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Influence Of Plantagogen Seed Oil (Plantago Arenaria) On The Level Of Brain Monoamines In Chronic Alcohol Intoxication

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Summary.
Experimental work was devoted to studying the corrective effect of plantain seed oil on the level of basic monoamines in the brain during chronic alcohol intoxication. As a result of the studies, it was established that the use of plantain seed oil in a dose of 100 mg/kg for animals against the background of experimental alcoholism helped to weaken the toxic effect of chronic alcoholism and had a targeted effect on individual components of the neurotransmitter systems of the brain in rats.
Keywords: *alcohol, dopamine, norepinephrine, serotonin, brain, plantain seed oil.*

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I. Introduction

All organs of the human body are exposed to the negative effects of alcohol. But it is the brain that suffers the most. Alcohol, which is part of any alcoholic beverage, enters the brain through the bloodstream and triggers destructive processes. The human brain consists of more than a billion neurons, each of which creates tens of thousands of connections throughout the body [1, 5]. Previously, scientists believed that the main stage of brain development occurs in the first few years of life, but new research has shown that important changes occur in it until a person reaches the age of twenty [3, 4]. For example, these are the parts of the brain responsible for making decisions and controlling emotions. With one-time or chronic use of even a small amount of alcohol, it causes muscle relaxation, gives a sedative effect, and a feeling of euphoria. When alcohol enters the bloodstream, it changes the activity of inhibitory systems, activates the activity of dopamine receptors responsible for pleasure, provokes the release of opioid peptides, and stimulates the functioning of the serotonergic system [5, 6, 7]. These changes occur very quickly (within a few minutes after taking the first dose of alcohol). The distribution mechanism of ethanol is such that its concentration in brain tissue is higher than in blood. Because of this, alcohol has a negative effect on the brain even when consumed in small doses, in the absence of other symptoms of intoxication or intoxication [5, 8].

With single and chronic moderate alcohol consumption, neuronal activity is suppressed. This is manifested by memory impairment, decreased mental activity, and attention problems. If a person drinks alcohol regularly, neurons die, and such changes become irreversible. Their death provokes the appearance of areas of necrosis and local hemorrhages. The cerebral cortex receives organic damage. Inhibition of subcortical structures (trunk, basal ganglia, cerebellum) occurs [10, 12].

With prolonged use of alcohol, if the addiction has already been formed, the volume of the brain decreases, and impairments of its cognitive functions occur. Some of these disorders manifest themselves immediately (a person’s ability to think becomes limited). Others increase the risk of early dementia, Alzheimer's disease, memory impairment, etc. [9, 10,13].

If a person drinks alcohol in large quantities, neurons receive oxidative damage (their rapid death occurs due to oxidation). Heavy alcohol intoxication is dangerous due to rupture of brain capillaries and stroke [10].

It should be noted that the most important role in the formation of signs of alcohol intoxication is played by disturbances in the functional state of brain neurotransmitters under the influence of ethanol [1, 12]. Moreover, alcohol affects not only the synthesis, release and metabolism of individual neurotransmitters, but also the process of their reception [7, 8].

At present, the search for new methods of pathogenetically targeted therapy for alcoholism is still

relevant. Summarizing the above, we came to the conclusion that we should study the corrective effect of oil obtained from the seeds of plantain growing in Azerbaijan on the monoaminergic system of the brain during chronic use of alcohol.

II. Materials And Methods

The studies were carried out on 24 white rats of both sexes weighing 170-200 g, raised in the vivarium of the Scientific Research Center of the Azerbaijan Medical University. The animals were divided into 4 groups. The 1st group (6 rats) consisted of control animals receiving saline solution, the 2nd group (6 rats) of animals receiving psyllium seed oil at a dose of 100 mg/kg body weight, the 3rd group (6 rats) of animals subjected to alcoholization for 21 days, group 4 (6 rats) - animals that received plantain seed oil at a dose of 100 mg/kg and ethyl alcohol 25% 12 ml/kg.

After completing the experiments, the animals were decapitated, the brain was removed on ice and the hypothalamus, striatum and frontal cortex were isolated, crushed, a homogenate was prepared, and after that the concentrations of monoamines (dopamine, norepinephrine, serotonin) in various brain structures (hypothalamus, striatum and frontal cortex) were determined fluorimetric trioxyindoleacetic method. Animals in the control group were intraperitoneally injected with isotonic sodium chloride solution at a rate of 0.1 ml per 100 g of weight.

The research followed the rules of the European Parliament and the European Union for the Protection of Animals on the proper handling of animals in scientific research [2].

For statistical processing of the study results, the Student's t-test and the nonparametric Wilcoxon-Mann-Whitney U-test were used. The results were processed using the statistical program Microsoft Excel (Office-2010).

