

## FOOD BEHAVIOR OF IMMATURE RATS IN T-SHAPED MAZE AFTER DAILY FOOD DEPRIVATION, HYPOXIA AND THEIR COMPLEX (COMBINED) IMPACT

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**ABSTRACT.** In rats of 1 and 2 months of age, in a T-shaped maze, food search reactions and appetite were studied after 24 hours of food deprivation, 20 minutes of severe hypoxic hypoxia (breathing in a pressure chamber at 5% O<sub>2</sub>) and in the deprivation + hypoxia mode. Daily fasting stimulated both the search for food and feeding in the maze compartments in rats of both ages, especially in 1-month-old rats. Acute hypoxia caused in immature experimental animals a rather pronounced passivity in the search for and consumption of food in the compartments of the T-shaped labyrinth, which was especially noticeable in 1- and 3-hour hypoxia in 1-month-old rats. Food deprivation, when combined with hypoxia, somewhat stimulated food behavioral responses in experimental animals.

From the conducted three-stage experiment, we can conclude the following. Firstly, physiological starvation during the day turned out to be a sufficiently active factor contributing to the transition of the locomotor functions of the animal to a higher level of activity of the entire system of its eating behavior than usual. Secondly, the possibility of a significant disruption of the functional structure of eating behavior under the influence of a severe form of hypoxic hypoxia has been shown, and physiological hunger can play the role of a factor mitigating this effect of hypoxia. And finally, the model of the T-shaped maze can become one of the appropriate methods for studying the reactions of eating behavior in one or another extreme state of the animal's body.

**Keywords:** immature age, T-shaped maze, daily food deprivation, hypoxia, starvation + hypoxia, search reaction, feeding

### I. Introduction

It is known that among all forms of animal behavior, eating behavior occupies a special place. Food consumption is necessary for the survival of the individual. Animals actively search for food with the help of sensory information and the motor apparatus, many of whose functions are aimed at moving the animal to food and at the very consumption of food [1]. The main starting excitation (or stimulus) is food motivation (the need for food), which, in terms of strength, the totality of the structures and mechanisms involved in it, and the ways to satisfy it, differs significantly from other forms of biological motivations [2, 3, 4]. According to the concept of P.K.Anokhin [2] about functional systems, certain nervous, reflex, hormonal, visceral and motor mechanisms formed in the animal body, and the afferent syntheses corresponding to them, can be coupled as separate specific functional systems providing integral behavioral reactions. Such complex systemic mechanisms and links are also involved in the structure of eating behavior [3]. As you know, in the processes of formation of food motivational arousal and its emotional coloring, as well as in the regulation of eating behavior in general, the hypothalamic "food centers" play a significant role - the "hunger center" and the "satiety center" (satiation) - which were discovered in the experiment by [5, 6] of the last century. Their functions are closely related to chemosensory mechanisms, limbic and cortical structures, neuropeptide and neurotransmitter influences, as a result of which, under various conditions of the external and internal environment, the feeding behavior of the animal is more or less effective [7, 8]. Thus, it can be assumed that under significant, extended, specific and non-specific effects (starvation, hypoxia, stress, etc.), critical changes or disturbances in eating behavior may be due to shifts in the functional states of various mechanisms and links of the integral system of eating behavior

According to the existing experimental and clinical data, hypoxia (oxygen deficiency, oxygen starvation), both of exogenous and endogenous nature, is a multilateral factor for the human and animal organism, a factor of an obvious pathological nature [9, 10, 11, 12, 13, 14].

Impact research is of particular importance such factors as starvation and hypoxia in the early periods of postnatal ontogenesis, when the formation and functioning of physiological links and mechanisms, restructuring and compensatory-adaptive processes in the developing organism become more intense. Based on these positions, this experimental study

was carried out on immature animals, given that the reactions of eating behavior during starvation and hypoxia have been studied extremely insufficiently.

**II. Methods**

The study was carried out on male Wistar rats. Animals are 1 and 2 months old. Body weight is 100-110 and 130-140 g, respectively. The total number of animals was 48 animals. They were divided into 4 groups: one control, and three experimental (6 animals in each group), taking into account their age and the nature of the study.

One group was subjected to daily food deprivation, the other to 20-minute hypoxic hypoxia, and the last group was subjected to their combined effects according to the same time parameters. Hypoxia was carried out in an extremely severe form: in a pressure chamber with a mixture of nitrogen 95% and oxygen 5%.

