFarlane 2010, Pacella et al. 2013, Gupta 2013, Ryder et al. 2018, Kind and Otis 2019). Pain experience is one of the most common complaints reported by people diagnosed with PTSD (Gasperi et al. 2021), and 25% to 80% of them also complain about chronic pain (Beckham 1997, Otis et al. 2003). In addition, studies conducted with chronic pain patients have revealed that patients with PTSD have more severe psychological problems and use more negative coping strategies than those with chronic pain alone (Alschuler and Otis 2012, Bair et al. 2020). They were also found to have higher levels of pain catastrophizing, pain intensity, and disability (Benedict et al. 2020).

When examining the reasons behind the widespread co-occurrence of PTSD and chronic pain, a single traumatic experience may sometimes lead to the development of both. However, more often, other factors come into play, such as shared vulnerability and mutual maintenance (Andersen et al. 2016, Murphy 2022). These concepts will be briefly discussed.

According to Asmundson et al. (2002), who propose a common vulnerability model for the co-occurrence of PTSD and chronic pain, there are some common symptoms in terms of cognitive, physical, and behavioral aspects: increased bodily preoccupation, hyperarousal, anxiety, and avoidance behaviors. In particular, anxiety sensitivity, which is characterized by fear of anxiety itself and fear of bodily sensations, paves the way for the development of both conditions and is one of the most important predisposing factors (Taylor 1999). Anxiety sensitivity is seen to be quite high in people with PTSD, but it is especially common in patients with persistent headaches and musculoskeletal pain. However, when the event that causes the development of trauma and the emergence of pain are the same or occur in close time intervals, the possibility of reacting to both situations with anxiety sensitivity increases, thus creating sensitivity to the development of both disorders (Asmundson 2002).

According to the 'reciprocal continuum model' (Sharp and Harvey 2001), cognitive, physical, emotional, and behavioral components of chronic pain play a role in the proliferation and/or persistence of symptoms of PTSD. In the same way, a reverse effect can also be seen; that is, PTSD is also effective on the symptoms of chronic pain. For example, chronic pain serves as a reminder of the traumatic experience, leading to heightened arousal and reinforcing avoidance behaviors related to pain. However, over time, this avoidance behavior may become a mechanism that perpetuates PTSD and the chronicity of pain (Liedl and Knaevelsrud 2008).

In summary, different perspectives exist on how trauma affects pain in the context of PTSD. Some suggest that the prolonged 'hyperarousal' response to a traumatic event contributes to chronic pain (McFarlane 1994, Boals et al. 2012). Others argue that heightened stress sensitivity makes the body more prone to pain and other physical symptoms when exposed to stressors (Raphael and Widom 2011). Another view is that pain arises as a result of avoiding and suppressing primary emotions associated with trauma (Lumley et al. 2015).

Childhood Traumas

Childhood trauma refers to the psychological impact of a sudden or prolonged external event that overwhelms a child's ability to cope, leading to feelings of helplessness. It is categorized into various subtypes, including physical abuse, sexual abuse, emotional abuse, physical neglect, and emotional neglect (Terr 2003). The definition of child abuse, according to the World Health Organisation (WHO 2021), is: 'Behaviours that adversely affect the health and physical development of the child and are done knowingly or unknowingly by an adult, society or country'.

For a child to calm down in response to stressful stimuli and regulate emotions by balancing their physiological arousal, the presence of caregivers with whom they can form secure bonds is essential. The bonds a child forms with significant others serve as a protective factor against trauma and shape their responses to stress throughout life. In cases of abuse and domestic violence, neglectful, inconsistent, or bullying caregivers fail to soothe the arousal caused by trauma. In this situation, the child often uses fight, flight, or freeze reactions and has difficulty organizing the experience (Van der kolk 2003). Since children struggle more than adults to regulate their responses to trauma, early-life trauma has more severe effects and is a significant predictor of adult mortality risk (Felitti et al. 1998). Due to its negative effects on brain development, early-life trauma predisposes the individual to various psychiatric diseases (Zlotnick et al. 2008), negative biological changes (Terr 2003), and an increased risk of chronic diseases (Dong et al. 2004). Physical diseases, including ischaemic heart disease, cancer, and chronic lung, liver, and bone diseases, have been significantly associated with a history of abuse in childhood (Felitti et al. 1998).

