EFFECTS OF NORMOBARIC AND HYPOBARIC HYPOXIA ON ENDOTHELIUM-DERIVED NITRIC OXIDE AND CARDIORESPIRATORY FUNCTION IN HEALTHY INDIVIDUALS

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The combination of intermittent hypoxia with high training intensity constitutes the most effective stimulus for increasing muscle oxidative capacity. The potential mechanisms through which exercise performance may be improved in response to hypoxia include stimulation of nitric oxide (NO) synthesis as well as restriction of NO overexpression. It has been suggested that endothelial-dependent adaptation to intermittent hypoxia differs depending on the type of hypoxia and/or the hypoxic regimen. Thus, the aim of this study was to analyze the effect of normobaric (NH) and hypobaric hypoxia (HH) on plasma levels of asymmetric dimethyloarginine (ADMA) and NO as well as cardiorespiratory function in healthy trained subjects. Thirteen endurance-trained athletes (mean age: 24±4 years) volunteered for the study. The training status of the subjects, expressed as maximal oxygen consumption (VO_{2max}), was 66.2±3.6 ml/kg/min. The first group of athletes stayed and trained for 3 weeks under hypobaric hypoxic conditions (2015and 3000 meters above sea level, respectively). The other group trained in normoxia for three weeks but stayed in normobaric hypoxia ($FIO_{2=}$16%). Prior to the hypoxic exposure and during each week of hypoxia, serum NO and ADMA were measured. The obtained results (NO, ADMA, pulse oxygen saturation - SpO_2, heart rate -HR, pulmonary ventilation - VE, and maximal oxygen uptake) were compared to pre-hypoxic values. Significant differences were found between serum NO levels (21.4±6.4 µmol/l) in HH group compared to NH (11.7±4 µmol/l; p=009) after the first and third (20.5±8.4 µmol/l vs. 7.4±1.4 µmol/l; p=0.003) week of hypoxic exposure. No significant differences between the groups were observed as to ADMA levels following each of the hypoxic weeks, and as to ADMA and NO levels at one week following the cessation of the experiment (p=0.2). Hypobaric hypoxia resulted in a significantly increased serum ADMA compared to pre-hypoxic resting values (0.42±0.08 µmol/l vs. 0.56±0.1 µmol/l; p=0.04) with a tendency to decreased NO levels. After the first week of normobaric hypoxia, significantly higher NO concentrations were found compared to the pre-hypoxic level (p=0.04). Our results revealed higher exercise tolerance and differences in VO_{2max} levels in trained subjects of HH (4.6%) and NH (1.5%) groups compared to pre-hypoxic values. The results of the study have demonstrated differences in endothelial vasodilatation factors release in response to normobaric and hypobaric hypoxia thus confirming an association between the hypoxic regimen and physiological and endothelial-dependent adaptation in athletes.