Editorial Comment

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From pain to relief: Exploring the consistency of exercise-induced hypoalgesia

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In this issue of the Scandinavian Journal of Pain, Aron et al. [1] published a systematic review examining the reliability and measurement error of exercise-induced hypoalgesia (EIH) in pain-free adults and those with musculoskeletal-related pain (MSK-related pain). Surprisingly, their study included five studies, all of them on pain-free subjects, and no article was found on MSK-related pain. The authors conclude that in pain-free adults, the reliability of EIH is insufficient, and the measurement error is indeterminate. This raises concerns about the reliability of outcomes in this field, particularly given the increasing number of articles on EIH in both populations. In this editorial, we provide insights for clinicians and researchers interested in utilizing and investigating EIH.

• EIH: What are we talking about?

EIH is commonly defined as a decrease in pain sensitivity following a single bout of exercise, persisting for up to 30 min afterward [2,3]. This phenomenon has been used to explore the activation of the descending pain modulatory system in pain-free individuals [4], and its investigations can enhance understanding of the mechanisms involved in the acute effect of exercise [4–6]. Many factors can influence the hypoalgesic response, including the type of exercise, body areas assessed (exercising or non-exercising), age, gender, and physical activity levels [4–9]. Psychological aspects and pre-exercise information can also play significant roles [10,11]. Aron et al. [1] highlighted the influence of factors such as menstrual cycle and pre-nutritional status; however, these topics are not entirely understood [12]. For instance, Hoeger Bement et al. [13] demonstrated that EIH does not appear to be influenced by the menstrual cycle phase. Therefore, the influence of these factors on EIH is currently more speculative, given the absence of studies investigating these topics.

• Rationality and clinical applicability of EIH

Exercise is strongly recommended for the treatment of several MSK-related pain conditions, leading to growing interest in its effects on pain and its mechanisms over recent decades. However, despite their widespread use in clinical practice, exercise-based treatments demonstrate small to moderate effect sizes in the long term in several different conditions [11,14,15]. As one would expect larger effect sizes, researchers and clinicians question why a proportion of patients do not show significant improvement after a period of exercising. One possible explanation may be related to the mechanisms of exercise action in each individual and how the peripheral and central nervous systems are functioning. Exercise activates descending inhibitory mechanisms [16], and when altered, the protective effect against harmful peripheral stimuli can be impaired as well.

EIH has gained strength in explaining this controversy. Several chronic pain conditions, including fibromyalgia, chronic low back, osteoarthritis, and neck and shoulder pain [4,17], have been investigated regarding EIH, demonstrating predictive value for long-term treatment response success [18–21] and relevant prognostic factors [22,23]. Pain exacerbation after exercise is likely to be a major barrier to adherence to exercise-based treatment, potentially leading to long-term worsening of pain and disability [24,25]. Furthermore, it can be used to continually monitor treatment success and readjust procedures, if necessary [22].

• Reliability and measurement error of EIH

Considering that EIH has been utilized as an outcome measure in several studies, it is important to
establish its reliability before its use in research or clinical applications [26]. Reliability is defined as “the degree to which the measurement is free from measurement error” [27], and measurement error is the systematic and random error of a patient’s score that is not attributed to true changes in the construct to be measured [27]. The authors found poor reliability, likely due to the lack of evidence on all influencing factors of EIH, which are not totally understood yet. Although some studies have shown errors, the standard error of measurement (SEM) remains unknown, making it difficult to distinguish clinically real changes in EIH from systematic and random errors. Additionally, the absence of SEM complicates agreement between measurements, emphasizing the need for cautious interpretation of EIH study results.

Furthermore, reliability is a population-dependent construct, indicating that the results of this systematic review [1] cannot be generalized for people with MSK-related pain. Similarly, no studies have tested inter-rater reliability, which could be essential since patients are often evaluated by different therapists over time in the clinical setting.

The authors also raised another important issue about participants’ clinical baseline parameters stability between evaluation sessions. While similar measurement conditions were assessed by the COSMIN Risk of Bias tool, the authors suggested further exploration of non-analgesic substances and pre-exercise nutritional status as potential confounders.

Additionally, methodological differences among studies complicate replicability and comparison. For example, in terms of exercise modalities, authors have included aerobic and isometric EIH. In addition to the different exercise modalities, even when studies investigated the same modality, they manipulated the intensity differently. For instance, three included studies investigated the effect of aerobic exercise (cycling) for 15 min; however, one increased the resistance until a rate of perceived exertion of 16/20 [28], another one used different intensities based on the lactate threshold (50, 75, and 100%) [29], and the third increased until participants achieved 85.9% of the maximal heart rate [22]. Although aerobic exercise seems to induce the most robust EIH, method selection becomes arbitrary, hindering meaningful comparisons.

Conclusions and recommendations

This study by Aron et al. [1] contributes to the current literature regarding the reliability and SEM of EIH, emphasizing important gaps. Future studies should focus on investigating EIH reliability in MSK-related pain populations to determine its suitability in clinical and research settings. Such investigations would aid in the implementation of EIH in clinical practice and research. Additionally, as pointed out by the authors, “its use to guide exercise prescription or to predict clinical outcomes requires developing ways to induce it reliably in clinical populations and defining cut-off to classify patients (e.g., the – Minimal Important Change (MIC))”.

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