Antioxidant Effect of Licorice Root on Blood Catalase Activity in Vibration Stress

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Rabbits were treated (orally) with a preparation of *Glycyrrhiza glabra L.* for 30 days and in parallel were exposed to vibration stress (30 days). The licorice preparation reduced catalase activity in the peripheral blood and increased animal resistance to vibration stress.

Key Words: *vibration; catalase; Glycyrrhiza glabra root*

Vibration is a highly prevalent environmental factor leading to stress. Long-term exposure to vibration leads to the development of vibration disease characterized by peculiar metabolic disturbances [3]. Vibration stimulates the pituitary-adrenal system, increases the content of bioactive amines, and modulates activity of redox processes [1,7,9] playing an important role in the maintenance of nonspecific resistance [4].

Acute stress is associated with metabolic changes including a complex of redox processes ensuring the adaptation potential of the organism [9]. Antiperoxide enzymes, the main cell antioxidant (AO) enzymes, are important factors in the maintenance of the redox homeostasis [4]. Mobilization of the antiperoxide component leading to activation of peroxisomal enzyme (catalase), a component of the cell antioxidant defense system participating in detoxification of hydrogen peroxide, also increases AO capacity of the organism [13].

Natural (mainly plant) preparations with adaptogenic and AO activity are now used for improving organism's resistance and for prevention and combined therapy of some diseases. Agents with AO effects are widely used in therapy of many diseases. Antiinflammatory and AO activities of *Glycyrrhiza glabra L.* root were proven experimentally. Antioxidant activity of licorice root (LR) can be explained by the presence of isoflavonoids [10,11].

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We studied changes in catalase activity in rabbit blood during LR treatment and vibration exposure.

MATERIALS AND METHODS

Experiments were carried out on 15 adult male chinchilla rabbits (2.5-3.0 kg). The animals were kept in a vivarium on a standard diet with free access to water. LR (150 mg/100 g) was added to fodder. The animals were exposed to vibration on an EV-1 device (frequency 60 Hz, amplitude 0.4 mm) 2 h per day for 30 days. The blood was collected from the marginal ear vein every 5th day of LR treatment and vibration exposure.

The animals were divided into 4 groups: 2 control groups (Nos. 1 and 3) and 2 experimental (Nos. 2 and 4). Group 1 animals were exposed to vibration for 30 days. Group 2 rabbits daily received LR and were exposed to vibration for 30 days. Group 3 rabbits received LR, and group 4 animals were exposed to vibration (30 days) after 30-day treatment with LR.

Catalase activity was evaluated by the reaction of H_2O_2 degradation [5]. Catalase index (C_I) and catalase number (C_N) were estimated.

The data were processed statistically, the significance of differences was evaluated using Student's *t* test.

RESULTS

In group 1 vibration exposure increased catalase activity, which can be explained by enhanced production

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TABLE 1. Changes in Blood Catalase Activity under the Effect of LR and Vibration (*M*±*m*)

Group		Day of testing				
		5	10	15	20	30
1	C_N	13.47±0.17	13.26±0.5	11.70±0.48***	13.57±0.41	14.25±0.43***
	C_I	2.66±0.07	2.40±0.02*	2.09±0.12*	2.51±0.1	2.74±0.18
2	C_N	12.75±0.33	11.67±0.26*	11.81±0.23*	11.25±0.15*	10.48±0.59*
	C_I	2.37±0.03*	2.14±0.08*	2.20±0.08*	2.17±0.07*	2.03±0.1*
3	C_N	9.89±0.32**	8.1±0.42*	7.93±0.41*	10.62±0.1*	11.16±0.73***
	C_I	2.03±0.02*	1.36±0.04*	1.37±0.07*	2.04±0.02*	1.98±0.1*
4	C_N	10.03±0.17*	10.07±0.09*	9.48±0.2*	10.26±0.33*	10.85±0.22*
	C_I	1.82±0.05*	1.89±0.05*	1.82±0.04*	1.95±0.01*	2.12±0.03*

Note. *p<0.001, **p<0.01, ***p<0.02 compared to the baseline values (C_N 13.20±0.13, C_I 2.55±0.01).

of H_2O_2 (Table 1). In group 2 animals exposed to vibration in parallel with LR treatment enzyme activity was below the normal at all terms of the experiment (7.06, 16.08, 13.73, 14.91, and 20.39% on days 5, 10, 15, 20, 30, respectively, p<0.001).

