Alterations in mood state following an ultra-marathon

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Abstract

Objective. To monitor alterations in mood state, specifically level of depression, following an ultra-marathon.

Design. Experienced male (N = 9) and female (N = 5) ultra-marathon athletes were required to complete the full version of the Profile of Mood States (POMS) questionnaire (65 questions), 1 week before an ultra-marathon (baseline), 24 hours before exercise, immediately post-exercise, 3 hours post exercise and then daily for 13 days after the race.

Main outcome measures. POMS results (tension, depression, anger, vigour, fatigue, confusion, total mood) were statistically analysed using a one-way analysis of variance (ANOVA). Level of significance was set at $p < 0.05$.

Results. There were no significant changes in level of depression. Fatigue was significantly elevated ($p < 0.05$) up to 3 hours after the race. Vigour was significantly increased 24 hours before the race and significantly decreased ($p < 0.05$) for 3 hours after the race compared with baseline. Interestingly, tension was significantly decreased ($p < 0.04$) from 3 hours after the ultra-marathon up to day 4, and then again from days 9 - 13. Total mood showed a positive progression over the post exercise period and was significantly ($p < 0.01$) decreased on day 13.

Conclusions. Contrary to expectations, no significant changes in level of depression were exhibited by the athletes. Rather, there was a significant decrease in tension and improvement in total mood during the 13 days after the ultra-marathon.

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Introduction

It is well established that chronic low to moderate intensity exercise is associated with positive mood changes.[1,2,5,9,12,13] However, the cumulative effect of excessive or intense exercise, with inadequate recovery, appears to produce a complex interrelationship of numerous factors that can adversely affect mood state. This state is synonymous with feelings of depression, apathy and changes in personality.[3] Whilst the above-mentioned alterations in mood state can be attributed to the chronic effects of 'too much' training, few studies have investigated the changes in mood state following acute bouts of strenuous, prolonged exercise. In addition, anecdotal reports suggest that endurance athletes may experience feelings of depression, or negative mood states following an intense aerobic session.

The majority of studies investigating alterations/fluctuations in affective states within a sports research setting have used the Profile of Mood States (POMS) questionnaire. This 65-question inventory measures six identifiable mood states, namely: tension, depression, anger, vigour, fatigue, and confusion, as well as an overall global measure of mood (total mood disturbance (TMD)) which is obtained by subtracting vigour from the sum of the five negative mood states.[7]

Although there is considerable evidence demonstrating alterations in mood associated with chronic exercise/training, minimal research has been conducted on acute prolonged bouts of exercise.[4] Therefore, the primary purpose of this study was to monitor alterations in post-exercise mood state following a prolonged, strenuous bout of running, and secondly, to determine the time period required for these alterations (if any) to be resolved.

Methods

Subjects

Nine male and 5 female athletes preparing for an ultra-marathon (89 km) were recruited from local running clubs. The subjects reported to the exercise testing laboratory 2 weeks before the race and signed an informed consent form, previously approved by the institution's ethics committee. All subjects underwent body composition analysis and VO_{2max} tests.[6,11]

On completion of the physiological evaluations the subjects were given instruction on how to complete the POMS questionnaire. They were required to complete the POMS inventory 7 days before the ultra-marathon (baseline), 24 hours pre-exercise, immediately post exercise, 3 hours post exercise, and then daily for 13 days after the race. The POMS was completed at the same time each day (17h00 - 18h00) so as to control for any diurnal effects. The baseline and 24-hour pre-

exercise questionnaires were collected from the subjects the day before the race. Immediate post exercise and 3-hour post exercise questionnaires were collected directly after they had been completed in the medical tent at the race finish. The remaining completed POMS questionnaires were returned to the laboratory 14 days after the race. All questionnaires were scored using overlay stencils in accordance with instructions in the POMS manual.[7]

Statistics

A one-way analysis of variance was computed to determine any significant changes in mood states. The level of significance was set at $p < 0.05$.

Results

The subjects' physical characteristics and related data were (mean ± SD): age 42 ± 10 years, weight 67 ± 10.5 kg, height 170 ± 7 cm, VO_{2max} 59.02 ± 7.02 ml/kg/min, body fat 12.7 ± 3.3%, training mileage from January to June 1 422 ± 424 km, number of completed ultra-marathons (89 km) 4 ± 1.

No significant alterations were found with regard to level of depression (Fig. 1). Similarly, there was no significant change in confusion (Fig. 1) and anger (Fig. 1). Although non-significant, the abovementioned mood states exhibited a general decrease up to 13 days after the race. Decreases in these variables may be regarded as an improvement in that specific mood state.

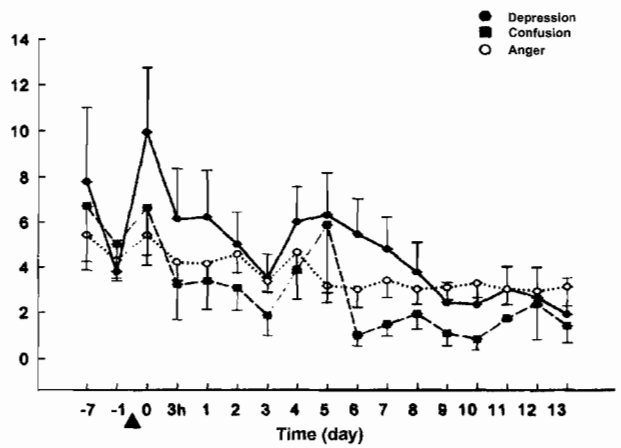

Fig 1. Alterations in depression, confusion and anger (mean ± SE) for 14 subjects (9 males, 5 females) for 13 days after an ultra-marathon.

