PHYSIOLOGY

Sensitivity to Hypobaric Hypoxia in Mice Selected for High and Low Brain Weights

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We studied the effect of hypobaric hypoxia on mice with various brain weights. Mice with low brain weight were more resistant to hypoxia than animals with high brain weight.

Key Words: *selected mice; brain weight; hypobaric hypoxia*

Individual resistance to hypoxia in mammals is an important problem of experimental physiology and medicine. Published data suggest that adaptation of the organisms to extreme conditions is determined by specific structure and functions of the nervous system. Studies of constitutive peculiarities of the central nervous system (CNS) would contribute to a better understanding of individual reactions to hypoxia. In this context, mice selected for brain weight are a perspective experimental model. The weight of the brain is an integral parameter reflecting the number of nerve elements and morphofunctional organization of this organ. Previous studies demonstrated a relationship between brain weight, animal behavior [2,4,5], and their resistance to extreme factors [1].

Here we evaluated the relationship between brain weight and lifetime of animals under conditions of hypobaric hypoxia.

MATERIALS AND METHODS

Experiments were performed on adult female mice selected for low (LBW) and high (HBW) relative weights of the brain (generation 22). During selection 50% animals from each litter were killed at the age of 60 days, and the body and brain weights were estimated. For further breeding we used mice, whose body weight and weight of the brain exceeded the confidence limits of the regression line between these parameters. The offspring of inbred CBA, DBA/2, C57Bl/6g, C57BR/cd, A/He, and BALB/c mice were used for selection. The conditions of selection were described previously [3]. Brain weights in HBW and LBW mice differed by 45 mg. Differences in body weights were insignificant (25.70±3.11 and 24.20± 3.83 g, respectively).

Hypobaric hypoxia was modeled in a 15-liter sealed chamber equipped with a vacuum pump, standard vacuum meter, and regulatory valves.

Two mice from different groups were placed in the chamber and atmospheric pressure was decreased to 0.194 atm over 4 sec, which corresponds to a simulated altitude of 11,000 m above sea level (5% O_2). Animal behavior were visually monitored through chamber windows. Time of death was determined by the last agonal inspiration. The results were analyzed (Student's *t* test) using Excel 97 software.

RESULTS

LBW mice were more resistant to hypoxia than HBW animals. The lifetimes of these mice were 249.9± 68.98 and 147.8±44.86 sec, respectively ($p<0.05$). The brain weights determined after decapitation significantly differed between these groups (0.4460±0.0193 and 0.4030±0.0247, respectively, $p<0.05$).

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Our results indicate that brain weight is an integral parameter, which reflects the structure of CNS and plays an important role in the individual resistance of mammals to oxygen deficiency. Probably, large brain requires much greater amounts of oxygen than small brain. These data should be taken into account in predicting the individual resistance to hypoxia in humans.

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