III. The Obtained Results And Their Discussion

The leaves of plantain and lanceolate plantain contain the glycoside aucubin, flavonoids (baicalin, scutellarin), polysaccharides, tannins, mucus, carotenoids (xanthophyll), silicic, oleanic, citric and ascorbic acids, vitamin K, mineral salts, zinc, hydroxycinnamic acids [13 , 14]. Psyllium seeds contain mucilages, fatty acids and plantose carbohydrates [15]. We assume that the composition of the oil obtained from plantain seeds is rich in biologically active substances, and that its use against the background of chronic alcohol consumption will minimize the side effects of alcohol. The results of our studies showed that chronic administration of ethanol is accompanied by multidirectional changes in the content of serotonin (5-HT) and norepinephrine (NA) in the cortical and subcortical structures of the brain. It should be noted that chronic administration of ethanol has the greatest effect on the activity of the norepinephrine system. Thus, the experimental results obtained once again confirm the presence of functional connections of a reciprocal nature between individual components of the 5-HT and HE-ergic system. However, it should be noted the important role of the dopaminergic system in these processes, which served as the basis for studying the DA content in the cortical and subcortical structures of the brain against the background of the influence of ethanol.

The determination of DA content was carried out against the background of the influence of psyllium seed oil before the introduction of ethanol. As the results of experimental studies show, the changes occurring in the DA content during the administration of ethanol depended on the anatomical structure of the cortical and subcortical structures.

Thus, in the experiments we conducted, we discovered some differences in the effects of psyllium seed oil on the DA content against the background of ethanol administration in the cortical and subcortical structures of the brain. As can be seen from the figure, the greatest activity of DA in the structures studied is observed in the hypothalamus. Against the background of chronic administration of ethanol, the DA content statistically significantly increases in the cortical and subcortical structures of the brain. Since, the content of DA in the hypothalamus in control animals was 758.4±1.2 μg/mg, while during the administration of ethanol it increased and amounted to 962.6±2.2 μg/mg. Against the background of ethanol administration, an upward change in the DA content, when compared with the control, is observed in the striatum and frontal cortex, where the concentration of the studied biogenic amine is 831.5 ± 2.9 μg/mg and 781.4 ± 2.6 μg/mg, respectively.

Thus, the content of DA in cortical and subcortical structures statistically significantly increases against the background of chronic administration of ethanol. Attention is drawn to the fact that, unlike other neurotransmitters, the maximum content of DA, against the background of ethanol administration, is observed in the frontal cortex.

In general, the changes occurring in the content of DA slightly facilitate the interpretation of the results of the effect of psyllium seed oil on the content of DA in the cortical and subcortical structures of the brain. The influence of plantain seed oil against the background of chronic administration of ethanol caused the following changes in the cortical and subcortical structures of the brain; in the hypothalamus, striatum and frontal cortex after administration of plantain seed oil at a dose of 100 mg/kg, the concentration of dopamine was 774±2.5 μg/mg, 515.3±2.2 μg/mg; and 497.6±2.4 μg/mg, respectively;

In our experiments, the effect of psyllium seed oil on the CA system as a whole against the background of chronic administration of ethanol does not differ from its effect on individual components of this system. Since after the introduction of ethanol the content of NA and DA significantly decreases. With prolonged use of plantain seed oil, a decrease in the content of monoamines is not observed; on the contrary, this indicator increases significantly compared to the group of animals subjected to chronic alcoholization. Along with this, distinctive features are noted in the activity of monoaminergic systems as a result of the influence of plantain seed oil. As can be seen from the data, chronic administration of ethanol has the greatest effect on the NE-ergic and DA-ergic systems [7, 9].

Changes occurring at the level of the hypothalamus indicate its important role in behavioral reactions. It was found that an increase in the content of OA in the hypothalamus against the background of chronic administration of ethanol makes it difficult to recognize the novelty of sensory information involved in the formation of the conditioned passive avoidance reflex (CPAR). In some cases, behavioral reactions in animals are disrupted, despite the optimal level of emotional stress [11].

Thus, the use of plantain seed oil in animals against the background of experimental alcoholism helped to weaken the toxic effect of chronic alcoholism and had a targeted effect on individual components of the monoaminergic system of the brain.

IV. Conclusions

1. Chronic intake of alcohol in experimental alcoholic animals contributed to a toxic effect on individual components of the monoaminergic system of the brain.
2. Plantain seed oil at a dose of 100 mg/kg, having a corrective effect in experimental alcoholism animals, helped to weaken the toxic effect of chronic alcoholism on individual components of the monoaminergic system of the brain.