Altitude-induced responses observed in the control group

Grégoire P Millet, Franck Brocherie

PROFESSOR GREGOIRE P MILLET (Orcid ID : 0000-0001-8081-4423)

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Grégoire P. Millet[1], Franck Brocherie[2]

[1] Institute of Sports Sciences (ISSUL), University of Lausanne, Lausanne, Switzerland

[2] Laboratory Sport, Expertise and Performance (EA 7370), Research Department, French Institute of Sport (INSEP), 11 Avenue du Tremblay, Paris, France

Corresponding author:

Prof. Grégoire Millet

ISSUL, Institute of Sport Sciences, University of Lausanne, 1015, Lausanne, Switzerland.

Tel: +41 216923294

Email: gregoire.millet@unil.ch

The study by Robach et al. [1] aimed to test the hypothesis that LHTL in hypobaric hypoxia improves exercise performance in elite endurance athletes. The authors have to be commended for this logistical challenge of having two VO_{2max}-matched groups training together between 600 and 1500m but either sleeping at 2207m (LHTL, n = 11) or at 1035 m (Control, n = 8). This protocol allows a good matching of the training loads and it was expected that it could "isolate" the specific effects of hypoxia in the LHTL group. The authors concluded that "*Contrary to their hypothesis, 4 weeks of LHTL was not associated to larger improvement in aerobic performance than 'Live Low- Train Low' in young cross-country skiers*"

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Unfortunately, the experimental design did not allow testing their (surprising from a research group claiming for years that LHTL is not effective in endurance athlete[2]) hypothesis since there was no control group (i.e. not exposed to altitude). This conclusion is a perfect example of scientific bad faith. It could be concluded with the same bad faith that the so-called “control group” benefited from their moderate altitude (1000-1500 m) exposure (for both sleeping and training). By the way, there was only a small (3.3-2.7% - Table 3) difference in SpO2 during sleeping time. It is therefore not so surprising to find similar responses between these two groups. Therefore, it is possible to suspect erythropoietic stimulation or altitude-induced physiological responses also in this "control" group exposed to a significant hypoxic dose (450 km.h). The time courses in plasma volume (acute change at return to sea-level for a transient period), Hbmass (continuous increase during the camp and maintained for at least 18-20 days), EPO (acute decrease at return to sea-level) are similar to the classically described responses following either LHTH or LHTL during the post-hypoxia period after return to sea-level (in this case, Lillehammer, 200m). Moreover the change in VO2max or test duration from PRE to POST1 (increase), POST2 (no change) and POST3 (increase) is in line with the assumptions of the coaches for this post-altitude period [3]. Finally, the delayed improvement (18-20 days in maximal aerobic speed and 3-km performance fits perfectly with the recommended window [3]. The “control” post-altitude kinetics of many parameters was similar than the one observed in the LHTL group. In highly-trained endurance athlete, it makes no sense to explain these time courses only by training effects. In our view, it makes sense that the control group benefited from the moderate altitude exposure, explaining the no-difference observed with the LHTL group.

1. Robach P, Hansen J, Pichon A, et al. Hypobaric live high-train low does not improve aerobic performance more than live low-train low in cross-country skiers. *Scand J Med Sci Sports.* Feb 22 2018.

2. Robach P, Lundby C. Is live high-train low altitude training relevant for elite athletes with already high total hemoglobin mass? *Scand J Med Sci Sports.* Jun 2012;22(3):303-305.

3. Chapman RF, Laymon Stickford AS, Lundby C, Levine BD. Timing of return from altitude training for optimal sea level performance. *J Appl Physiol (1985).* Apr 2014;116(7):837-843.

4. Millet GP, Chapman RF, Girard O, Brocherie F. Is live high-train low altitude training relevant for elite athletes? Flawed analysis from inaccurate data. *Br J Sports Med.* Dec 15 2017.