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Pain and fatigue in sport: are they so different?

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Pain and fatigue are common reasons for athletes to avoid, or reduce, sporting participation. Despite commonly coexisting, they are usually treated as distinct entities. Both sensations are often interpreted by medical staff as indicating that physical activity should be reduced or avoided, either due to tissue damage (pain) or excessive training (fatigue). But paradoxically, that management plan—relative rest—means that athletes avoid what keeps them healthy, fit and resilient—physical activity.

Coaches sometimes view the sensations of pain and fatigue as indicators of physical and/or psychological weakness; they should be ignored to 'toughen up' athletes, sometimes leading to athletes unhelpfully provoking symptoms. These opposing views between medical staff and coaches—which often reflect limited understanding regarding the interaction of training load, beliefs and other external factors on pain and fatigue—often place the athlete in a conflicted state. 'Should I tell (the medical team) or should I remain stoic' (figure 1). We discuss the parallels between pain and fatigue, and how their management reflects the lens through which these sensations are viewed.

NEITHER PAIN NOR FATIGUE ALWAYS INDICATE IMPENDING DISASTER

Both pain and fatigue are potentially important signals that the body perceives danger. There are scenarios when these sensations should cause the athlete to cease the provoking activity such as in the case of demonstrable tissue injury linked to trauma (eg, fracture) and/or underlying systemic illness (eg, infection). However, in the absence of pathology, or obvious signs and symptoms of maladaptation,[1] these sensations can be misinterpreted as tissue injury and/or illness. Since some functional over-reaching is required for physiological adaptation, some fatigue is unavoidable.[2] However, the ability of athletes to perform (and tolerate) high training loads, and cope with fatigue, may be influenced more by the central nervous system (CNS) than the cardiovascular and musculoskeletal systems.[3] Similarly, while local biological processes (eg, inflammation, tissue damage) are important components of pain, the CNS plays a large role in determining a person's pain experience.[4] In both situations, interpretation of these sensations can be influenced by social, cultural, psychological and environmental factors.

A key challenge is accurately interpreting these sensations. Athletes should first be triaged to identify any pathological causes of these sensations, to reduce the risk of further injury or systemic illness. However, to assume these sensations indicate injury or illness risks consistently under-loading athletes,[5] and might lead athletes to believe these sensations indicate that their 'vulnerable' body might break down.

INTERPRETING AND MANAGING PAIN AND FATIGUE: PRACTICAL CONSIDERATIONS

Listen carefully to the athlete's story

For many athletes, pain develops insidiously and is not associated with an identifiable injury mechanism. A detailed history should establish whether the pain coincides with other sensitising factors (eg, stress, poor sleep).[6] Similarly, athlete responses to training load are highly individual, such that fatigue may be reported despite their training being similar to other athletes. In some cases, fatigue may have less to do with the training programme, and more to do with other contextual stressors. For both pain and fatigue, evaluating athlete responses to such sensations and identifying anxious thought processes can be valuable.

Educate and reassure through behavioural learning

If pain is always explained as tissue damage, and blamed on presumed biomechanical or structural flaws, fear about the ability to train and compete will lead to