In terms of pain, various studies have found that people who have been exposed to childhood traumas have lower pain tolerance (Pieritz et al. 2015) and higher pain levels. Furthermore, research has shown that various forms of childhood trauma contribute to pain in adulthood. Emotional abuse (Brown et al. 2018) and neglect (Poli-Neto 2018) have been identified as the most significant types, and physical and sexual abuse are also recognized as major factors in the development of chronic pain symptoms in adulthood. The presence of PTSD alongside childhood trauma further amplifies this risk (Raphael and Widom 2011).

Pain and Emotions

Emotions, which are an extremely important form of information processing for human life, have various functions, primarily to serve survival, to provide defence against dangerous situations, and to perform other important tasks. At the same time, emotions motivate people to initiate and terminate behaviors and are also very important in evaluating the consequences of behaviors. People base their behavior on their positive and negative feelings as well as their thoughts. Therefore, emotions create a driving force to take actions in a way to minimise unpleasant affect and maximise positive affect (Greenberg 2004, Uslu and Gizir 2019). Positive emotions include active, enthusiastic, vigorous, and strong feelings associated with satisfaction. In contrast, negative emotions encompass stressful, fearful, hostile, tense, and dull feelings. The physical manifestations of emotions can appear in various forms, such as trembling, sweating, rapid heartbeat, facial flushing, or a fluttering sensation in the stomach (Burger 2006).

High-intensity negative emotions have a positive relationship with the intensity of pain as well as many physiological problems such as irritability, physical tension and sensitivity, insomnia, and fatigue (Ciuffini et al. 2023). At the same time, various studies have revealed that people with chronic pain problems experience more negative emotions such as anger, hostility, tension, restlessness, guilt, and anxiety (Keefe 2001, Lumley 2011, Shuchang et al. 2011). In this relationship between emotions and pain, it is quite difficult to determine the causality of which is the cause and which is the effect (Wiech and Tracey 2009). Firstly, if the experiences after the onset of pain are considered, it is possible to say that negative emotions can arise from various situations, including pain itself (Lumley 2011). A negative emotional state affects the person cognitively and behaviorally, causing the pain experience to change in various ways (Lumley 2011), thus bringing unwanted effects in the pain management process (Shuchang et al. 2011) and increasing the feeling of dissatisfaction with pain (Loggia et al. 2008). However, it is important to note that pain itself can also have a detrimental effect on an individual's emotional state, through biological and behavioral responses. Indeed, the experience of chronic pain has been demonstrated to induce anatomical and functional changes in the relevant parts of the brain, which can in turn give rise to emotional difficulties (Bushnell et al. 2013). Furthermore, the experience of prolonged pain can be perceived as a threat to one's physical integrity, daily activities, and overall quality of life. Consequently, the phenomenon of "secondary pain effect" emerges, characterised by the onset of long-term emotional disturbances (Price 2000).

It is evident that negative emotions are not only consequential after the onset of pain but also serve as a significant risk factor for its emergence and intensification. Therefore, emotions play a crucial role in the mechanisms underlying pain (Keefe 2001). There is increasing scientific evidence that stressful life events

and a history of psychological trauma can cause a predisposition to chronic pain, and negative emotions that cause high levels of arousal as a result of such experiences can also be effective in the onset and intensification of pain (Lumley 2011, Yavne et al. 2018, Janssen et al. 2022). However, it is important to consider the possibility that internal conflicts, which are not considered to be a history of trauma but rather arise from relationship problems or challenging emotions such as shame and guilt, may activate certain neural pathways in the emergence and maintenance of pain, in a manner similar to that of trauma (Lumley et al. 2015). Moreover, certain studies have demonstrated that the presence of a concrete noxious stimulus is not a prerequisite for the onset of pain, and that these regions can be activated, and pain experience can occur, simply by observing another individual experiencing pain. In this regard, empathy exerts a significant influence on the experience of pain (Loggia et al. 2008). This phenomenon has been found to be particularly pronounced when the observer is close to the individual experiencing pain, particularly if the individual observed is a loved one (Loggia et al. 2008, Cheng et al. 2010).

Research on anxiety has also demonstrated that anxiety can lead to an increase in perceived pain intensity and a decrease in pain tolerance (Michaelides and Zis 2019), and is therefore thought to have a long-term effect on the chronicization of pain (Lumley 2011). Furthermore, studies on both human and animal subjects have demonstrated that diazepam, a drug that is effective in the treatment of anxiety, can result in a decrease in pain sensitivity and pain intensity (Andre et al. 2005, Benedetti et al. 2006).