In group 3 treated with LR for a long time catalase activity in the peripheral blood decreased below the normal on days 5, 10, and 15 (by 20.39, 46.67, and 46.28%, respectively, p<0.001). On days 15-30 enzyme activity tended to increase, but remained below the initial level: by 20% on day 20 of treatment (p<0.001) and by 22.35% on day 30 (p<0.001). In group 4 animals catalase activity was lower than in groups 1 and 2 throughout the experiment.

Changes in C_N and C_I were similar in all experimental groups (Table 1). LR contains inhibitors of free-radical processes markedly increasing the AO potential of tissues (which is confirmed by published data on the presence of effective natural antioxidants in LR [6,11]), therefore this agent can suppress free-radical processes in tissues.

Licorice is chemically similar to corticosteroid hormones: it contains glycyrrhisine that can be hydrolyzed to glycyrrhizic acid [8,14] producing a corticosteroid-like effect. This pharmacological property of the plant is very important. Glucocorticoids normalize metabolic processes in the organism [2]. This role of glucocorticoids, their capacity to exert a physiological effect depending on the state of the organism and maintain it at a certain level facilitating adaptation to novel conditions can determine the adaptive effect of LR [8,14].

It can be assumed that LR has a dual effect on blood catalase: it modifies enzyme activity and its synthesis. The latter effect can be realized at the gene level, because the most important effects of steroids are the result of modification of protein synthesis [2].

Hence, our results indicate that LR decreases catalase activity and reduces the effect of vibration stress. Similar data were previously obtained in experiments on rats [12].

REFERENCES

1. V. S. Aizenshtadt, N. P. Karkhanin, M. S. Esin, and A. V. Kapishnikov, *Gig. Truda Prof. Zabol.*, No. 6, 41-43 (1986).
2. B. V. Aleshin, S. G. Genes, and V. G. Vogralik, *Manual of Endocrinology* [in Russian], Moscow (1973), pp. 231-265.
3. V. G. Artamonova, *Vibration, Noise, and Human Health* [in Russian], Leningrad (1988), pp. 106-111.
4. G. A. Baskovich, Z. S. Tkhorzhevskaya, A. Yu. Panina, *et al.*, *Gematol. Transfuziol.*, No. 3, 13-16 (1993).
5. T. T. Berezov, *Manual of Laboratory Studies of Biological Chemistry* [in Russian], Moscow (1976), pp. 81-83.
6. G. G. Konovalova, A. K. Tikhaze, and V. Z. Lankin, *Byull. Eksp. Biol. Med.*, **130**, No. 7, 56-58 (2000).
7. M. I. Loseva, T. M. Sukharevskaya, *et al.*, *Gig. Truda*, No. 10, 19-22 (1984).
8. M. D. Mashkovskii, *Drugs* [in Russian], Khar'kov (1997), vol. 1, pp. 345-346.
9. S. M. Minasyan, *Integrative Structures of the Brain in Vibration* [in Russian], Erevan (1990), pp. 177-193.
10. D. A. Muraveva, *Pharmacognosia* [in Russian], Moscow (1991), pp. 261-266.
11. G. V. Obolentseva, V. I. Litvinenko, A. S. Ammosov, *et al.*, *Khim. Farm. Zh.*, No. 8, 24-31 (1999).
12. K. R. Oganesyan, *Biol. Zh. Armenii*, **44**, Nos. 1-2, 57-61 (2001).
13. L. F. Panchenko, S. V. Pirozhkov, S. V. Popova, *et al.*, *Byull. Eksp. Biol. Med.*, **109**, No. 4, 407-410 (1987).
14. S. Ya. Sokolov and I. P. Zamotaev, *Handbook of Medicinal Plants. Phytotherapy* [in Russian], Moscow (1988), pp. 208-211.