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The following abstract was received at a late date. As indicated by the abstract number, this paper will be presented in Session IV Human Performance at Altitude.

23a Changes in pulmonary diffusing capacity at simulated high altitudes under different ambient temperatures

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There has been no study on the effect of cooling on pulmonary diffusing capacity for CO (DL) at high altitude where it is naturally cool or cold. The purpose of this study is to examine the effects of ambient temperature and hypobaric hypoxia on D_L at rest and during exercise.

Climatic conditions in a biotron were kept constant at temperatures of **16,20,** 24 and 28OC (RH 50%, respectively) combined with barometric pressures corresponding to sea level and high altitude of 2,000 and 4,000m. Each subject (five young male adults), wearing a thin running shirt and shorts, was exposed to each condition for about 150 minutes. D_L was measured by a breath-holding method at almost the same partial O_2 pressure as that of room air under each condition. D_L, oxygen intake and heart rate were measured at the 5th, 60th and 120th minute of exposure at rest in a sitting position and also measured during exercise after a rest period. Exercise was performed successively at workrates of 50 and 100 watts with a bicy cle ergometer for about 7 minutes each.

D_L increased significantly with increased altitude at rest and during exercise. In addition, D_L in a cool environment, 16% at 2,000m and below 20°C at 4,000m, was further increased significantly compared with that in 28°C at rest and during mild exercise (50 watts), although any thermal effect was not observed at sea level. This means that the difference in D_L between altitudes was dependent on ambient temperature.

However, the regression coefficient of D_L on oxygen intake was statistically constant under every combined condition between temperature and altitude. The y-intercept of this regression line was affected significantly by the change in ambient temperature at 4,000m, while there was no thermal effect at sea level and at 2,000m.

D_L at high altitude was predicted, presuming that pulmonary capillary blood volume and reaction rate between CO and hemoglobin (0co) were the same as those at sea level. As a result of comparison between measured and predicted value, there was no difference on every Occasion at 2,00Om, while significant increase in measured D_L was observed at rest and during mild exercise at 4,000m in a cool environment. It was implied that gas exchange surface area increased under hypobaric condition in a cool environment caused by increase in capillary blood volume in **itself** and/or change in distribution of capillary blood flow in the lungs. However, these effects were relatively reduced at ambient temperature above 24°C. It was presumed that the degree of increase in D_L was more pronounced at higher altitude in a cooler environment, especially at rest.

Judging **from** predicted D_L at high altitude, it was suggested that the increase in D_L from sea level to 2,000m was caused mainly by Increase in **Oco** due to fewer O_2 molecules to compete with CO for binding sites **on** the hemoglobin. On the other hand, further increase in D_L from 2,000m to **4,000m** was caused mainly by increase in gas exchange surface area due to hypoxic effect in alveoli in addition to further increase in ***Oco.***