In the relationship between emotions and pain, one perspective suggests that individuals may have a unique sensitivity in the specific area of the body where the pain is located, as well as in the surrounding regions. This notion proposes that muscle tension in these regions is increased by negative emotions, resulting in the manifestation of pain. For instance, research has demonstrated that individuals experiencing lower back pain exhibit exaggerated contractions in the lower back muscles in response to negative affect, and that muscle tension takes longer to recover in comparison to that observed in healthy individuals. Furthermore, research indicates that this heightened sensitivity is most evident in patients experiencing chronic low back pain, particularly when they are experiencing anger (Burns 2006). Anger has been identified as the most prevalent emotion in chronic pain patients, in comparison to other negative emotions such as guilt, fear, sadness, and shame (Fernandez and Milburn 1994). Anger, a highly destructive emotion (Soykan 2003), can result in a multitude of adverse psychological, social, and physiological consequences (Martin and Watson 1997). Furthermore, how anger is experienced and managed in daily life can have a substantial impact on the coping process with physical illnesses, particularly chronic pain (van Middendorp et al. 2010, Russell et al. 2016). Given anger's significant role among other emotions in the context of chronic pain, a detailed examination of anger is warranted.

The distinction between different ways of experiencing anger in the form of ‘suppression’ and ‘expression’ is also very important. Aggressive behaviors (e.g. slamming doors, physical attacks, insults) directed towards other people and/or objects are defined as anger-out, while anger-in is defined as anger-suppressed if it is not expressed in any way, even if it is felt intensely (Spielberger et al. 1995). The suppression of anger has been identified as a contributing factor to an individual's heightened vulnerability to pain, and it has been associated with elevated levels of pain and impaired functioning (Bruehl et al. 2006, Burns et al. 2008, van Middendorp et al. 2010, Burns et al. 2015, Russell et al. 2016). Furthermore, the expression of anger in a hostile or aggressive manner, as opposed to its suppression, has been demonstrated to be a contributing factor to issues pertaining to pain, as well as the phenomenon of anger suppression itself (Martin and Watson, 1997).

The distinction between 'state anger' and 'trait anger' is made on the basis of the duration of anger. State anger is defined as a psychobiological state ranging from mild anger to intense anger, with the activation of the autonomic nervous system under the influence of various unpleasant situations. Trait anger, in contrast, refers to the frequency with which anger is experienced over time. Research has indicated that individuals with high levels of trait anger tend to perceive a broader range of events as potentially arousing, in contrast to those with low levels. Consequently, they exhibit heightened sensitivity to anger and experience a greater degree of physiological arousal (Spielberger et al. 1995, Russell et al. 2016). Concurrently, the role of externalised trait anger in the exacerbation of acute pain and its subsequent transformation into chronic pain is noteworthy (Burns 2006). While the relationships between both high

muscle tension and increased central adipose tissue in this effect of trait anger can explain the emergence of chronic pain, the same is not true for acute pain (Bruehl et al. 2006). Consequently, the interplay between anger and pain can lead to the predisposition for pain, the onset, exacerbation and/or persistence of pain, as well as the experience of anger in response to pain (Fernandez 2005).

A review of brain imaging studies on pain reveals an interaction between brain regions involved in pain perception and those responsible for emotional processing. It has been reported that pain-related components are encoded in the parts of the limbic system called 'anterior cingulate cortex' and 'insula', which are responsible for emotions (deCharms et al 2005, Bushnell et al. 2013) and changes are observed in these areas with the experience of positive and negative emotions (Schweinhardt and Bushnell 2010). This phenomenon illuminates the underlying mechanisms that precipitate the co-occurrence of depression, a prevalent mood disorder characterised by persistent negative emotions (Alsancak-Akbulut 2018), and chronic pain (Corruble and Guelfi 2000, Bair et al. 2003, Wiech and Tracey 2009, Bushnell et al. 2013, Snyder and Handrup 2018, Roughan et al. 2021). Indeed, these brain regions play a critical role in the development of depression (Sheng et al. 2017).

Depression is recognised as the most prevalent mental disorder associated with chronic pain (Demyttenaere et al. 2007). However, the relationship between chronic pain and depression is complex, and the causality between them is not fully elucidated (Surah et al. 2014). Each condition may occur independently or chronic pain and depression may develop secondary to each other. In instances where depression precedes the onset of chronic pain, it is theorised that depression may contribute to the development of chronic pain by increasing pain sensitivity and reducing the pain threshold. Indeed, a significant proportion of depressed patients also report experiencing pain (Tyrer 1992, Demyttenaere et al. 2007, Miller and Cano 2009, Surah et al. 2014). This phenomenon points to the physical reflections of a psychological disorder (Magni et al. 1994). However, the presence of chronic pain is itself a risk factor for the development of depression. Chronic pain has a negative impact on mood as it is a long-term stress factor that limits the individual's participation in physical and social activities and general mobility. This phenomenon can potentially contribute to the onset of depression, particularly in cases where individuals adopt a passive role and experience feelings of isolation and worthlessness, resulting in diminished self-control due to the constraints imposed by the pain. Consequently, depression is regarded as a maladaptive response to pain (Romano and Turner 1985, Williamson and Schulz 1992, Von Korf and Simon 1996, Surah et al. 2014).