Tension was significantly ($p = 0.048$) decreased at 3 hours post exercise and remained significantly ($p < 0.05$) decreased up to day 4 after the race, as well from days 9 - 13. Although still lower than baseline, tension returned to non-significant levels ($p > 0.05$) between days 5 and 8 (Fig. 2).

Vigour was significantly ($p = 0.01$) elevated 24 hours before the race and significantly ($p = 0.01$) reduced immediately after the event. By 3 hours post exercise, vigour began returning to baseline levels (Fig. 2).

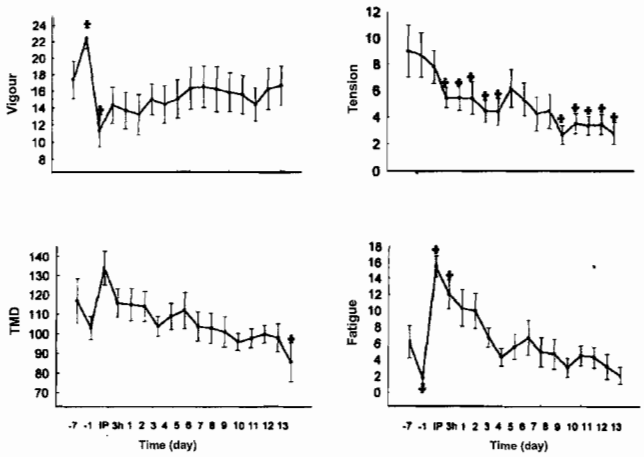

Fig 2. Alterations in tension, vigour, fatigue and total mood disturbance (mean ± SE) for 14 subjects (9 males, 5 females) for 13 days after an ultra-marathon (+ p < 0.05, IP = immediately post).

Fatigue was significantly ($p = 0.02$) reduced 24 hours before the race and was significantly elevated directly after the ultra-marathon ($p < 0.001$) and 3 hours post exercise ($p = 0.01$). Within 24 hours after the race, fatigue had returned to non-significant levels (Fig. 2).

TMD showed a non-significant ($p > 0.05$) increase immediately post exercise, and general decrease over the following 12 days until reaching a significantly lower ($p = 0.01$) level at 13 days after the race (Fig. 2).

Discussion

This study examined the alterations in mood state following an ultra-marathon. No significant changes in the level of depression were exhibited by the athletes up to and including 13 days post ultra-marathon. Based on anecdotal reports it was hypothesised that depression or tension would manifest at least for a few days after the race. A possible physiological explanation for the manifestation of depression following excessive exercise like the ultra-marathon could be that of inflammation/muscle micro-trauma. Strenuous exercise is associated with muscle soreness that often peaks 48 - 72 hours post exercise. This soreness, caused in part by muscle micro-trauma, is associated with the release of the pro-inflammatory cytokine interleukin-6 (IL-6). Although IL-6 was not measured in the present study, numerous studies have shown IL-6 to be elevated following strenuous bouts of exercise.[8,10] Receptors for IL-6 can be found in the brain within the hypothalamus. This area is responsible for emotions, appetite, sleep-wake cycles, temperature regulation and endocrine function. With an increased synthesis of IL-6 following exercise it would seem tenable that elevated levels of this cytokine could elicit alterations in mood state. Contrary to anecdotal evidence, no significant elevation in depression was exhibited by the subjects in the present study.

However, tension was significantly decreased from 3 hours after the race up to 4 days. From days 5 - 8 it returned to non-significant levels; however, from days 9 - 13 it once again showed a significantly decreased level. This trend, in conjunction with a decline in anger (although non-significant) suggests

that a strenuous bout of prolonged activity may elicit beneficial alterations in terms of mood state for an extended period after the race. This is supported by a decline in TMD, which is indicative of an improved mood state.

Due to the extremely demanding nature of the race, it was not surprising to see fatigue significantly elevated immediately after the race and vigour significantly decreased. However, it was interesting to note how quickly the athletes' 'perception' of fatigue and vigour returned to normal following such a strenuous event, as within 3 hours of the race both these mood states began returning to pre-race levels.

The values used as baseline were taken at 7 days pre ultra-marathon (the athletes were tapering). When analysing the results, it becomes apparent that fatigue was significantly ($p < 0.05$) decreased and vigour was significantly increased ($p < 0.05$) when comparing 7 days pre-race with 24 hours pre-race. This is perhaps indicative of the athletes' heightened state of arousal so close to the race. It also raises the question of when baseline values for scientific research should be obtained, as many studies using the POMS use reference values obtained immediately before the race. This could certainly lead to over-or under-inflated results.

The subjects were all middle-aged, experienced ultra-marathon athletes who completed the race at an average of 6.80 min/km. Future studies should investigate the alterations in mood state, specifically tension and depression, in a group of runners who race at a faster pace and higher intensity as their mood alterations could arguably differ from those of the group in the present study.

Conclusion

The objectives of the study were primarily to validate anecdotal claims of athletes and coaches concerning the depression/tension experienced by individuals completing a prolonged strenuous bout of running. Very few studies have been conducted on alterations in mood state following acute bouts of prolonged exercise, and those that have addressed this issue have generally only looked at changes before and immediately after exercise. In this study, it was found that middle-aged, experienced athletes exhibited no elevation in depression and that mood state improved up to and including 13 days after an ultra-marathon.

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