EFFECT OF BICYCLE AND ONE-LEG EXERCISE UPON OXYGEN DELIVERY AND CONSUMPTION IN WORKING MUSCLE
Popov Daniil, Missina Svetlana, Vinogradova Olga
(Institute for Biomedical Problems, Russia)

During dynamic exercise of large muscle groups in trained human subjects O2 consumption is limited predominantly by O2 supply. On the other hand central circulatory limitations do not play a major role in one-leg knee extension exercise, because cardiac output does not reach maximal capacity.

The aim of the study is to compare dynamics of lung VO2, delivery and consumption of O2 in working muscle (m. vastus lateralis) during maximal incremental exercise. 6 athletes and 7 physically active young men (maxVO2 2.7-5 l/min) of the same age participated in experiment. Incremental exercise was performed either on bicycle ergometer and one-leg knee extension test. An assumption was made that common Hb/Mb (cHb) and deoxygenated Hb/Mb (HHb) are proportional to delivery and consumption of O2 in the area of interest of working muscle. These parameters were evaluated by near-infrared spectroscopy. Lung VO2 was measured by breath-by-breath method and arterial O2 saturation by pulsoxymetry. Lactate concentration in capillary blood was evaluated during incremental tests as well.

Lung VO2 linearity increased during one-leg test at all subject. On the other hand during bicycle test the increase in lung VO2 was attenuated at near maximal work. It means that O2 delivery restrict maxVO2 during bicycle test in contrast to one-leg test.

No marked decrease of O2 saturation was observed during both bicycle and one-leg test. An index of O2 delivery (cHb) increased till exhaustion during one-leg test in all subjects. The index of oxygen consumption in muscle (HHb) either increased till exhaustion or attenuated at near maximal intensity. The later may be related to insufficient oxidative potential or diffusion limitation of muscle.

In physically active subjects cHb increased during incremental bicycle exercise up to 88% from Wmax and after that even decreased. A decrease of cHb may be explained by decrease of cardiac output or redistribution of blood from working muscles to other regions (to breathing muscle, for example). HHb increased during initial period of bicycle exercise at physical active subjects as well, but decrease started earlier than of cHb (at 82% of Wmax). Therefore in this subject O2 delivery during incremental bicycle test does not limit muscle O2 consumption.

In contrast to physically active subjects some of athletes did not show decrease of cHb and HHb even at maximal work in bicycle test (HHb rose till exhaustion).

The obtained data allow to understand where O2 delivery may restrict local muscle O2 consumption at individual subjects during specific muscle work.

Keywords: Oxygen Consumption, Near Infrared Spectroscopy, Exercise Metabolism