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An Experimental Approach to Examining Psychological Contributions to Multisite Musculoskeletal Pain

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Abstract: The present study examined the prospective value of pain catastrophizing, fear of pain, and depression in the prediction of multisite musculoskeletal pain following experimentally induced delayed-onset muscle soreness (DOMS). The study sample consisted of 119 (63 females, 56 males) healthy university students. Measures of pain catastrophizing, fear of pain, and depression were completed prior to the DOMS induction procedure. Analyses revealed that pain catastrophizing and fear of pain prospectively predicted the experience of multisite pain following DOMS induction. Analyses also revealed that women were more likely to experience multisite pain than men. There was no significant relation between depressive symptoms and the experience of multisite pain. The discussion addresses the mechanisms by which pain catastrophizing and fear of pain might contribute to the spreading of pain. Clinical implications of the findings are also addressed.

***Perspective:** The results of this experimental study suggest that pain catastrophizing and fear of pain might increase the risk of developing multisite pain following musculoskeletal injury.*

***Key words:** Multisite pain, fibromyalgia, catastrophizing, fear of pain, depression, sex differences.*

Recent research indicates that musculoskeletal pain frequently occurs at more than 1 anatomic site.[6,9,47] A survey of patients attending general practice clinics revealed that three quarters of chronic pain patients reported pain in more than 1 site.[6] Multisite pain has been associated with poorer prognosis as indicated by heightened susceptibility to chronicity, increased health and mental health problems, and greater disability.[11,32,33,38] In light of the high prevalence and increased costs associated with multisite pain, clinical researchers have called for more research on risk factors and determinants of multisite pain.[33,38]

Psychological factors such as pain catastrophizing, fear of pain, and depression have been discussed as possible risk factors for the development of multisite pain.[4,9] Although it has been suggested that psychological variables might play a role in the onset or maintenance of multisite pain, the correlational nature of clinical studies precludes strong statements about causality. On the basis of research conducted to date, it cannot be ruled out that psychological variables such as pain catastrophizing, fear of pain, and depression might be consequences rather than antecedents of multisite pain.

The present study used an experimental approach to address the possible antecedent status of psychological variables in the experience of multisite pain. One advantage of using an experimental approach is that putative psychosocial risk factors can be assessed before pain induction, thereby permitting examination of the antecedent status of the variables. In addition, experimental methods permit specification and standardization of the pain stimulus, whereas the pain stimulus of many clinical pain conditions is unknown. To date, no experimental study has addressed the influence of psychological variables on the development of multisite pain.

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In the present study, measures of pain catastrophizing, fear of pain, and depression were administered in healthy young adults while they were in a pain-free state. Musculoskeletal pain was then induced by means of a delayed-onset muscle soreness (DOMS) protocol.[1,8] DOMS is characterized by soreness, swelling, stiffness, and strength loss in the 24- to 48-hour period following a strenuous bout of exercise.[1,63] The muscle soreness that develops following strenuous exercise is the result of structural damage to the involved muscles, triggering a localized inflammatory response that produces pain on movement or tactile stimulation.[65] DOMS has been associated with a number of pain-related changes, such as allodynia,[13] referred pain,[26] and temporal summation,[49] similar to those observed in clinical pain conditions. Given the similarities in symptoms and pathophysiology, several investigators have used DOMS as an experimental analog for musculoskeletal injury.[24,43,62]

The day following the DOMS protocol, participants returned to the laboratory and were asked to complete a body drawing to indicate the distribution of their pain symptoms. For the purposes of this study, multisite pain was operationalized as the number of body sites where participants reported experiencing pain. It was hypothesized that pain-related psychological variables would prospectively predict multisite pain following the DOMS protocol.

Demonstrating a prospective relation between psychological variables and multisite pain would have important clinical and theoretical implications. From a clinical perspective, knowing that certain psychological factors represent a heightened risk for multisite pain could permit early identification of high-risk individuals and might also provide the empirical foundation for the development of new avenues of intervention that might prevent the development or reduce the severity of multisite pain. From a theoretical perspective, findings linking psychological variables to the development of multisite pain would bring greater precision to conceptual models that address the mechanisms underlying the development of multisite pain.[31,53]

Methods

Participants

The study sample consisted of 119 healthy undergraduate students (63 females, 56 males). Participants were recruited through advertisements placed in the classifieds section of the McGill University website. The mean age of the sample was 22.3 years, with a range of 18–52 years. A standardized telephone interview was used to screen participants for the exclusion criteria. Individuals were not considered for participation if 1) they had a medical condition that could be aggravated by participation in the study, 2) they suffered from a chronic pain condition, 3) they were currently experiencing joint or muscle problems, or 4) they had engaged in resistance training of upper body or trunk muscles more than once per week in the 6 months prior to participation.

Measures

Contraindications to Physical Activity

The Physical Activity Readiness Questionnaire (PAR-Q) was used as a screening measure for potential contraindications to participation in the DOMS induction procedure. The PAR-Q screens for the presence of factors that are linked to increased health risk when engaging in strenuous activity (eg, shortness of breath, muscle or joint problems, fainting, circulatory problems). Participants endorsing any item on the PAR-Q were excluded.[61]

Depression

The Patient Health Questionnaire-9 (PHQ-9) was used to assess the severity of depressive symptoms. On this scale, respondents indicate how often they have been troubled by each of 9 symptoms of depression during the last 2 weeks.[52] A number of studies have supported the reliability and validity of the PHQ-9 as a measure of depressive symptom severity.[27,36,41]

Pain Catastrophizing

The Pain Catastrophizing Scale (PCS) was used to measure catastrophic thinking related to pain. Participants indicated the frequency with which they experienced each of 13 different thoughts and feelings when in pain. Ratings were made on a 5-point scale with the endpoints 0 (not at all) and 4 (all the time). Research has supported the reliability and validity of the PCS.[35,56]

Fear of Pain

The Fear of Pain Questionnaire-III–Short Form (FOP-III-SF) was used to assess pain-related fears. The FOP-III-SF is a 20-item self-report instrument describing different painful situations. Respondents are asked to rate how fearful they are of experiencing the pain associated with each situation described in the item content. Fear intensity ratings are made on a 5-point scale with the endpoints 1 (not at all) and 5 (extreme). Research has supported the reliability and validity of the FOP-III-SF.[2]

Multisite Pain

A schematic body drawing modeled after Margolis and colleagues[44] was used to assess the distribution of pain symptoms. Immediately after lifting a weighted canister (2.9 kg), participants shaded in the areas on the drawing that corresponded to where they felt pain. The schematic body drawing is subdivided into 45 different areas, covering the entire body. A score of 1 was assigned to any area that participants had shaded to indicate the experience of pain. A score of 0 was given if an area had been left blank. Four criteria were applied when determining if shading was present: 1) any mark within a body area was assigned a score of 1 regardless of the extent of shading, 2) marks to indicate intensity were disregarded, 3) circling of an area was counted as though the entire circled area had been shaded, and 4) any marks outside the schematic body drawing were disregarded. Consistent with Bortsov and colleagues,[4,5] multisite pain was assessed as the number of sites on the body