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Exploratory Study on Predicting Acute Altitude Sickness by Using Oxygen Saturation

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Objective The aim of the present study was to investigate the probability of altitude sickness based on the correlation coefficient between oxygen saturation and LLS score by analyzing the correlation of physiological parameters, like oxygen saturation, between the simulated altitude 5000m and altitude conditions. The results of our study may provide suggestions for public and mountaineering team.

Methods Fourteen male subjects from Chinese Agricultural University participated in acute hypoxic exposure a simulated altitude of 5000m. The study was carried out in hypoxic laboratory (Low Oxygen Systems GmbH, Germany) at Sports Science Research Centre. Oxygen Saturation (SpO₂), maximum expiratory flow, Peak Expiratory Flow (PEF), heart rate, blood pressure, the Lake Louis consensus scoring of AMS (LLS) and other indicators were measured every 1h in hypoxic environment. After hypoxic exposure, all subjects climbed the Mountain in Sichuan Province (the main peak was 6300m above sea level). During climbing, the SpO₂, maximum expiratory flow, heart rate, blood pressure and LLS assessment were measured in the early morning of the team's arrival at 4020m, 4950m and 5000m. All results were expressed as mean ± standard deviation. The data were analyzed by paired sample T test by SPSS 19.0. The difference between two tests was considered significantly when $P < 0.05$.

Results The significant difference was observed between simulated altitude of 5000 meters and three levels real high altitude conditions in SpO₂, heart rate, maximum expiratory flow, blood pressure. There was a significant negative correlation between blood oxygen saturation and AMS score at the simulated altitude of 5000m at 4th-5th hour (4th hour $P=0.030$, 5th hour $P=0.011$), and the correlation function relationship $AMS\ score = (76.842 - SpO_2) / 1.313$ was obtained. When the oxygen saturation decreased 1.313mmol /L, AMS score increased 1.0. PEF and LLS scores has a high negative correlation ($P < 0.05$). As the height increased, the score increased and PEF decreased significantly.

Conclusions In simulated altitude of 5000 meters, the change of human SpO₂ has a corresponding relationship with oxygen concentration, and the SpO₂ value is significantly correlated with the AMS score. It has a functional relationship of $AMS = (76.842 - SpO_2) / 1.313$ during the period of 4th-5th hour exposure to hypoxia. Therefore, oxygen saturation in simulated 5000m altitude can predict the altitude response intensity during the actual mountaineering process.