

EFFECT OF THE SAPONINS OF MANCHURIAN ARALIA ON THE ELECTRICAL ACTIVITY OF THE BRAIN

(UDC 612.822.54:615.785)

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Translated from Byulleten' Éksperimental'noi Biologii i Meditsiny, Vol. 60, No. 8,

pp. 73-77, August, 1965

Original article submitted March 30, 1965

In 1960 N. K. Kochetkov and group [6] isolated from the roots of the Manchurian Aralia (Aralia Mandshurica Rubr. et Max.) the sum of the triterpene saponins—ABC aralosides.

As we reported earlier [11, 12] the sum of the saponins of the Manchurian Aralia is rather nontoxic (LD_{50} is 470 mg/kg with subcutaneous injection); its hemolytic index is 10,000. The aralosides in animal experiments distinctly stimulate heart activity and have an evident effect on the central nervous system.

In the present work we studied the stimulating effect of ABC aralosides on the higher divisions of the central nervous system in the norm and with the injection of aminazine (chlorpromazine).

METHOD

The investigation was carried out on 12 intact rabbits of both sexes weighing 3-3.5 kg.

The ABC aralosides were injected intravenously in a dose of 10 mg/kg. The EEG in the I series of experiments was recorded in the initial state, after 2 min dark adaptation, immediately after the injection of the preparation, and after 5, 10, 20, 30, 40, 60, and 90 min. The EEG in the functional tests was recorded in the initial state and 10, 30, and 60 min after injecting the preparation. In the II series of experiments we preliminarily injected the rabbits intravenously with aminazine in a dose of 3 mg/kg and after 15-20 min recorded the electrical activity and response reactions of the EEG to the functional tests. Then we injected the ABC aralosides and recorded the EEG after 10, 20, 40, 60, and 90 min.

The bioelectric potentials were tapped unipolarly and bipolarly from the frontal, parietal, and occipital zones of the cortex and from unipolar electrodes placed in the region of the reticular formation of the midbrain and geniculate body. For tapping we used implanted nichrome electrodes fixed to the bones of the skull by a styracl paste. The subcortical electrodes were oriented by means of the stereotaxic coordinates of Sawyer, Everett, and Green [18].

The action currents were recorded on an encephalograph made by the "Kaiser" Company. To determine the functional state of the processes of higher nervous activity by the method of the curves of the reactivity and assimilation of the rhythm, we used light stimuli of different intensity and frequency and for sound stimulation we used continuous and discontinued signals with a frequency of 100 cps and duration of 8-10 sec.

RESULTS

In the initial state of the rabbits we noted on the EEG in all leads a combination of two basic rhythms—a low frequency one (1-4 cps) with an amplitude of 150-250 μ V and a high frequency one (4 cps and higher) with an amplitude of 50-120 μ V.

After recording the initial state the rabbits of the I series were injected with ABC aralosides. The effect of the preparation developed about 25-35 min after its injection, and after 40-60 min the relationship of the slow and fast

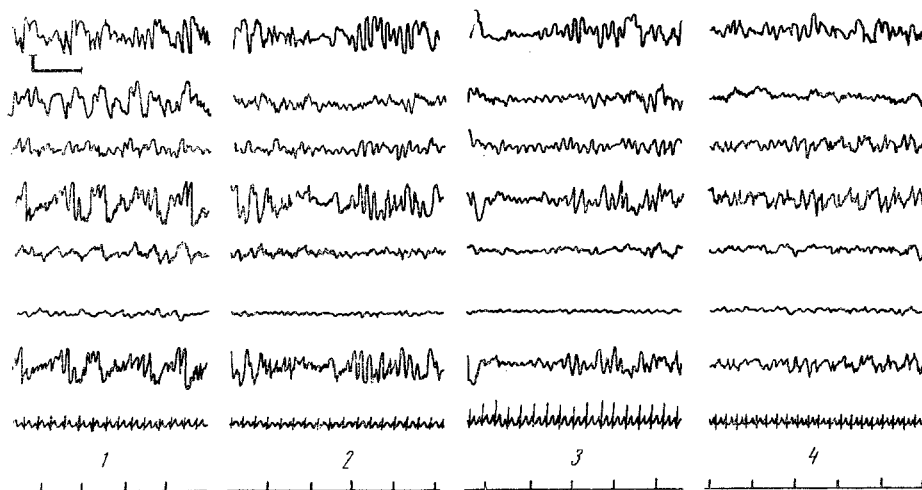
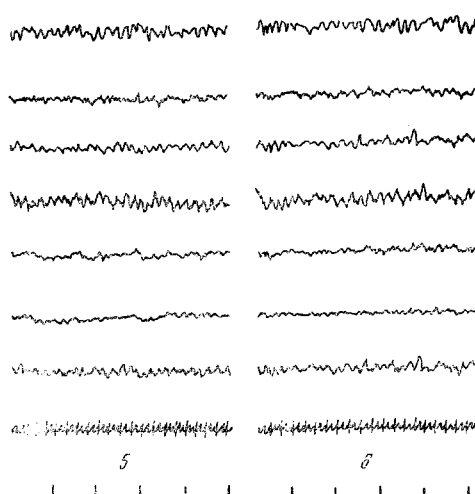


