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Implicit evaluations and physiological threat responses in people with persistent low back pain and fear of bending

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HIGHLIGHTS

- Self-report does not always reflect implicit associations of movement and threat.
- People with back pain showed implicit associations between bending and danger.
- Viewing a threat was not sufficient to elicit physiological defensive responses.
- Exposure to unavoidable movement may be needed to elicit physiological responses.
- Results are consistent with contemporary views on 'fear' in the fear-avoidance model.

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ABSTRACT

Background and aims: Pain and protective behaviour are dependent on implicit evaluations of danger to the body. However, current assessment of perceived danger relies on self-report, on information of which the person is aware and willing to disclose. To overcome this limitation, attempts have been made to investigate implicit evaluation of movement-related threatening images in people with persistent low back pain (PLBP) and pain-related fear. Lack of specificity of the sample and stimuli limited those explorations. This study investigated implicit evaluations and physiological responses to images of tasks commonly reported as threatening by people with PLBP: bending and lifting. We hypothesized that people who differ in self-reported fear of bending with a flexed lumbar spine (*fear of bending*) would also differ in implicit evaluations and physiological responses.

Methods: This study used a convenience sample of 44 people (54% female) with PLBP, who differed in self-reported *fear of bending*. Participants completed a picture-viewing paradigm with pleasant, neutral and unpleasant images, and images of people bending and lifting with a flexed lumbar spine ('round-back') to assess physiological responses (eye-blink startle modulation, skin conductance). They also completed an implicit association test (IAT) and an affective priming task (APT). Both assessed implicit associations between (i) images of people bending/lifting with a flexed lumbar spine posture ('round-back' posture) or bending/lifting with a straight lumbar spine posture ('straight-back' posture), and (ii) perceived threat (safe vs. dangerous).

Results: An implicit association between 'danger' and 'round-back' bending/lifting was evident in all participants (IAT (0.5, CI [0.3; 0.6]; $p < 0.001$) and APT (24.2, CI [4.2; 44.3]; $p = 0.019$)), and unrelated to self-reported fear of bending (IAT ($r = -0.24$, 95% CI [−0.5, 0.04], $p = 0.117$) and APT ($r = -0.00$, 95% CI [−0.3, 0.3], $p = 0.985$)). Levels of self-reported fear of bending were not associated with eye-blink startle ($F(3, 114) = 0.7$, $p = 0.548$) or skin conductance responses ($F(3, 126) = 0.4$, $p = 0.780$) to pictures of bending/lifting.

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Conclusions: Contrary to our expectation, self-reported fear of bending was not related to physiological startle response or implicit measures. People with PLBP as a group (irrespective of fear levels) showed an implicit association between images of a round-back bending/lifting posture and danger, but did not display elevated physiological responses to these images. These results provide insight to the understanding of the relationship between pain and fear of movement.
Implications: The potential clinical implications of our findings are twofold. First, these results indicate that self-report measures do not always reflect implicit associations between particular movements and threat. Implicit association tasks may help overcome this limitation. Second, a lack of the predicted physiological and behavioural responses may reflect that the visualization of a threatening task by people in pain does not elicit the same physiological defensive responses measured in people with fear of specific objects. It may be necessary to expose the person to the actual movement to elicit threat-responses. Together, these results are consistent with current views of the role of 'fear' in the fear-avoidance model, in which a fear response may only be elicited when the threat is unavoidable.

1. Introduction

Modern understanding of the relationship between pain and fear poses that both can be considered emergent protective feelings [1,2], broadly captured by the idea that pain emerges when the organism concludes that a body part needs protecting and fear emerges when the organism concludes that the entire body needs protecting [3–5]. Within this conceptualization, pain and fear are dependent on implicit evaluations of danger to the body [3–5]. However, current assessment of perceived danger to the body relies solely on explicit, or self-report, measures [6–8], which require conscious reflection, only accessing information of which a person is aware and which they are willing to disclose [1,9–11]. To overcome this limitation, attempts have been made to investigate implicit evaluation of movement-related threatening images in people with persistent low back pain (PLBP) and pain-related fear [1,2,12].

Explorations of implicit attitudes of people with PLBP found no implicit association between 'danger words' and movement-related threatening images, despite participants explicitly evaluating the stimuli as aversive [1,2]. A common limitation of these studies [1,2,12] was the use of a wide range of threatening images (e.g. driving, hanging a coat, digging, running) [1,2] and words (e.g. warning, AIDS, fatal) [1,2]. Those stimuli lack threat-specificity, which is an important aspect of fear/danger assessment [13,14].

Investigations of physiological threat-responses in people with PLBP and pain-related fear [12–14] report mixed results [14]. One study found that people with high fear display enhanced autonomic arousal (indexed by skin conductance) in anticipation of performing a task they perceived as harmful [15]. Different from autonomic arousal measures, eye-blink startle modulation enables assessment of the emotional valence of stimuli [16–18]. Thus far, only one study recorded eye-blink startle as a measure of threat-responses in people with PLBP [12], and found no difference between those reporting high and low fear beliefs [12] when presented with pictures of back pain-related movements (e.g. bending and rotation). Although a pilot sample determined the images were sufficiently aversive, participants did not report feeling 'fearful' of performing the depicted tasks [12]. That study may have been limited by a non-specific sample, based on a generic fear-avoidance beliefs questionnaire [12], and by not using task-specific or personally-threatening stimuli.

Considering that threat-specificity is critical for evaluating perceived danger to the body, the current study selected a group of people with PLBP reporting different levels of explicit fear of bending with a flexed lumbar spine (*fear of bending*). This movement was chosen because bending and lifting are one of the most feared tasks for people with and without LBP, holding a high threat-value in western society [19–23]. To investigate implicit evaluations of danger, we employed implicit measures of attitude (affective priming task – APT [28], and implicit association test – IAT [19]), and physiological responses (eye-blink startle modulation [16–18], and skin conductance [15,18]) to images of people bending and lifting with a flexed lumbar spine ('round-back' posture). We hypothesized that: (1) Higher levels of explicit *fear of bending* would be positively associated with higher levels of implicit association between round-back bending/lifting and danger. (2) Physiological threat-responses to pictures of round-back bending/lifting would be enhanced in people with higher self-reported *fear of bending*.

2. Materials and methods

This section and Table 1 report only key aspects of the methodology. Full detailed methods are provided in Appendix.

2.1. Study design

Exploratory cross-sectional experimental study.

2.2. Participants and recruitment

Participants were sequentially recruited from a cohort who had indicated willingness to participate in future studies [24], and via physiotherapists and general practitioners. Adults aged 18 years and older with dominant axial low back pain (LBP), greater than 6 months duration, and average pain in the past week ≥3/10 on the Numerical Rating Scale (NRS: 0–10 – Appendix), were included in the study. Participants who reported red flags, dominant leg pain, radicular pain with nerve compression, uncorrected hearing impairment (restriction for the acoustic stimulus during the eye-blink startle), pregnancy, taking opioids, or were unable to read English were excluded. Long-term analgesics or medications for other co-morbidities were allowed, however participants were asked not to take non-prescribed analgesics on experiment day.

To ensure balanced sequential recruitment of equal numbers of participants with and without fear of bending, potential participants were screened over the phone with the question: "*Are you fearful of reaching to the floor without bending your knees? Yes or No*". Recruitment continued until a minimum of 20 participants in both groups was reached.

The study was approved by the Human Research Ethics Committee of the Faculty of Health Sciences-Curtin University (HR157/2015). All participants provided informed consent.

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