Eating behavior responses were studied in a T-shaped maze constructed from glass plates. Dimensions: 60 x 12 x 12 sm, and the length of each of its arms is 20 sm. The labyrinth is open on top, had a starting compartment with a cup for drinking water, in the right and left shoulders for feeders. Minced meat was used as food either in fried or non-fried form, in granules, weighing 1 g, total weight 50 g. After applying deprivation, hypoxia and their combination for 1 day, every 3 hours, the time of movement of the animal from the launch pad was recorded to the feeder in the right or left shoulder of the labyrinth and the amount of food consumed by him in the feeder for 5 minutes. The animal was then removed from the maze. Drinking rates were not taken into account in these experiments.

Digital data were processed parametrically (Lakin G.F., 1980), and the significance of differences in the feeding behavior of animals was established by Student's t-test, statistically significant differences were evaluated at  $p < 0.05$  significance values.

**II. Results and Discussion**

Before the start of the experiment, rats of both ages selected for the study were preliminarily tested twice (1 time per day) for situational and food-procuring (search) reactions in a T-shaped maze. Visual evaluative observations showed that in general there was no clear age difference in their feeding behavior, with the exception of some individuals from each age group.

Daily (24-hour) food deprivation (physiological starvation) significantly activated locomotor functions in the experimental groups to search for food in the final compartments of the labyrinth. Immediately after deprivation, the rats of the experimental groups spent less time searching for food inside the maze and ate more food than the control rats fed 3 hours earlier before testing in the vivarium mode.

Characteristically, the smell of food at the end of the maze provoked the experimental rats to be more active in searching for food than the control ones. It was found, that after food deprivation in animals from the one-month-old group, the reactions of eating behavior in the maze are more active compared to animals from the two-month-old group. In older hungry rats, the activity in finding food and group. In older hungry rats, the activity in finding food and in eating food was somewhat lower than in younger hungry rats. The data are presented in table 1.

In the next experiment, in a T-shaped maze, the feeding behavior of 1- and 2-month-old rats was studied after hypoxic exposure, but over a longer period than in the previous experiment format. The data obtained are shown in figure 1 (A and B).

Table 1.

*Temporal and quantitative indicators of searching for and eating food in the terminal compartments of the T-shaped maze in 1 and 2 month old control and food deprivation rats ( $M \pm m$ ,  $n=6$  individuals in each group).*

Objects and conditions of the experiment	The term for determining indicators	Time spent searching for food in the maze, in minutes	The amount of food taken in the maze in 5 minutes, in grams
Control			
1 month	-	4,30±1,0	24±3,0
2 monthly	-	4,0±1,20	26±2,5

Daily food deprivation			
1 month	1st hour after depriv.	2,40±0,35*	33±4,0*
2 monthly	1st hour " "	4,50±1,20	29±3,5

\* - statistically significant differences between control and experimental animals ( $p < 0.05$ ).

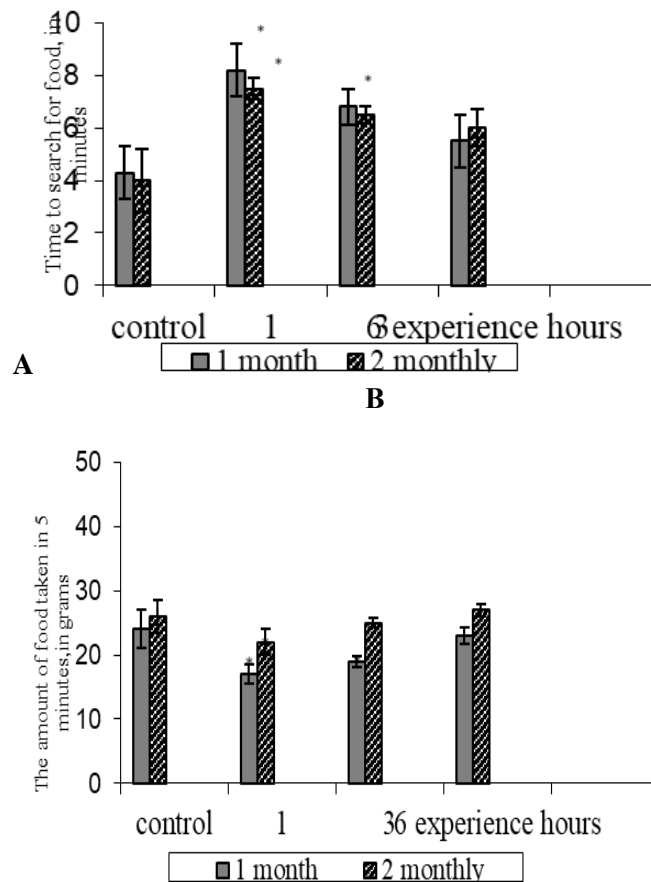


Figure 1. Post-hypoxic changes in the eating behavior of 1- and 2-month-old rats in the T-shaped maze: A - indicators of the time of searching for food in the maze; B - indicators of food intake in the compartments of the labyrinth. \* - statistically significant differences ( $p < 0.05$ ).

