

In sports and sport science, ‘fatigue’ is an elusive concept that knows many definitions. One important aspect is that it can be induced both cognitively and physically. Quite some research has focused on this physical component of fatigue, making strong links between the muscles and the brain, but by now it has become clear that there is more to take into account if we look at human performance. Over the last decade, ‘mental fatigue’ has gained significant attention. Professor Bart Roelands, from the ‘Vrije Universiteit Brussel’ outlines this relatively new concept, linking it with performance capacity in the lab and the field.

The Effects of Mental Fatigue on Physical Performance

by Van Cutsem • Marcora • De Pauw • Bailey • Meeusen • Roelands, Sports Medicine 2017

Mental fatigue is a psychobiological state caused by prolonged periods of demanding cognitive activity

Negative effect on endurance performance

This decline is associated with a higher than normal perceived exertion

No effect on the physiological variables traditionally associated with endurance performance (HT, blood lactate, etc.)



VS



No effect on maximal strength, power & anaerobic work



1. The high cognitive demands of sport are most probably mentally fatiguing when prolonged over time
2. This opens new opportunities to improve endurance performance by minimizing as much as possible the cognitive load during competitions
3. ...and/or by increasing resistance to the negative effects of mental fatigue on perception of effort and endurance performance

BACKGROUND

- Mental fatigue is the representation of a psychobiological state induced during prolonged demanding cognitive activity, which results in a subjective feeling of tiredness, decreased cognitive and/or physical performance capacity, and/or altered brain activation.¹
- Mental fatigue is a clearly established construct in daily life, and regarding sport performance, it affects not only cognitive aspects such as attention, but also physical aspects such as endurance capacity (figure 1) and sport-specific psychomotor performance.²

MECHANISM

- The most consistent change while performing exercise in a mentally fatigued state is an increase in rating of perceived exertion, while peripheral measurements such as blood lactate, heart rate, and neuromuscular function remain largely unaltered at such time.³
- An increase in adenosine because of cognitive effort would inhibit presynaptic neurotransmitter releases and neuronal firing, essentially diminishing neural activity in task-specific brain areas, such as the prefrontal cortex, specifically the anterior cingulate cortex (important for emotional control, planning, attention, and self-regulation).⁴
- Much more mechanistic work remains to be done.

FROM SCIENCE TO THE FIELD, AND VICE-VERSA

- Research on the occurrence of mental fatigue during actual competition, and the practical implications this has on performance, is still in its infancy.⁵
- A small number of studies have confirmed that mental fatigue can occur during a single game, multiday competition (eg, padel⁶) and during a regular season in a team sports (eg, netball⁷).
- Performing a 20 min Loughborough Soccer Passing Test induced mental fatigue to the same extent as a 20 min Stroop task, indicating practitioners should be cautious about the prolonged cognitive-demanding skill section of pre-match warmup.⁸

COUNTERACTING MENTAL FATIGUE

- The cognitive and/or physical impairments caused by mental fatigue can be partially countered by using a physiological, behavioural or psychological countermeasure.⁹
- Caffeine, odours, music and extrinsic motivation seem promising countermeasures against mental fatigue. However, the heterogeneity in the protocols to induce and determine mental fatigue makes it difficult to draw firm conclusions.⁹
- Future studies should evaluate the impact of the most promising countermeasures on (neuro)physiological markers of mental fatigue and on optimizing mental fatigue-combating interventions by combining multiple strategies.⁹

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IDENTIFYING AND COUNTERACTING MENTAL FATIGUE IN SPORTS AND SPORT SCIENCE

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