Acute physiological responses during walking under low oxygen exposure of 4000m altitude environment

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Background. Physiological functions are adapted when ascending above 2500m and exposing to the hypoxic environment. As altitude increases, the density of oxygen in air and the atmospheric pressure is decreased from that at sea level. These atmospheric conditions result in a reduction in the partial pressure of oxygen and causes the development of acute mountain sickness in some individuals. During maximum exercise in the hypoxic environment, maximum oxygen consumption (VO_2max) is lower and blood lactate concentration is greater than those in the normoxia condition; however, it is still unclear how the low intensity exercise under the hypoxic exposure simulated to 4000m altitude environment affects physiological functions.

Purpose. The purpose of this study was to investigate physiological responses during low-intensity exercise in a low oxygen environment.

Method. Twelve healthy men performed stationary walking in normoxia (NOR: 20% O_2, altitude 0m) and hypoxic (HYP: 12.8% O_2, equivalent to 4000m altitude) conditions. Experiment was carried out at the climate chamber at an ambient temperature of 25° and relative humidity of 50%. The exercise condition was set at NOR. Subjects walked with arm swing at the same place and they were asked to raise their knees up to the greater trochanter of femur, 60 repeats per minute for 5 minutes. Exercise intensity was 20.4 ± 4.4% HRmax calculated by Karvonen Formula. Peripheral capillary oxygen saturation (SpO_2), oxygen consumption (VO_2), heart rate, rating of perceived exertion (RPE), blood lactate and glucose were measured using pulse oximeter, a metabolic cart, heart rate monitor, Borg scale and a blood test meters, respectively. Also, respiratory exchange ratio (RER: VCO_2/VO_2) was calculated.

Results and discussion. Our results show that during the low intensity exercise under the hypoxic exposure simulated to 4000m altitude environment VO_2 was no different as compared to normoxic environment; however, RER became close to 1 and the blood glucose and lactate concentrations increased. Also, the low oxygen exposure increased the heart rate at rest and during exercise, indicating increasing sympathetic activity. There results suggest that temporary exposure to an hypoxic environment promotes the utilization of the glycolytic energy pathway compared to the same exercise performed in a normoxic environment.