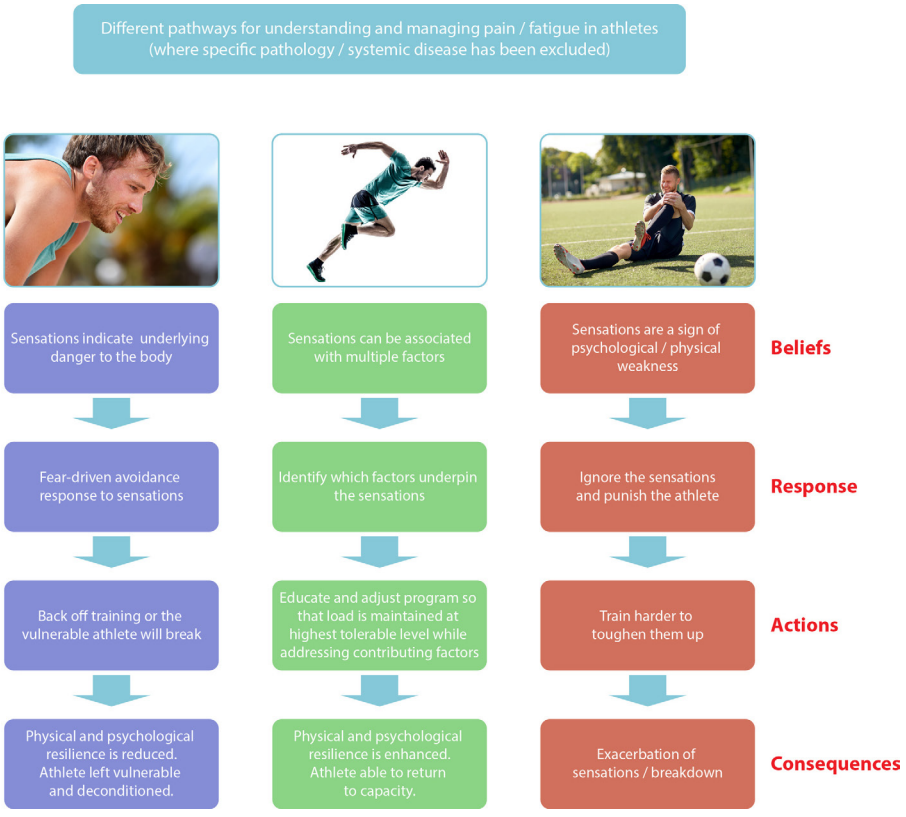

Figure 1 Parallels between the interpretation of pain and fatigue.

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load avoidance. Similarly fatigue, especially among inexperienced athletes, can create fear about the safety of training. Alternatively, ignoring these sensations without considering other contributing factors can lead to symptom exacerbation (figure 1).

By identifying the contributing factors to these sensations, and developing strategies to control them, activity can be maintained while building physical and psychological resilience (figure 1). Positive and reflective communication can help athletes reconceptualise their symptoms, and realise why activity avoidance is a major barrier to achieving goals. Central to this is athletes realising that both pain and fatigue are multifactorial and modifiable, and do not necessarily imply injury, illness or weakness. Identifying discrepancies between an athlete's predicted response to a threatening situation (eg, increased pain) and the actual outcome (eg, pain same) can assist in this process.[7]

Team environment

Medical and coaching staff need to understand each other's perspectives, and share a common understanding of athletic resilience, to achieve athlete-centred goals. We recommend that clinicians and coaches develop good relationships with their athletes so they can identify the breadth of factors that make athletes vulnerable to reporting these sensations.

In conclusion, monitoring perceived training load, pain and fatigue can be useful. However, once serious pathology has been excluded, athletes reporting these sensations should not panic. Instead, this information should be used within a decision-making framework[7 8] to understand *why* an athlete is struggling, allowing for identification and management of the relevant modifiable factors underlying these sensations. In this manner, athletes can continue at least some training, without unnecessarily avoiding activity or provoking symptoms.

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REFERENCES

1 Meeusen R, Duclos M, Gleeson M, *et al*. Prevention, diagnosis and treatment of the overtraining syndrome: ECSS position statement 'task force'. *Eur J Sport Sci* 2006;6:1–14.
2 Selye H. The general-adaptation-syndrome. *Annu Rev Med* 1951;2:327–42.
3 Noakes TD, St Clair Gibson A, Lambert EV. From catastrophe to complexity: a novel model of integrative central neural regulation of effort and fatigue during exercise in humans: summary and conclusions. *Br J Sports Med* 2005;39:120–4.
4 Butler DS, Moseley GL. *Explain pain:(revised and updated)*: Noigroup Publications, 2013.
5 Gabbett TJ. The training-injury prevention paradox: should athletes be training smarter and harder? *Br J Sports Med* 2016;50:273–80.
6 Finan PH, Goodin BR, Smith MT. The association of sleep and pain: an update and a path forward. *J Pain* 2013;14:1539–52.
7 O'Sullivan P, Caneiro JP, O'Keeffe M, *et al*. Unraveling the complexity of low back pain. *J Orthop Sports Phys Ther* 2016;46:932–7.
8 Gabbett TJ, Nassis GP, Oetter E, *et al*. The athlete monitoring cycle: a practical guide to interpreting and applying training monitoring data. *Br J Sports Med* 2017;51:1451–2.

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