

EFFECT OF SEROTONIN ON THE LEVEL OF FREE AMINO  
ACIDS IN BRAIN AND LIVER TISSUE

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It has now been established that certain amino acids exert a specific action on nerves, influencing inter alia the conduction of nervous impulses. They also act as the source of formation of biologically active substances influencing the brain [1, 9, 10, 12]. Now that these facts have been discovered, the study of the amino-acid profile of individual tissues, and especially of nerve tissue, when exposed to the action of various pharmacological and hormonal preparations may help to shed light on the chemical basis of brain pathology. Bearing in mind the important role of serotonin in the regulation of certain functions of the central nervous system, the study of the concentration of free amino acids in the brain tissue following the administration of this substance in various doses to animals is of considerable interest. This is particularly true because, according to some reports, serotonin leads to pathological changes in the central nervous system [4-6, 8, 10, 11].

The present study is a continuation of earlier investigations of the effect of serotonin on metabolic processes [2], and its object was to examine the changes in the level of the free amino acids in the brain and liver tissues.

## EXPERIMENTAL

Experiments were carried out on albino rats of both sexes weighing from 180 to 200 g, receiving identical diets. The rats received no food for 16-18 h before the experiments. Serotonin was injected subcutaneously in different doses (2.5, 5.0, 7.5, 15.0, 25.0, and 50.0 mg/kg) made up in physiological saline. Two hours after injection of the preparation, i.e., when its action on the central nervous system was manifested most clearly, the rats were decapitated, the brain and liver were extracted and cleaned, and weighed samples of the fresh tissue were taken and treated to extract the free amino acids [3]. The amino acids were estimated quantitatively by the method of linear descending chromatography on paper [7]. Chromatography paper from the "Chistye Soli" factory (batch No. 11) was used after preliminary treatment with 8-hydroxyquinoline. The concentration of amino acids was determined from calibration curves plotted beforehand for separate groups of amino acids.

## EXPERIMENTAL RESULTS

The results showed that the content of free amino acids in the brain and liver of the intact animals was considerable. The concentrations of aspartate and glutamate were higher than those of the other amino acids, and their concentrations in the brain were much higher than in the liver (see table). The histidine level in the brain tissue characteristically was much lower than in the liver, and the brain also contained significantly less glycocol, alanine, serine, agrinine, phenylamine, and tyrosine than the liver.

Administration of serotonin to the animals was accompanied by marked changes in the level of certain amino acids in the liver tissue (see table).

In the same conditions the level of glycocol, alanine, and leucine remained unchanged. The observed changes in the concentrations of free amino acids in the tissues of the brain and liver were independent of the dose of the preparation injected. Very characteristically, in both the liver and the brain, considerable changes in the concentrations of the essential amino acids took place under the influence of serotonin.

The results of these investigations showed that the tissues of various organs react differently to administration of serotonin. The level of many amino acids rose more in the brain than in the liver after injection of the same doses of serotonin. This fact may be attributable to the selective utilization of

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Content of Free Amino Acids in the Brain and Liver Tissues  
of Rats before and after Administration of Serotonin  
(in mg% of fresh tissue)

Amino acid	Brain		Liver	
	before injection *	after injection †	before injection *	after injection †
Glycocol	4,90±0,30	4,05±0,15	6,20±0,60	8,4±0,10
Alanine	4,40±0,20	3,84±0,10	8,10±0,13	7,3±0,17
Serine	5,40±0,10	7,9±0,08	8,00±1,00	11,5±0,9
Threonine	7,30±0,06	3,9±0,25	7,00±0,30	10,2±0,65
Leucine	1,90±0,17	1,25±0,10	2,60±0,09	8,4±0,4
Arginine	2,50±0,10	6,85±0,22	5,40±0,40	2,1±0,1
Aspartate	23,00±0,40	47,0±1,0	17,60±0,90	28,0±0,6
Glutamate	47,00±1,00	55,5±2,0	13,30±0,90	13,2±0,9
Phenylalanine	1,00±0,2	2,35±0,12	5,00±0,65	11,4±0,8
Tyrosine	2,50±0,07	8,9±2,3	5,60±0,36	11,0±0,8
Histidine	1,60±0,10	5,1±0,09	9,80±0,12	5,5±0,3

\*The mean content of the amino acids was calculated from five observations.

†The maximal increase or decrease in the amino acid content under the influence of serotonin is significant.

amino acids by the brain tissue under the influence of serotonin. Nervous disorders may develop in animals receiving injections of this compound evidently as a result of disturbance of the metabolism of individual amino acids and of the formation of neurotropic substances from them, capable of modifying the function of the central nervous system.

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