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Effect of hypobaric “live high – train low” training on blood parameters in elite track cyclists.

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INTRODUCTION:
By combining hematological adaptations to chronic hypoxia benefits, while avoiding the hypoxia-induced reduction of maximal training intensity, “Live High – Train Low" (LHTL) has popularly grown to be a common hypoxic training practice in elite endurance sport disciplines [1]. However, despite arguably being the “gold standard” of altitude training for sea-level competition, its validity and effect, particularly within elite athletes with a high natural hemoglobin mass (Hb(mass)), remain debated [2]. Hence, the purpose of this case-study was to evaluate the effect of LHTL on blood parameters in elite track cyclists.
METHODS:
Four Swiss male national team track cyclists (age: 24.9 ± 2.1 years; relative VO2max: 73.3 ± 3.8 ml/kg/min; relative Hb(mass): 14.7 ± 1.0 g/kg) underwent a typical 23-day hypobaric LHTL altitude training intervention, residing in hypobaric hypoxia (2309 m) and training between 440 m and 1850 m. Hematological parameters were assessed with duplicate measures before (PRE) and after (POST) the intervention with a modified version of the carbon monoxide rebreathing technique [3]. Blood oxygen saturation (SpO2), body weight, subjective sleep quality, and subjective training quality were recorded daily. Training, as well as nutrition and hydration were individualized, adapted and optimized according to these parameters. Athletes’ ferritin levels were assessed two weeks pre-altitude, and were thenceforth supplemented with 138 mg elemental iron three times/week until the end of the intervention.
RESULTS:
From PRE to POST, the total Hb(mass) increased by 8%, from 1097 ± 111 g to 1185 ± 143 g ($p = 0.01$). Similarly, the red blood cell volume increased by 6% from 3294 ± 295 ml to 3518 ± 397 ml ($p < 0.05$). Pre-altitude ferritin levels were 82.0 ± 9.1 µg/L. Mean SpO2 the first four and last four days were 93.6 ± 0.9% and 95.05 ± 1.29% ($p > 0.05$), respectively. The body weight remained stable from PRE to POST (74.5 ± 3.5 kg vs 73.9 ± 4.6 kg, $p > 0.05$).
CONCLUSION:
A 23-day LHTL sojourn at 2309 m induced large improvements in hematological values in elite endurance athletes, despite already high natural Hb(mass) values. This underlines the importance of both individualizing all possible parameters as well as maximizing the altitude dosage (high altitude and sufficient time spent at altitude) in order to trigger erythropoietic adaptations.

References:
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