

E60914 The Effect of Blood Volume on Plasma Volume Reduction during Exercise in Japanese Professional Football Players

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Purpose: Maintenance of blood volume is an important factor for providing circulatory stability and thermoregulatory during exercise and performance. It is well known that during dynamic exercise, blood volume tends to fall slightly due mainly to decrease plasma volume (PV) in proportion to the exercise intensity. This shift of PV results from an osmotic movement of water from intravascular space and can be up to a 20-25% of initial PV during very intense exercise. To assess the relationship between blood volume and plasma volume exchange during exercise, we measured changes in plasma volume during exercise and blood volume in fifteen Japanese professional football players, attached to Japan football league.

Method: Blood volume was measured by the pulse Indocyanine green dilution method (DDG-2001, Nihon Kodan, Japan). Exercise intensity was increased stepwise until voluntary exhaustion. Blood samples were collected at each stepwise exercise intensity and at exhaustion.

Results: Peak oxygen uptake ($\text{VO}_{2\text{peak}}$) of subjects were $61.49 \pm 1.09 \text{ ml} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$ and a mean BV and PV were $63.85 \pm 3.49 \text{ ml} \cdot \text{kg}^{-1}$ and $37.58 \pm 2.17 \text{ ml} \cdot \text{kg}^{-1}$. The $\text{VO}_{2\text{peak}}$ per body weight indicated significant positive correlation with BV and PV. PV decreased significantly with exercise intensity and $-16.5 \pm 0.5\%$ of the resting values at the lactate threshold (LT) of $4 \text{ mmol} \cdot \text{l}^{-1}$. $\% \text{VO}_{2\text{peak}}$ at LT showed significant positive correlation with BV. We analyzed a relationship between $\% \text{PV}$ shift at LT and BV in the individual case and $\% \text{PV}$ shift showed significant negative correlation with BV.

Conclusion: These findings would suggest that 1) there is a closely relationship between $\text{VO}_{2\text{peak}}$ and BV and PV, and 2) $\% \text{PV}$ shift during exercise is higher in the high-BV subject than the low-BV subject while circulatory blood volume may be maintained in the high-BV subject compared with the low-BV subject.

Key words: Blood volume, Plasma volume reduction, Aerobic power, Japanese professional players

E60915 Circulation Dynamics of the Upper Body during Abdominal Breathing Exercise

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Purpose: This study was designed to appear the circulation admittance changes during the abdominal breathing exercise that was reinforced the diaphragm shortening into the upper-side, physically.

Method: Admittance (Impedance) of the upper body was recorded to acquire Stroke Volume, Cardiac Output, and Thorax Capacity from the NICO VIEW Apparatus. This abdominal breathing exercise was compared with natural, chest, speaking, and hyperpnea respiratory types, physiologically.

Results: Those admittance showed from 30.7 to 30.2 Z at the lying attitude, and then fluctuation of RR wave intervals (CVRR) increased to mean 6.0% related to expired respiration volume, statistically.

Conclusion: Those data indicated that expired capacities during abdominal breathing exercise should have effectiveness on admittance changes of the upper body, the diaphragm movement, and fluctuation of the autonomic nervous system, bio-dynamically.

Key Words: Breathing, abdomen, Admittance, Fluctuation