One of the factors involved in the co-occurrence of pain and depression is the change in serotonin levels. Normally, pain signals are modulated by various chemicals, particularly serotonin, but decreased serotonin levels prevent adequate modulation. This has been shown to increase sensitivity to pain and decrease the functionality of the areas responsible for controlling pain, thereby leading to an exacerbation of pain. A decline in serotonin levels is a recognised causative factor in depression, and it is frequently observed that these two conditions co-occur. This suggests that there are brain chemicals shared by both disorders, which explains the use of antidepressant drugs in the treatment of both disorders (Salerno et al. 2002, Verdu et al. 2008, Mika et al. 2013, Surah et al. 2014, Roughan et al. 2021).

In addition to the strong effect of serotonin, the dopaminergic system, which is closely related to the reward center in the brain, has a very close relationship with pain. In studies examining this system, it is one of the important findings that when positive emotions are experienced, activity in the dopaminergic system increases and thus pain intensity decreases. From this point of view, it is possible to say that chronic pain patients have abnormalities in the dopaminergic system and the decrease in dopamine levels increases the severity of pain (Navratilova et al. 2016, Mohammadi 2021). Therefore, in contrast to the effects of negative emotions on chronic pain, positive emotions generally have a pain-reducing effect (Lumley 2011). Indeed, some laboratory studies conducted with applications such as reading texts and watching movie scenes that contain content to reveal various emotions have revealed that negative mood causes an increase in pain, while positive mood causes a decrease (Zelman et al. 1991, Meagher et al. 2001, Wunsch et al. 2003, Kenntner-Mabiala and Pauli 2005). Similarly, positive emotions serve as a buffer by alleviating the impact of dysfunctional cognitions and negative emotions on pain, thereby contributing to more effective pain management (Finan and Garland 2015). In summary, positive emotions have an

important effect on the reduction in pain intensity and even the termination of pain and increase in physical functionality (Müller et al. 2022).

Apart from positive and negative emotions, it is considered beneficial to refer to the concept of alexithymia, which is defined as "absence of words for emotions". This condition basically points to difficulties in recognizing and verbalizing one's emotions. Since alexithymic individuals are unable to comprehend their emotions, they are not aware of their disturbing emotions. The tension caused by these emotions is expressed through the body, thus paving the way for the emergence of physical complaints. For this reason, alexithymia has been frequently included in studies on psychosomatic disorders (Krystal 1979, Lesser 1981, Sifneos 1996, Epözdemir 2012).

Alexithymia has been identified as a significant factor in research on chronic pain. Numerous studies have demonstrated that individuals experiencing chronic pain frequently exhibit higher levels of alexithymia compared to those without this condition. Considering the studies conducted, chronic low back pain (Margalit et al. 2014), chronic facial pain (Haas et al. 2013, Castelli et al. 2013, Mingarelli et al. 2013), migraine (Karşıkaya et al. 2012, Vieira et al. 2013), irritable bowel syndrome (Phillips et al. 2013, Porcelli et al. 2014), fibromyalgia (Madenci et al. 2007, Baeza-Velasco et al. 2012, Peñacoba-Puente et al. 2013, Martínez et al. 2015, Di Tella et al. 2015) and other chronic pain conditions (Saariaho et al. 2013, Shibata et al. 2014, Saariaho et al. 2015) have higher levels of alexithymia than those without pain. However, although limited in number, there are studies that do not support this perspective (Mendelson 1982).

