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Research Article

The Curcuma Longa and Hypoxia Effect on The Spatial Memory in Alzheimer Disease Experimental Model

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Introduction

Alzheimer disease (AD) is known as an extremely insidious neurodegenerative disease. According to forecasts, by 2030 the number of patients suffering worldwide will reach 65 billion people [1]. According to WHO, AD accounts for more than 70% of all cases of dementia. The characteristic symptoms of AD are the following processes: 1) memory loss, amnesia; 2) loss of ability to concentrate; 3) loss of orientation in time and space; 4) impairment of cognitive functions [2].

Aim

The purpose of this study was to conduct a comparative analysis of the hypoxia and natural antioxidant (Curcuma longa) effect on the cognitive function, spatial memory and visually controlled behavior in the Morris water maze [3].

Material and Methods

The experiments were carried out on eight-month-old albino rats weighing 250-300g. Three groups of experimental animals (n=5) were preliminarily identified. All experimental animals (except for control group) received an aqueous solution of turmeric (250 mg/50ml) for 30 days before surgical bilateral bulbectomy. The first part of rats group was curcuma aqueous solution administrated before training but did not expose to hypoxia; the second group: the animals that were curcuma administrated before training and did expose to hypoxia; the third group included control animals that did not curcuma administrated and were not exposed to hypoxia. Testing was carried out using the standard Morris water maze method [4,5].

The water labyrinth was a pool with 120cm diameter. The pool was filled with water painted over with milk. In the middle of one of the four quadrants of the pool, a hidden platform was located 0.5-2cm below the water level. The water temperature was 20-25°C. During the experiments, the searching latency duration for a hidden platform was measured. To create an AD experimental model, a bilateral surgical bulbectomy was performed [6]. Rat brain coordinates were used according to the stereotaxic atlas (Fifkova and Marsala, 1967) [2]. After formation of AD experimental analogue by surgical bilateral bulbectomy rats could not detect the

platform in water stained with milk. The rats of the second group were exposed to hypoxia. The animals were previously placed in a pressure chamber, into which a mixture of gases consisting of nitrogen (97%) and oxygen (3%) was introduced for 20 minutes. There was a sharp change in the behavior of the rats, which was caused by placing them in a stressful (almost exhausting) situation.

Results and Discussion

Before training in the Morris water maze, the latent period of searching for the hidden platform, measured in relation to all three groups of experimental animals, was 60-120s. Among the behavioral reactions characteristic of this stage of the experiment, the following were observed: grooming, rearing, and the release of 2-5 boluses. After training, a significant reduction in the latent period of searching for the invisible platform to 5-10s was observed and the cessation of boluses. After the spatial memory formation in albino rats, a surgical operation was performed for bilateral total bulbectomy. Three months after the surgical operation, subsequent testing in the water maze revealed the following data:

1. Animals that received curcuma administration, but were not exposed to hypoxia, were found on the platform within 5-10s [7]. At the same time, rearing and grooming were not observed. There was also a complete absence of bonuses.

2. Rats from the group after curcuma administration before training and were exposed to hypoxia for 20 minutes showed the following features: behavioral responses manifested themselves similarly to the first experimental group. It should be noted that in rats exposed to hypoxia, a significant reduction in the escape latency for the invisible platform; compared with the result described above, an even more reduced latency of the search for the platform was observed to 3-5s.

3. Testing of the control group showed a sharp increase in the search time for the life-saving platform to 120-180s, which indicated a total memory impairment, characteristic of an experimental analogue of AD. In this group of rats, the following observations were evidence of a total impairment of spatial memory and cognitive functions. The escape latency extended to 120-180s (as was noted in naive, untrained animals) [8]. Just like in naive animals, the release of 2-3 boluses was recorded in these rats. This fact indicates a total destruction of all cognitive functions.

Conclusion

It is concluded that hypoxia, as well as the natural antioxidant (Curcuma longa), contributes to the preservation and improvement of visually controlled spatial memory and cognitive functions. AD is a severe form of impairment of cognitive mechanisms and is characterized by catastrophic changes in the integrity of pyramidal and interneurons, dysfunction of the amygdala and olfactory bulbs, the formation of beta-amyloids and tau protein structure disruption. Beta-amyloids have a toxic effect on neurons and disrupt intercellular communication; Tau proteins disrupt the neuronal transport system and are toxic to brain cells.

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