

# **Biologically Active Mixture Obtained From The Plant Rosemary (Rosmarinus) Increases Tolerance To Hypoxia**

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Date of Submission: 23-11-2024

Date of Acceptance: 03-12-2024

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## **I. Introduction**

Hypoxia is a condition in which tissues and organs do not receive enough oxygen to enable them to maintain normal functioning. With an acute disruption of the oxygen saturation process in tissues, irreversible destructive processes begin, as a result of which organs gradually lose their functions. In the 21st century, on the one hand, the very rapid development of science and technology, on the other hand, large-scale global wars, excessive increase in emissions of transport toxic gases into the atmosphere, forest fires and deforestation have caused an increase in hypoxia-induced pathologies [8, 9]. In this regard, it is important to conduct research in the direction of finding new methods of treatment and means of pharmacological correction that ensure successful results in the treatment and prevention of hypoxic pathologies. Hypoxia, as one of the most pressing problems of modern medicine, continues to be a major risk factor for the development of many diseases [4, 8]. Hypoxia creates conditions for the manifestation of any pathological process in the body, or plays the role of the main pathogenetic factor in the occurrence of many diseases [4, 8, 9]. Reduced oxygen levels cause ischemic heart and brain diseases, disruption of oxygen supply to many organs, and hypoxia also activates the development of a number of infectious diseases [9, 12, 13]. In light of the above, protecting the body from many diseases by protecting it from hypoxia and its undesirable consequences is one of the most pressing challenges facing practical medicine and has high social significance [4].

Elimination of hypoxia is always carried out in two directions. The first is the improvement of the natural supply of oxygen to the body, the second is the intake and use in practical medicine of drugs with antihypoxic and antioxidant activity of natural origin. Taking into account the above, we set ourselves the goal of studying the effect of a biologically active mixture on tolerance to hypoxia in comparison with Mexidol for the first time. The mixture was obtained from the rosemary plant growing on the Absheron Peninsula of Azerbaijan [1, 3].

## **II. Materials And Methods**

The acute hypobaric hypoxia method was used in the experiments. The model of acute hypobaric hypoxia was created in an aspiration pressure chamber on 60 white rats of both sexes weighing 180-210 g. The pressure was measured with an altimeter, and the rate of ascent was measured with a variometer. The animals were raised to a platform at a height of 11,000 m at a speed of 25 m/s (198.7-185 mm Hg). They were kept in this state for 10 minutes. After that, the animals were lowered to their previous position for 5 minutes. To eliminate hypercapnia, a CO<sub>2</sub> absorber (30-35% alkali) was placed in the chamber. To create identical hypoxic conditions, 3 animals from the experimental and control groups were simultaneously placed in the chamber. A separate control group was used for each experimental group. The survival time of the animals and the number of surviving rats were recorded.

To study the effect of a biologically active mixture obtained from the Rosemary plant (*Rosmarinus*) at a dose of 300 mg/kg on hypoxia tolerance in comparison with mexidol at a dose of 200 mg/kg [2], these substances were dissolved in water 40 minutes before the experiments and administered to animals into the abdominal cavity. Animals in the control group were injected with a similar amount of saline.

The figures obtained during the experiments were processed statistically taking into account modern needs. For each group, the mathematical mean (M), its standard error (m), as well as the maximum (max) and minimum (min) limits of the series were determined. All calculations were made in an EXCEL table.