Fig. 1. Variation in the changes of the electrical activity of the cerebral cortex and certain subcortical formations in rabbits after the injection of the ABC aralosides in a dose of 10 mg/kg. 1) Initial EEG; 2, 3, 4, 5, 6) EEG after injection of the ABC aralosides after, respectively, 10, 20, 40, 60, and 90 min. Lead zones (top to bottom): right frontal, right occipital, left parietal, lateral geniculate body, left occipital bipolar, reticular formation of midbrain, EEG in the II lead.



rhythms of the background activity on the EEG both in the cortical zones and in the zones of the subcortical structures shifted markedly to the side of high-frequency oscillations of a low-amplitude character (the frequency coefficient of predominance dropped to 8/22-3/27). In some animals there occurred a prolonged generalized reaction of activation (Fig. 1). The threshold of excitability dropped by 1-2 units and the degree of the activation reaction to the threshold intensity of the light stimuli increased appreciably. The range of the evoked potentials both at the threshold and at the maximal brightness of the stimuli shifted to the side of a high frequency of light flashes, reaching 40-45 cps. The activation reaction of the EEG in response to the sound stimuli became more evident in comparison with the initial data, especially to the discontinued signal. An appreciable after-effect of the activation reaction to a sound lasting 3-5 sec was noted.

After recording the initial state the rabbits in the II series were injected with aminazine in a dose of 3 mg/kg. This average dose was selected on the basis of the data in the literature [3, 10]. Ten to twenty minutes after injecting the aminazine we observed on the electrogram at all leads an expressed reorganization of the initial activity toward a high-amplitude (200-300 μ V), low-frequency rhythm (1-3 cps). The injection of ABC aralosides during the first 30-40 min did not change the predominating background of high-amplitude slow activity. The EEG returned to the initial level 40-60 min after the injection of the preparation and the response reactions to the light and sound stimuli were restored. The high-amplitude rhythm of 1-3 cps disappeared completely when recording the EEG after 90 min. The electrograms of both the cortical and subcortical regions at this period were characterized by a pronounced predominance of a low-amplitude, high-frequency rhythm (7-12 cps). The frequency coefficient of pre-

