Recovery from infectious mononucleosis after altitude training in an elite middle distance runner

Damian M Bailey, Bruce Davies, Richard Budgett, George Gandy

Abstract

Objectives—This investigation was designed to monitor altitude acclimatisation in an elite cohort of distance runners and follow the subsequent recovery from infectious mononucleosis which developed in one of these athletes.

Methods—Twenty six national standard distance runners performed treadmill tests 24 days before they travelled to an altitude camp (1500 to 2000 m). One of these athletes was diagnosed as suffering from infectious mononucleosis 14 days after return to sea level. A physician prescribed an individualised training programme which was designed to maximise recovery from the condition, which was monitored on days 16 and 147 after altitude training.

Results and Conclusions—The data suggest that the athlete was in a state of over-reaching during the altitude sojourn. After return to sea level, the early stages of infectious mononucleosis resulted in a marked impairment in physiological response to endurance exercise, which improved over time. Longitudinal physiological monitoring in conjunction with a carefully prescribed training programme made recovery from this condition possible.

Keywords: mononucleosis; altitude training; runners

Infection with the Epstein-Barr virus, a DNA virus of the herpes group, causes infectious mononucleosis, which results in a positive Paul-Bunnell test after ten days. The infection is a self limiting lymphoproliferative disease, limited mainly to the B lymphocytes and results in some immunosuppression in its active form. This case study recorded the impact and subsequent recovery from infectious mononucleosis on the health status and endurance performance of an elite competitor. The subject gave signed consent for the publication of this case study.

Case report

The subject was an international standard 800/1500 m male runner with a body mass of 70.8 kg. Arterialised capillary blood samples were analysed for fasting serum urea (Refletron; Boehringer-Mannheim). Supine morning heart rate (HR) was determined by individual palpation at the wrist over a 30 second period immediately on waking and after 20 seconds of standing, the difference being ∆HR. These measurements were taken seven days before travelling to altitude, between days 9 and 20 at an altitude of 1500 m and on return to sea level.

The subject complained of extreme fatigue, a sore throat, lower limb soreness, and impaired running performance 14 days after return to sea level. A medical examination identified that the subject was suffering from a low grade fever and cervical lymphadenopathy. Laboratory findings included modest leucocytosis and absolute lymphocytosis, and a positive Paul-Bunnell test led to the diagnosis of infectious mononucleosis. Treadmill tests had been conducted 24 days before altitude training (the results designated as PRE) and on days 16 and 147 after return to sea level (results designated as POST 1 and 4). These tests were conducted 2 and 133 days after the diagnosis of infectious mononucleosis. The subject performed five running stages, each of four minutes duration, separated by a 30 second break for the determination of whole blood lactate (HLa) (Analogox Champion, PLM5). Running speeds ranged from 14 to 22 km/h. This was followed by a 30 minute jog at 8 km/h and a 90 second supramaximal sprint at 24 km/h. HR and HLa were measured at zero, two, four, six and eight minutes at 8 km/h after the sprint (results designated as REC).

After clinical diagnosis of infectious mononucleosis, a significantly moderated training programme was prescribed which consisted primarily of steady state running at an HR equivalent to 140 beats/min (Borg scale rating of 11). HR during exercise was monitored using electrocardiogram calibrated bipolar telemetry (Vantage Sports Tester; Polar Electro Oy, Kempele, Finland). Total weekly running distance was reduced from 73 miles before altitude training and 66 (14) miles at altitude to approximately 30 miles after. Progressive increases in training volume and intensity were determined by the subject, who monitored
Table 1 Effects of infectious mononucleosis during and after recovery from exercise

