C57Bl/6 Mice are More Resistant to Hypoxic Hypoxia than BALB/c Mice

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C57Bl/6 mice with low intensity of metabolic processes are more resistant to hypoxic hypoxia than BALB/c mice.

Key Words: *hypoxia; mouse strains*

The survival of humans and animals under extreme conditions is known to depend on their resistance to hypoxia. Changes in cells and tissues induced by functional and structural shifts can induce death of the organism. Therefore, the mechanisms of hypoxia-induced disturbances, methods of antihypoxic protection, and individual resistance to hypoxia are of considerable importance.

Nootropic drugs and tranquilizers are potent antihypoxic agents. The mechanism of protective effects of these preparations is poorly understood. Probably, they result to a great extent from the decrease in cerebral functional activity. However, xenobiotics induce short-term and reversible changes in the body, which hinder experimental studies. At the same time, the electrical activity of the brain in C57Bl/6 mice has some peculiarities observed in other rodents under the effect of tranquilizers [2]. A large body of data on specific behavioral features of these animals agrees with this fact [1]. Therefore, C57Bl/6 mice are assumed to be more resistant to experimental hypoxia than BALB/c mice, which have opposite physiological peculiarities [1,2].

MATERIALS AND METHODS

Experiments were performed on adult male C57Bl/6 and BALB/c mice kept under standard conditions (Table 1).

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Respiratory gas mixtures (RGM) were formed in a pressure chamber (150 liters) equipped with a pressure compensator (60 liters) and hermetic sleeves for manipulations inside the chamber without its decompression. A VN-2 fan for mixing RGM, a booster for increasing gas consumption connected to gas analyzers for oxygen (Pac 1102, electrochemical detector, instrument range 0-100%, "Dreger") and carbon dioxide (GIAM-5M, instrument range 0-5%), a flat diffusion CO_2 absorber (absorbent KhP-I), and a polarographic transducer of the oxygen analyzer (OksitM, instrument range 0-100%) were placed in the pressure chamber. The contents of nitrogen and oxygen were monitored using a gas chromatograph (Tsvet). The temperature of RGM and the relative humidity were measured by a TF-3-M1 alcohol thermometer and hair hygrometer, respectively.

The gas mixture was formed in the chamber by delivering a set volume of gases through a GSB-400 gasometer. The mixture composition was then corrected by reading the indications of gas analyzers and chromatograph. The decrease in O_2 content due to respiration was constantly compensated. Recordings began from the moment when the mice were placed into the chamber. Time of death was determined by the last agonal inspiration.

RESULTS

C57Bl/6 mice were shown to be more resistant to hypoxic hypoxia than BALB/c mice (Fig. 1). The mean survival times of C57Bl/6 and BALB/c mice were

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TABLE 1. Experimental Conditions

Strain	Weight, g	Gas medium				
		O_2, %	N_2, %	CO_2, %	T, °C	relative humidity, %
C57Bl/6 (n=7)	21.5±2.6	5	95	<0.05	22	43
BALB/c (n=11)	19.3±1.8					

536.6±188.07 and 311.3±67.59 sec, respectively (p<0.05). This was probably due to some differences in the intensity of metabolic reactions in these animals. The CNS is most sensitive to oxygen deficiency. Obviously, the resistance of the CNS to hypoxic hypoxia depends on oxygen reserve (over the first few seconds of hypoxia) [4], efficiency of anaerobic glycolysis (4-10 min of hypoxia), degree of cell intoxication with glycolysis products, and intensity of LPO processes (>10 min of hypoxia) [7]. Thus, low intensity of metabolic processes and low relative weight of the brain should determine higher resistance to hypoxia.

C57Bl/6 mice are characterized by very low intensity of metabolism. They have low body temperature [9] and oxidation rate in the hepatic cytochrome P450-dependent monooxygenase system [8]. A low sensitivity of C57Bl/6 mice to radiation correlates with their resistance to hypoxia [5]. Physiological parameters of these animals are similar to those observed under the effects of tranquilizers. C57Bl/6 mice are resistant to stress [1-3], electrical activity of the brain in these animals is inhibited [1,2], and they display a high level of aggressiveness [6]. BALB/c mice have opposite features.

Tranquilizers display protective properties in hypoxia and suppress vital activity by decreasing energy consumption. Our findings suggest that C57Bl/6 mice, which have physiological peculiarities observed in other rodents under the effects of tranquilizers, are highly resistant to hypoxic hypoxia.

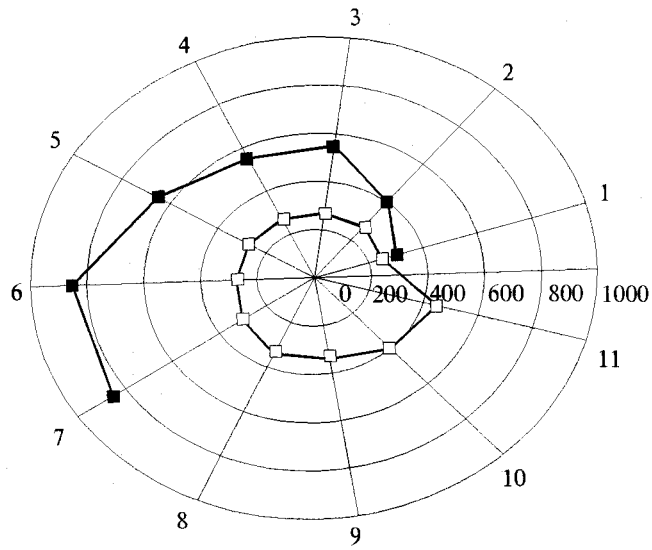

Fig. 1. Survival times of mice in hypoxic medium (5% O_2 and 95% N_2).

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