

# ANALYSIS OF CHANGES IN ARTERIAL PRESSURE AND WORKING EFFICIENCY OF THE MYOCARDIUM IN RABBITS TRAINED FOR ANOXIA AND MUSCULAR EXERTION

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The use of an electromanometric recording technique has shown that the systolic arterial and pulse pressures and also the maximal pressure in the left ventricle are increased in rabbits trained for anoxia and for muscular exertion, indicating an increase in myocardial working efficiency. Conversely, the diastolic pressure of these animals is lowered, leading to economy in the work of the left ventricle.

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Laboratory investigations have shown that a natural increase in the load on the skeletal muscles of dogs during postnatal ontogenesis, produced by the creation of a state of physiological anoxemia, causes the development of vagotonia, slowing the heart rate and increasing the working efficiency of the myocardium [1-10].

In contrast to dogs, in idioadaptive animals such as rabbits, under normal conditions of development a smaller load is thrown on the skeletal muscles, and neither physiological anoxemia nor vagotonia develops, and the heart rate remains at a high level. However, transformation of activity of the respiratory and cardiovascular systems can be obtained in rabbits also by daily training for muscular exertion or anoxia. Vagotonia arises in rabbits trained in this manner, and their heart rate falls [11, 12, 13].

The object of this investigation was to study changes in the arterial pressure and myocardial working efficiency of rabbits developing normally and under the conditions of artificially produced physiological anoxemia.

## EXPERIMENTAL METHOD

A state of physiological anoxemia was produced in the experimental animals in chronic experiments as follows. The animals of group 1 were trained for anoxia daily for 2 h (in a pressure chamber at an altitude of 5 km). The animals of group 2 also were trained for muscular exertion daily (swimming in a bath at a water temperature of 20-22°). The animals of group 3 received combined training for anoxia and muscular exertion. The two types of training were alternated in these animals: training for anoxia one day, for muscular exertion next day, and so on. The training period began at the age of one month and continued for 5-6 months. Intact rabbits aged 5-6 months, of the same weight as the experimental animals, were used as controls. After the end of the training period, the pressure within the femoral artery and left ventricle of the experimental and control rabbits was recorded (successively) by retrograde catheterization under acute experimental conditions, under local anesthesia (0.5% procaine solution) by means of an "Orion" electromanometer and recorded photographically on a type MPO-2 loop oscillograph.

## EXPERIMENTAL RESULTS

The results (Table 1) demonstrate that in rabbits trained for anoxia and muscular exertion during development, the diastolic pressure was lowered, leading to economy in the work of the left ventricle [14], while the systolic arterial and pulse pressures were increased, indicating an increase in the systolic output of the heart [14]. In addition, in the trained rabbits the duration of the systolic portion of the pulse wave

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TABLE 1. Pressure in Femoral Artery and Left Ventricle (in mm Hg) and Duration of Phases of Pulse Changes in Arterial Pressure (in msec) in Control and Trained Rabbits (M±m)

Group of rabbits	Pressure in femoral artery			Duration of pulse wave of arterial pressure			Maximal pressure in left ventricle	Pulse rate (per min)	No. of animals	
	systolic	diastolic	pulse	as a whole	systolic part					diastolic part
Control	115,1±2,5	94,4±2,0	20,7±1,8	233,0±8,6	51,0±1,4	182,0±6,5	117,2±1,4	240—294	10	
Training	124,5±2,0	86,9±1,4	37,6±0,4	244,0±7,9	43,0±1,8	201,0±6,5	128,7±2,8	225—300	7	
Anoxic	134,2±4,1	81,0±2,7	53,2±3,4	245,0±11,6	40,0±1,3	205,0±11,5	147,1±2,2	200—300	6	
Muscular	130,0±1,6	77,8±1,1	52,2±1,2	239,0±12,3	39,0±1,1	200,0±13,6	139,9±5,5	220—288	6	
Combined										
Significance of difference between groups	<0,05	<0,05	<0,01	>0,1	<0,01	<0,02	<0,01			
P <sub>1-2</sub>	<0,05	<0,01	<0,01	>0,1	<0,01	>0,1	<0,01			
P <sub>1-3</sub>	<0,05	<0,01	<0,01	>0,1	<0,01	>0,1	<0,01			
P <sub>1-4</sub>	<0,05	<0,01	<0,01	>0,1	<0,01	>0,1	<0,01			

was reduced, in consequence of which the expulsion phase was shortened. The maximal pressure in their left ventricle was higher than in the control rabbits. The last three facts indicate that the working efficiency of the myocardium was higher in the experimental animals than in the controls.

Training of rabbits during development for systematic muscular exertion and anoxia, leading to the development of vagotonia through the creation of physiological anoxemia, thus leads to an increase in the working efficiency of the myocardium and to increased economy in the work of the heart.

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