Defining naturally occurring muscle pain and discussing its role on motor behaviour

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Résumé

Physical tasks often elicit pain. Of the various pain types, naturally occurring muscle pain (NOMP) is likely the most common. Its physiological pathways and subsequent experience distinguish NOMP from other pain types (O'Connor & Cook, 1999). However, direct investigation of NOMP is sparse compared to alternative forms of pain. Therefore, this talk will discuss the main characteristics of NOMP, its neurophysiological underpinnings, and current research concerning the potential effects of NOMP on motor behaviour.

Four key features define NOMP: (i) it only originates from the working musculature; (ii) it is an acute and tonic experience; (iii) it is ultimately non-damaging though it does signal potential damage due to the metabolic demands of the task; and (iv) it can be controlled by the individual (O'Malley et al., 2024).

Using these key features, it is evident that NOMP is dissociable from other exercise-related pain such as delayed onset muscle soreness and injury-induced pain which either involve pain non-local to the working musculature, signal immediate tissue damage, and/or are characterised as chronic and phasic experiences (O'Malley et al., 2024).

Neuro-physiologically, NOMP derives from the activation of A-delta and C Fibres – also known as group III-IV muscle afferents. These mechano- and metabo-sensitive receptors are stimulated by deformations of muscle tissue and metabolites (e.g., H+/K+ ions, bradykinin, and glutamate) which increase with task demand (Pollak et al., 2014). Afferents transmit nociceptive signals via the dorsal horn of the spinal cord to brain centres including the thalamus and somatosensory cortex. Wherein, nociceptive signals are processed, resulting in pain. Contextual, emotional, and cognitive factors can influence how the brain integrates these inputs, therefore influencing the NOMP experience.

While NOMP pain is non-pathological, functionally, it helps to regulate behaviour through effort-based decision making. Most studies observe that NOMP has inhibitive effects on physical performance (O'Connor & Cook, 1999). For instance, higher NOMP is linked to earlier task cessation during tasks with a constant workload (Cook et al., 1997). There is likely a similar pattern during self-regulated tasks (e.g., fixed perceived effort tasks) whereby increases in NOMP are linked to a decrease in force production. In practice, NOMP increases the physiological and psychological task demands, thus requiring compensatory increases in effort to maintain a performance level. However, if an increase in effort is no longer viable and the maximal effort is insufficient, individuals disengage or reduce their effort to a sustainable level.

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Unfortunately, most data about NOMP derives from studies using experimental pain models. This could be problematic due to basic differences in the pathways, experience, or meta-cognition compared to 'actual' NOMP. Consequently, this talk will conclude with some research recommendations to isolate NOMP effects. By which, researchers can leverage their understanding of NOMP to create targeted approaches which combat its inhibitive effects on physical performance.

To summarise, NOMP is an inherent part of, and critical factor which regulates, behaviour during physical tasks. Yet, NOMP remains relatively misunderstood because it has been conflated within other pain types, and it is hard to isolate its effect from other exercise-related phenomena. Nevertheless, our understanding of how NOMP impacts decisions during physical tasks is developing. Although there are several caveats to current experimental approaches, there are promising future directions to explore NOMP and its impacts on physical performance.

References

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