Conclusion

The studies reviewed in this article support the hypothesis that chronic pain is not solely caused by biological factors, but may also be associated with a history of trauma and emotional processes. Consequently, while the experience of pain itself can induce psychological distress, challenging circumstances such as traumatic experiences involving negative emotions, interpersonal challenges, and exposure to neglect and abuse during childhood can also contribute to the development of chronic pain (Mills et al. 2019). A review of studies addressing chronic pain and trauma reveals a predominant focus on PTSD and childhood traumas. It is noteworthy that childhood traumas have gained an important place in the literature on pain in Türkiye (Sinani 2012, Atagün 2013, Bayram and Erol 2014, Serhatlı 2016, Karaş 2017, Karataş 2022), while there are fewer studies on PTSD (Karşıkaya et al. 2013, Cankardaş 2020). A review of studies on chronic pain conducted abroad reveals that childhood traumas (Goldberg and Goldstein 2009, Nicolson et al. 2010, Sansone 2013, Kascakova et al. 2020, Walton et al. 2021, Tidmarsh 2022) as well as PTSD (Sharp and Harvey 2001, Otis 2003, Liedl and Knaevelsrud 2008, Beck et al. 2011, Benjamin et al. 2013, Bosco et al. 2013, Scioli-Salter 2015, Fishbain et al. 2017) are observed. Despite the numerous studies that have demonstrated the significant impact of both conditions on the chronicisation of pain, it is acknowledged that traumatic experiences that do not meet the diagnostic criteria for PTSD and are not categorised as childhood trauma also play a pivotal role in the development of chronic pain (Tesarz et al. 2015). Indeed, there is evidence to suggest that therapeutic interventions aimed at addressing challenging emotions stemming from traumatic experiences can lead to a reduction in chronic pain (Lumley, 2008). Similarly, a significant decrease in fibromyalgia symptoms was found after the application of EMDR (Eye Movement Desensitization and Reprocessing), a psychotherapy technique that works with traumas (Kavakçı et al. 2010, Zat-Çiftçi et al. 2024). In another study, EMDR was reported to be an effective technique in reducing chronic pain problems (Grant and Threlfo 2000). In consideration of the findings, it is considered to be of paramount importance to identify and treat psychological traumas in patients suffering from chronic pain.

In considering the relationship between emotions and pain, a vicious cycle is identified. This cycle begins with chronic pain, which in turn leads to negative emotions. These emotions, in turn, further exacerbate the chronic pain (Wiech and Tracey 2009, Shuchang et al. 2011). Negative emotions are important in terms of creating the mechanism of chronic pain in contexts such as stimulating pain-related centers, causing physiological sensitivity and increasing pain sensitivity. Moreover, anger has been identified as a salient factor in numerous studies examining chronic pain. The extant literature suggests that anger is a

significant contributing factor to the development of chronic pain. Conversely, positive emotions have received comparatively less research attention. Studies have been conducted on the significance of positive emotions in the management of pain rather than their role in underlying mechanisms. For instance, studies that have employed positive psychology practices to elicit positive emotions have demonstrated that this can effectively alleviate pain (Keeris 2015, Ziadni et al. 2020, Müller et al. 2020, Müller et al. 2022).

In the context of mind-body interaction, numerous practices that focus on the regulation of the mind over the body have been embraced and are gaining widespread acceptance within the field of chronic pain research. The utilisation of techniques such as relaxation techniques, hypnosis and meditation, which possess emotional components and are employed in the management of pain, constitutes a significant therapeutic domain. Specifically, experimental studies on meditation have demonstrated its efficacy in alleviating pain and its protective effect on the brain circuits responsible for regulating pain (Hölzel et al. 2011, Lutz et al. 2013, Bushnell et al. 2013)

Based on all these research findings, the importance of the biopsychosocial model in explaining the etiology of chronic pain has been revealed, and it has been proven that pain felt as a physical phenomenon cannot be understood by considering only the physiological components. Therefore, the factors affecting the sensitivity to pain in the individual should be addressed not only biologically but also psychologically and socially; it should always be taken into consideration that the cognitive, emotional processes and lifestyle of the individual may have important roles by creating a 'predisposition to pain' (Engel 1959). From this perspective, it is crucial to adopt a multifaceted, comprehensive treatment approach that also focuses on mental health in the treatment of chronic pain (Gonzales et al. 2000, Sertel-Berk and Bahadır 2007, Tütüncü and Günay 2011).

The present article aims to combine these three important areas in the literature by focusing on the relationship between chronic pain and trauma, as well as emotional processes. In Türkiye, there are limited studies that address chronic pain in terms of psychological trauma and emotional processes in the background of pain or accompanying pain. In this context, the present study explains different types of trauma and emotions separately to elucidate their roles in the chronicity of pain. The findings discussed in this context are also instructive for the treatment of chronic pain. In light of their role in the etiology of pain, it can be hypothesised that enhancing emotion regulation skills may facilitate pain management, in addition to trauma- and emotion-focused psychotherapy methods.

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