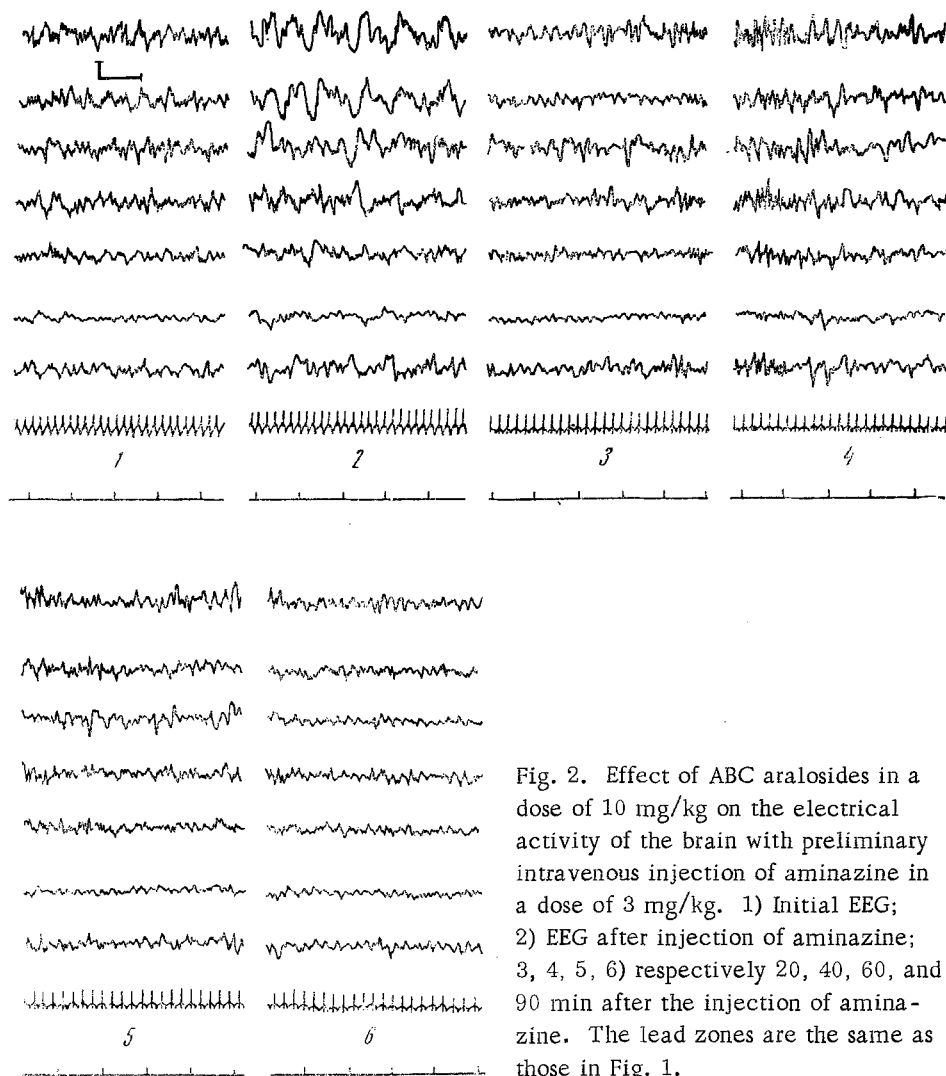


Fig. 2. Effect of ABC aralosides in a dose of 10 mg/kg on the electrical activity of the brain with preliminary intravenous injection of aminazine in a dose of 3 mg/kg. 1) Initial EEG; 2) EEG after injection of aminazine; 3, 4, 5, 6) respectively 20, 40, 60, and 90 min after the injection of aminazine. The lead zones are the same as those in Fig. 1.

dominance dropped considerably. A distinct activation reaction of the EEG accompanied the functional light and sound stimulations (Fig. 2).

The analysis of the data obtained was based on the variation of the frequency-amplitude characteristic of the electroencephalographic curves of the background activity and response reactions of the EEG to the functional tests.

A distinct reorganization of the background activity toward a low-amplitude, high-frequency rhythm (8-15 cps) occurred on the EEG of the rabbits of the I series in the investigated zones of the cortex and subcortical regions 30-40 min after injection of the drug. This reorganization of the background activity and the appearance of sections of a spontaneous generalized activation reaction indicate the stimulating effect of the preparation [1, 9].

The exciting effect of aralosides is also confirmed by the method of reactivity curves. A decrease in the threshold of excitability and an increase in the reactivity of nerve cells in comparison with the initial state were established by this test [7, 8]. The shift in the range of rhythm-assimilation frequencies characterizes an enhancement of the lability and excitability of nerve cells [4, 5].

As a result of the effect of ABC aralosides the degree, duration, and after-effect of the response activation reaction to sound stimuli increased significantly, which also supplements the overall electroencephalographic picture of stimulation of the cortical and subcortical divisions of the central nervous system.

The increase of the excitability and lability processes and the occurrence of a generalized activation reaction

under the effect of ABC aralosides can be considered as due to stimulation of the functions of the ascending activating system of the reticular formation of the midbrain [13, 16, 17].

Aminazine inhibits the activating effect of the reticular formation and causes on the EEG a pronounced high-voltage slow activity [2, 14, 15].

The ABC aralosides completely removed the high-amplitude aminazine rhythm of the EEG and effected the resotration of the responses to the afferent stimuli, which confirms their effect on the function of the ascending activating system of the reticular formation of the midbrain.

SUMMARY

The object of study was the influence of saponins of the Manchurian aralia—ABC aralosides—on the electrical activity of the rabbit brain. It was found that ABC aralosides upon intravenous injection in a dose of 10 mg/kg produce a marked stimulating effect upon the electrical activity of the brain portions subject to investigation, and increase the processes of nerve cell excitability and lability. The effect of ABC aralosides relieves the blocking of the ascending activating system of the reticular formation of the midbrain.

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All abbreviations of periodicals in the above bibliography are letter-by-letter transliterations of the abbreviations as given in the original Russian journal. *Some or all of this periodical literature may well be available in English translation. A complete list of the cover-to-cover English translations appears at the back of this issue.*