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>PRE†</th>
<th>POST ††</th>
<th>POST ‡‡</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resting HR* (beats/min)</td>
<td>38</td>
<td>55</td>
<td>48</td>
</tr>
<tr>
<td>Mean submax HLa* (mmol/l)</td>
<td>1.0</td>
<td>1.9</td>
<td>1.6</td>
</tr>
<tr>
<td>Mean submax HR (beats/min)</td>
<td>143</td>
<td>155</td>
<td>145</td>
</tr>
<tr>
<td>Mean REC* HLa (mmol/l)</td>
<td>4.6</td>
<td>4.6</td>
<td>3.8</td>
</tr>
<tr>
<td>Mean REC HR (beats/min)</td>
<td>120</td>
<td>126</td>
<td>118</td>
</tr>
</tbody>
</table>

* HR = heart rate; HLa = whole blood lactate; REC = result for HLa measured at zero, two, four, six, and eight minutes at 8 km/h.
† PRE = result of treadmill tests 24 days before altitude training; POST 1, POST 4 = result of treadmill tests 16 and 147 days after return to sea level.

Results and discussion

The resting serum urea and ΔHR values of the subject with infectious mononucleosis increased from 5.77 mmol/l and 7 beats/min at sea level (PRE) to mean (SD) values of 8.04 (0.55) mmol/l and 23 (5) beats/min at altitude. These values decreased to 6.34 mmol/l and 18 beats/min (POST 1) and 4.65 mmol/l and 9 beats/min (POST 4). Group mean (SD) resting serum urea and ΔHR values increased from 5.63 (1.79) mmol/l and 18 (9) beats/min before to 6.57 (1.26) mmol/l and 20 (10) beats/min at altitude, to 6.01 (1.56) mmol/l and 18 (8) beats/min 16 days after return to sea level. A repeated measures analysis of variance identified that the altitude and POST 1 group mean serum urea and ΔHR values were not significantly different from PRE values (P = 0.10 and P = 0.14 respectively). The interpretation of serum urea and ΔHR as markers of over-reaching must at present be considered equivocal. However, if we accept the findings of Hollmann and Czajkowski, these data suggest that the subject with mono-nucleosis was in a state of over-reaching at altitude. This may have been related to changes in training intensity and/or the additive stress of hypobaric hypoxia itself (Po, 125–140 mm Hg). Scientific evidence accumulated from in vivo and in vitro experimentation has identified adverse changes in immune function after both acute and chronic exposure to hypobaric hypoxia. It would appear that hypoxia is responsible for a suppression in T cell mediated immunity, whereas B cell function remains unimpaired. This response may be more pronounced in the elite athlete who has been demonstrated to be more prone to developing arterial hypoxaemia while training at altitude. The data summarised in table 1 identified that infectious mononucleosis was associated with changes in the kinetics of lactate production and removal and recovery of HR during exercise. These changes may be mediated by chronic stimulation of the sympathoadrenal system, which has been shown to cause accelerated glycogenolysis through activation of the rate limiting enzymes phosphofructokinase and phosphofructokinate.

The additive stress of a reduction in the inspiratory Po, in conjunction with the extensive training loads employed by this subject at altitude may have precipitated a less favourable change in immune function. The precise aetiology of hypoxia mediated immunosuppression is not known, but the immunomodulatory role of endogenous glucocorticoids and neuro-peptides, which are increased at altitude, need to be considered. In a recent investigation, we demonstrated a significant decrease in resting plasma glucose concentrations in elite distance runners who trained at 1640 m above sea level in comparison with pre-altitude values. This has been identified in overtrained athletes at sea level and may be a contributory factor leading to immunosuppression and under-performance. It has been suggested that oral glutamine supplementation (5 g l-glutamine per day) may counteract the immunosuppression associated with endurance exercise. If these findings are confirmed, then it is probable that similar advice may serve to maintain normal immune function and thus optimise performance in elite athletes who train at altitude.

Summary

An individualised tapered training programme, in conjunction with continuous physiological and medical assessments, made it possible for this athlete to recover from infectious mononucleosis while maintaining a significant level of aerobic fitness. Ten months after diagnosis, the subject recorded a personal best time for 1500 m indoors. After and during an illness, longitudinal monitoring and consultation has serious implications for both the fitness and the health of the elite competitor.