Further, the combined (conjugated) effect of daily food deprivation and 20-minute severe hypoxic hypoxia on the eating behavior of 1, 2-month-old rats in a T-shaped maze was studied. The terms of observation and indicators of behavior are the same as in the previous experiment. The experimental data are shown in figure 2 (A and B).

In this experiment, the feeding behavior of experimental rats in the conditions of the maze looked somewhat different than in previous versions of the study, where the effects of daily food deprivation and hypoxia on this type of behavior were studied separately. When testing in the mode of food deprivation + 20-minute hypoxic hypoxia in severe form, it was found that daily fasting somewhat softened, or rather stimulated the search for food and self-feeding in rats in the maze.

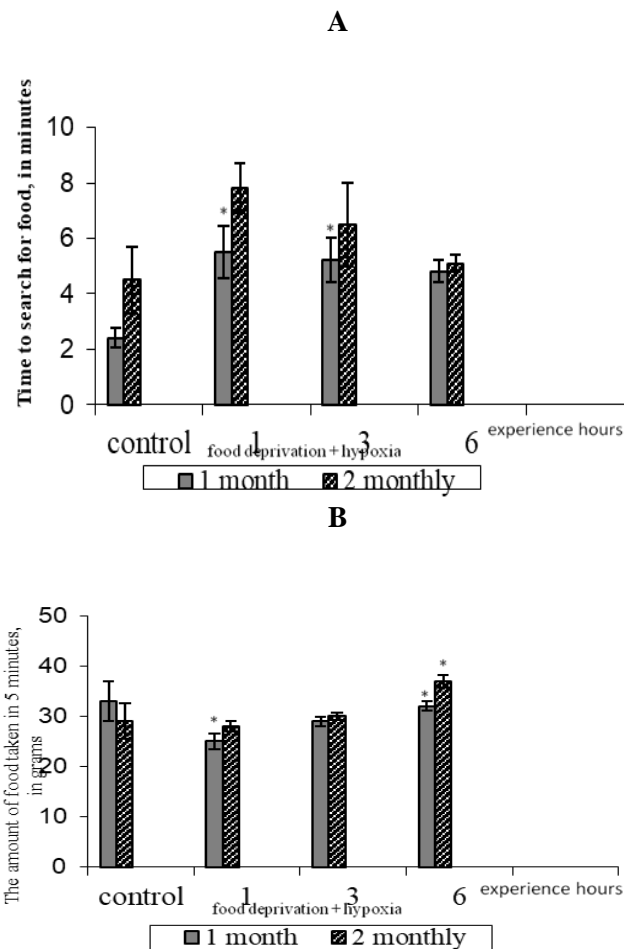


Figure 2. Characterization of the effect of daily food deprivation and a 20-minute severe form of hypoxia on the performance of acts of eating behavior in the T-shaped maze by immature rats; A - the activity of searching for food in the compartments of the labyrinth; B - the intensity of feeding in the compartments at a given time (for 5 minutes). \* - statistically significant differences ( $p < 0.05$ ).

Already in the initial period of the experiment, rats, especially older ones (2 months old), made search movements inside the maze in a shorter time than in the experiment with hypoxia separately. And at 3 and 6 hours of the experiment, the experimental animals behaved quite effectively in locomotion and feeding in the conditions of the labyrinth.

Thus, from the conducted three-stage experiment, we can conclude the following: Firstly, physiological starvation during the day turned out to be a rather active factor, to a large extent contributing to the transition of the animal's locomotor functions to a higher level of motivationally determined activity of the entire system of its eating behavior, than usual. Secondly, the experiment showed the possibility of a significant disruption of the functional structure of eating behavior when exposed to a severe form of hypoxic hypoxia, and physiological hunger can play the role of a factor mitigating this effect of hypoxia. And finally, the model of the T-shaped maze can become one of the appropriate methods for studying the reactions of eating behavior in one or another extreme state of the animal's body.

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