SOME ACETYLATION PROCESSES IN THE NORMAL HUMAN ORGANISM AND IN FUNCTIONAL DISTURBANCES OF THE NERVOUS SYSTEM

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Pantothenic acid deficiency in the human [2, 3] has been associated with symptoms of adrenal insufficiency, of impaired activity of the alimentary tract, and of lesions of the nervous system.

The biochemical basis of these pathological changes is related to the functions of coenzyme A (CoA), which is concerned in the synthesis of citric acid [9], in acetylation of amines, including choline, to give acetylcholine [6, 8], in fatty acid metabolism [7], in steroid synthesis [4], and in formation of peptide bonds [1].

The appearance of functional disturbances of the nervous system of human subjects suffering from pantothenic acid deficiency led us to investigate certain biochemical transformations connected with CoA, in patients suffering from neuroses.

We examined: 1) the acetic acid content of the blood, as a possible source of active acetate, 2) percentage acetylation of sulfanilamide, as an index of CoA activity, and 3) the blood citric acid content, since formation of citric acid is closely bound up with CoA activity.

We examined patients suffering from functional disturbances of the nervous system (hysterical neurosis, neurasthenia, and other neuroses). For normal values we took those found for a group of normal persons. This group corresponded in age, sex, and period of observation with the neurotic group.

Blood acetate was determined for groups of 30 normal and 30 neurotic individuals, blood citric acid in 42 normals and 59 neurotics, and percentage acetylation of sulfanilamide in 44 normals and 68 neurotics.

EXPERIMENTAL RESULTS

The results, subjected to statistical treatment, are presented in Tables 1, 2, and 3*, for healthy normals, for patients suffering from hysteria and from neurasthenia, and for the whole group of neurotic patients, including, apart from hysteria and neurasthenia, a small group of other neuroses.

The range of values found was: healthy controls 0-17 mg %, patients 0-18 mg %.

It is evident from Table 1 that the differences found between blood acetic acid content of healthy and neurotic individuals are not statistically significant, although the mean values found for hysterical patients are higher than for the other groups.

The mean citric acid content of the blood of neurotics was much higher than in the control group. This difference is statistically significant (Table 2).

The individual variations found were: controls 0.8-1.6 mg %, neurotics 0.4-1.5 mg %.

* The symbols at the heads of the columns of Tables 1, 2, and 3 represent: n) number of determinations (persons), M) arithmetic means of the values, σ) standard deviations, m) mean error, t) coefficient of significance of differences, P) statistical probability of significance of difference from the values for healthy controls, as per cent.

TABLE 1

Acetic Acid Content (mg %) of the Blood of Normal and Neurotic Individuals

Group examined	*n*	*M*	σ	*m*	*t*	*P*
Healthy	30	6.77	±3.8026	±0.69	—	—
Hystericals	15	8.47	±4.8683	±1.26	1.2	87
Neurasthenics	8	6.88	±5.3301	±1.89	0.1	54
All forms of neurosis	30	7.63	±5.2621	±0.96	0.7	76

The individual variations for percentage acetyiation of sulfanilamide found were: healthy controls 10-39, patients 4-27.

The mean values for percentage acetylation of sulfanilamide were lower for the neurotic group than for the controls. The difference is statistically significant (Table 3).

TABLE 2

Blood Citric Acid Content (mg %) of Normal and Neurotic Individuals

Group examined	*n*	*M*	σ	*m*	*t*	*P*
Healthy	43	1.18	±0.1874	±0.03		—
Hystericals	27	0.90	±0.1952	±0.04	5.6	100
Neurasthenics	24	0.90	±0.2350	±0.05	4.8	100
All forms of neurosis	59	0.91	±0.2278	±0.03	6.4	100

TABLE 3

Percentage Acetylation of Sulfanilamide in Normal and Neurotic Individuals

Group examined	*n*	*M*	σ	*m*	*t*	*P*
Healthy	44	20.82	±6.1806	±0.93	—	—
Hystericals	30	14.57	±5.6000	±1.02	4.5	100
Neurasthenics	27	16.00	±6.7313	±1.30	4.5	100
All forms of neurosis	68	15.63	±5.8438	±0.71	4.4	100

The simultaneous lowering of the citric acid content of the blood and of percentage acetylation of sulfanilamide encountered in functional disorders of the nervous sytem may be evidence of deficiency of dietary pantothenic acid, or of disturbances in its synthesis in or assimilation from the alimentary tract (percentage acetylation of sulfanilamide was always lowered in neurotic patients when they also suffered from disease of the alimentary tract), or of impairment of synthesis of acetyl CoA.

The experimental evidence does not permit to state which disturbance of pantothenic acid metabolism is present in patients suffering from neuroses, but there can be no doubt that this metabolism is disturbed.

SUMMARY

The content of acetic and citric acid and percentage of acetylation of sulfanilamide were determined both in healthy individuals and patients with neurosis. Metabolism of these substances takes place with the aid of coenzyme of acetylation (CoA), which contains pantothenic acid. The average content of acetic acid in the blood of neurotic patients is nearly normal except in cases of hysteric patients in whom it is slightly increased. Simultaneous decrease of content of citric acid in the blood and the percentage of acetylation of sulfanilamide, which is noted in the functional disturbances of the nervous system may point to deficiency of pantothenic acid in the diet, to disturbance of its synthesis or its assimilation in the digestive tract and to disturbance of the synthesis of acetyl CoA. Evidence at our disposal still does not permit to decide the nature of the metabolic disturbances which take place during neuroses.

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