### III. The Obtained Results And Their Discussion

The effect of an effective dose of a biologically active mixture obtained from the rosemary plant on hypoxia tolerance in white rats of both sexes was studied in comparison with Mexidol. For comparison, similar studies were carried out on intact white rats. Rats were intraperitoneally injected with 300 mg/kg of a biologically active mixture obtained from the rosemary plant and 200 mg/kg of Mexidol. A biologically active mixture obtained from the rosemary plant increased tolerance to hypoxia in both male and female rats at a dose of 300 mg/kg. In male rats of the control group, the indicators were  $8.48 \pm 0.36$  minutes and increased to  $13.06 \pm 0.51$  minutes due to exposure to a biologically active mixture obtained from 300 mg/kg rosemary. Thus, a biologically active mixture obtained from rosemary at a dose of 300 mg/kg statistically increased the tolerance of male rats to hypoxia by 46%. An antihypoxic effect was also observed in female rats due to a biologically active mixture obtained from rosemary. If in the control group, the indicators were  $7.30 \pm 0.31$ , then with the introduction of a biologically active mixture obtained from rosemary at a dose of 300 mg/kg it became  $9.25 \pm 0.39$  minutes. The results obtained showed that the biologically active mixture obtained from rosemary at a dose of 300 mg/kg increased tolerance to hypoxia in male rats by 46%, and in female rats by 26.7%.

We compared the research results obtained with the results of Mexidol, a modern representative of antioxidant drugs. As a result of the studies, it was established that Mexidol at a dose of 200 mg/kg statistically significantly increased the tolerance to hypoxia of white male rats compared to the control group. Thus, if in male rats of the control group tolerance to hypoxia was  $8.48 \pm 0.36$  minutes, then under the influence of Mexidol at a dose of 200 mg/kg it was  $11.54 \pm 0.47$ . That is, Mexidol statistically increased tolerance to hypoxia by 36.08%. When conducting experiments on female rats, we observed the same increase in tolerance to hypoxia. Thus, if the tolerance to hypoxia in female rats of the control group was  $7.30 \pm 0.31$ , then under the influence of Mexidol at a dose of 200 mg/kg these indicators were  $9.17 \pm 0.42$ . That is, Mexidol statistically increased tolerance to hypoxia by 25.6% compared to the control group.

Summing up the results of our research, we came to the conclusion that the biologically active mixture obtained from the Rosemary plant does not have a toxic effect, but at the same time is able to compete with the modern representative of antioxidants, Mexidol, as a substance that increases tolerance to hypoxia. Analysis of the results obtained shows that the biologically active mixture obtained from rosemary increases tolerance to hypoxia to the same extent as Mexidol.

The results of the studies are shown in Table 1.

#### The effect of a biologically active mixture obtained from rosemary at a dose of 300 mg/kg, compared with mexidol at a dose of 200 mg/kg, on hypoxic tolerance.

M±m n=10 Table No.1

Study Groups	Gender	
	Male	Female
Control group (0.9% NaCl) + hypoxia (n=10)	8,48±0,36 (7,59-9,20)	7,30±0,31 (7,06-7,56)
Mexidol - 200 mg/kg + hypoxia (n=10)	11,54±0,47 (9,59-13,01) **	9,17±0,42 (8,07-9,32) **
Rosemary 300 mg/kg + hypoxia (n=10) (n=10)	13,06±0,51 (11,46-13,31)**	9,25±0,39 (8,31-9,21)**

Note: statistical significance of differences with the indicators of the intact group: \* –  $p < 0.05$ ;  
\*\* –  $p < 0.01$

Summing up the results obtained, we come to the conclusion that the biologically active mixture obtained from rosemary increases tolerance to hypoxia compared to Mexidol, due to its composition with essential oils and flavonoids [5, 6, 7]. Essential oils contain cineole, camphor, limonene, borneol, linal, tannins, resins, bitter substances, iron, phosphorus, magnesium, sodium, potassium, zinc. Rosemary contains several forms of antioxidants [10, 11, 12]. Its main ingredient is rosmarinic acid, which increases tolerance to hypoxia and rejuvenates. The richness of rosemary in biologically active substances determines its strong sedative, hypnotic, neurotensive and anti-stress effects [13].

Everything I have said is confirmed by scientific data that the biologically active mixture obtained from the Rosemary plant has antioxidant, antihypoxic and anti-stress effects.

### IV. Conclusions:

1. A biologically active mixture obtained from the rosemary plant at a dose of 300 mg/kg statistically significantly increased tolerance to hypoxia in rats.
2. A biologically active mixture based on rosemary at a dose of 300 mg/kg increased tolerance to hypoxia in white rats more than Mexidol at a dose of 200 mg/kg.

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