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Monitoring and Titrating Symptoms

A Science-Based Approach to Using Your Brain to Optimise Marathon Running Performance

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Abstract

A key challenge to optimising marathon running performance is to train with adequate frequency, duration and intensity as well as get enough recovery to optimise biological adaptations underlying performance. Some marathon runners train inadequately and underperform, while others perform poorly because they become injured or develop staleness in response to overtraining. Staleness, a depression-like syndrome, could plausibly be caused by overtraining-induced molecular and cellular changes in brain circuits involved in depression or other related mood states such as anger, fatigue, vigor and confusion. The central thesis of this paper is that easily assessed resting and/or exercise symptoms, valid markers of either difficult-to-access, expensive-to-assess or unmeasurable brain circuits, can be used to optimise marathon running performance by helping to avoid either inadequate training or excessive training resulting in staleness. Available models of human performance and relevant data, admittedly incomplete at the present time, suggest that marathon runners may benefit from systematically using symptom responses to training in order to aid in adjusting training loads for the purpose of optimising training. As this approach is better linked with neuroscience and neuroimaging findings, it could be refined and prove to be useful for elite as well as non-elite marathon runners.

"It is the brain, not the heart or lungs that is the critical organ, it's the brain" (Sir Roger Bannister, page 13).[1]

This brief article summarises several key points regarding a systematic approach for using your brain to optimise marathon training and running performance. The approach is simple, logical, feasible and individualised. The approach is consistent with much of the relevant published data and the mental health model of athletic performance, which posits that good mental health is associated with better athletic performance.[2]

Overtraining can be defined as a significant increase in training volume, intensity or frequency that is at or near an individual's maximal capacity and can be endured for only a short (<1 month) time period.[3] Training frequency determines the amount of time available for recovery; consequently, recovery is an integral component of the overtraining

process. Distance runners often include overtraining cycles in preparation for a marathon.

Staleness is a depression-like syndrome that results from overtraining and is not explained by another medical condition.[4,5] It is uncertain if one aspect of overtraining is the primary culprit contributing to staleness. It has been suggested that total training duration and/or training 'monotony' (e.g. failure to include variation in training such as easy days interspersed between hard training days) may be more important contributors to staleness than exercise intensity;[6] however, currently there is no compelling evidence to support this hypothesis.

Although no consensus definition of staleness exists and Europeans refer to it as overtraining syndrome,[7] staleness is characterised by significant (>5%) and extended (>2 weeks) reductions in athletic performance, as well as increased perceptions of effort during a standard bout of exercise and mood disturbances (i.e. feelings of low energy as well as increased feelings of fatigue, depression and anger). The lifetime prevalence of staleness is quite high among elite female (60%) and elite male (64%) distance runners and common but less prevalent (≈33%) among non-elite, but highly trained distance runners.[8,9]

Symptom is a medical term that refers to "a subjective indication of a disease, perceptible to the patient, as opposed to an objective sign of the disease" (Oxford English Dictionary, 2000). Because staleness is not a disease, symptoms are defined here more broadly as self-reported subjective feelings and thoughts. Self reports of the intensity of feelings of anger, depression, fatigue and pain are examples of symptoms. The criterion measures of symptoms are self reports using standardised instruments with established psychometric properties such as the profile of mood states (POMS) questionnaire and Borg's 6–20 perceived exertion scale.

Symptoms provide a powerful, albeit imperfect, window into the function of the body and brain. Symptoms are thought to be the outcome of neural circuits that integrate the activity of tens of thousands of brain neurons. Symptoms of depression, which are prominent in staleness, are thought to be mediated by multiple neurotransmitter systems (e.g. dopamine, norepinephrine, serotonin) and brain regions.[10] Neural circuits involving the prefrontal cortex and hippocampus may mediate the cognitive aspects of depression, such as feelings of worthlessness and concentration impairments. Neural circuits involving the nucleus accumbens and ventral tegmental area may mediate the reduced motivation and ahedonia (loss of interest in pleasureable activities). Neural circuits involving the hypothalamus may mediate depression-related disturbances in appetite, sleep, libido, circadian rhythms, releasing factors (e.g. corticotrophin releasing factor) and hormones (e.g. cortisol). Also, factors that regulate the plasticity and survival of neurons and glia cells, such as brain derived neruotrophic factor, may be deficient in depression.

Effects of overtraining on brain molecular and cellular events that could contribute to symptoms such as depression are poorly understood at the present time but there is growing evidence that exercise training has widespread effects on the brain.[11] Currently, there is only a small body of research that suggests overtraining could induce staleness by influencing some of the neural circuitry thought to underlie depression.[12-16] Nevertheless, it is plausible that overtraining-induced changes in the brain cause staleness.

1. Central Thesis

The general idea of this article is that selected symptoms can be systematically measured, both at rest and during training runs, and can be used to either decrease the frequency, intensity and/or duration of daily exercise sessions during overtraining cycles to attempt to prevent staleness or increase the

frequency, intensity and duration of daily exercise sessions to attempt to avoid inadequate training.[5]

The central thesis is that easily assessed resting and exercise symptoms, valid markers of either difficult-to-assess or unmeasurable brain circuits, can be used to optimise marathon running performance by helping to avoid either inadequate training or excessive training resulting in staleness. Many distance runners do monitor symptoms in order to adjust training. However, the suggestion made here is that more success may be achieved by approaching the task systematically and focusing on symptoms that the scientific evidence indicates are most useful.

2. Evidence

The following research findings support monitoring and titrating symptoms to optimise endurance running performance. Overtraining consistently increases ratings of perceived exertion (RPE) and feelings of fatigue, and reduces feelings of energy.[5,17] Such changes are expected and they are not indicators of staleness. Reductions in training (i.e. a taper) consistently reduce RPE and feelings of fatigue as well as increase feelings of energy.[5,18] Staleness may be indicated when an adequate taper fails to reduce RPE and feelings of fatigue, and fails to increase feelings of energy. Because this observation can only be made during the taper phase, it is often too late in the training process to assist athletes in optimising training.

Some evidence suggests that elevated symptoms of depression and anger are the most useful symptoms for discriminating between stale and healthy athletes. Specifically, 80% of stale swimmers were found to meet clinical criteria for depression,[5] yet the intensity of depression symptoms was significantly higher among stale compared with non-stale swimmers who trained similarly.[15] Also, depression and anger questions from the POMS questionnaire were found to be best at discriminating between poorly performing, and better performing swimmers and track athletes.[19] Lastly, two prospective studies[20] (Morgan et al., unpublished data) have shown a reduced incidence of staleness when symptoms were monitored and used to titrate (increase and decrease) the training load of competitive athletes. Limitations of the evidence, with regard to distance running performance, include that most of the data were not generated from distance or marathon runners and that there is an absence of evidence from randomised, controlled trial experiments.

3. Summary/Implications

A key challenge to optimising marathon running performance is to train with adequate frequency, duration and intensity as well as get enough recovery to optimise biological adaptations underlying performance. Some marathon runners train inadequately and underperform, while others perform poorly because they become injured or develop staleness during periods of overtraining. Available models of human performance and relevant data suggest that benefits may be obtained from systematically using symptom responses to training in order to aid in adjusting training loads for the purpose of optimising training. The approach could be useful for elite as well as non-elite marathon runners.

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