The goal of this study was to investigate the effects of a training with voluntary hypoventilation, which could mimic the effects of "Living low training high" method (Woorons et al., 2007). Fifteen moderately trained runners were divided into two groups according to their fitness level and their training history: Hypoventilation group (HYPO) (n = 7), and control group (CONT) (n = 8). The experiment consisted in performing twelve sessions of 55 min within four weeks. At each session, HYPO and CONT ran 24 min at 70% of VO2max with a breath holding at functional residual capacity and with normal breathing respectively. Arterial oxygen saturation (SaO2) was permanently monitored during the training by a pulse oximeter. A VO2max test was performed in laboratory before (PRE) and after (POST) the training period. Cardiorespiratory parameters were measured continuously and an arterialized capillary blood sampling at the earlobe was performed at rest, at 90% of age predicted maximal heart rate (THRmax) and at 2-min recovery. A time to exhaustion test (TE) at 100% VO2max was also undertaken. All the runners from HYPO demonstrated a severe arterial desaturation (SaO2 < 88%) during training. There was no change in VO2max, lactate threshold or TE in both groups after the training period. At maximal exercise, [La] was lower in CONT at POST compared with PRE (16.6 ± 3.0 vs 14.9 ± 3.2 mmol/L, p < 0.01) whereas it remained unchanged in HYPO. At rest in both groups there was no difference between PRE and POST in haemoglobin concentration. At 90% of THRmax in HYPO, both pH (7.33 ± 0.06 vs 7.36 ± 0.04, p < 0.05) and bicarbonate concentration (HCO3) (19.4 ± 3.5 vs 20.4 ± 2.9 mmol/L, p < 0.05) were higher at POST vs PRE whereas there was a tendency to a lower [La] (p = 0.07). There was no alteration in these three parameters in CONT. At 2-min recovery, there was no difference in pH and HCO3 in both groups after the training period whereas [La] was lower at POST in CONT and unchanged in HYPO. The results of this study did not demonstrate an improvement of endurance performance by training with voluntary hypoventilation. On the other hand, this kind of training could modify the glycolytic status. The training at 70% of VO2max probably constituted a detraining in anaerobic glycolysis which led to a lower lactate production in CONT at maximal exercise. On the other hand, the unchanged [La] in HYPO could mean that even at moderate intensity, anaerobic glycolysis may be solicited when voluntary reducing the breathing frequency. The weaker blood acidosis in HYPO at 90% of THRmax as well as the higher HCO3 level could be due to an improvement in muscle buffer capacity. This phenomenon may have a significant positive impact on anaerobic performance.


Keywords: Hypoxia, Training, Arterial O2 Saturation