THE EFFECT OF VITAMIN B_1 UPON THE METABOLISM OF RACEMIC ACID BEFORE AND AFTER INTRODUCTION OF PLAGUE TOXIN

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[Following is a translation of an article by Z. I. Vasil'yev and I. V. Domaradskiy in the Russian-language periodical Izvestiya Irkutskogo Gosudarstvennogo Nauchno-Issledovatel'skogo Protivochumnogo Instituta Sibiri i Dal'nego Vostoka (Report of the Irkutsk State Scientific Research Anti-Plague Institute of Siberia and the Far East), Vol 25, Irkutsk, 1963, pages 105-108.]

It was established by our (Vasil'yev, Domaradskiy, 1963) previous research that plague toxin inhibits the metabolism of racemic acid. Analogous observations were made by Ajl and co-workers (Ajl, Woebke and Rust, 1960). Moreover, in demonstrating the reasons for the various types of sensitivity of animals to plague toxin, Ajl (1960) assigns a special role to the disturbance of the metabolism of keto acids, in particular racemic acid. However, the mechanism of disturbance of the metabolism of racemic acid remains thus far unclear.

Therefore, considering that Vitamin B_1 takes part in the synthesis of the coferment of dehydrogenase of racemic acid, catalyzing the acidifying decarboxylizing keto acids in living tissues, we set a goal -- to study the influence of Vitamin B_1 on the metabolism of racemic acid before and after introduction of plague toxin.

Materials and Methods of Investigation

Vitamin B_1 in the amount of 0.1 ml per 4 mkg in a physiological solution was given subcutaneously to white mice daily over a 15-20 day period. White mice which were not given Vitamin B_1 served as control. In the period of application of the vitamin, starting from the seventh day, the content of the dehydrogenase of racemic acid was determined in lines homogenates of the animals.

We identified Vitamin B_1 by the thiochrome method (Solov'yev, 1960). An instrument which we devised from a fluroscope and the optical parts of a horizontal photometer, model FMS, was used as a flurometer.

We conducted experiments to determine the activity of the dehydrogenase of racemic acid and the influence on it of plague toxin by a method similar to that described in a previous report (Vasil'yev and Domaradskiy, 1963). However, in contrast to previous experiments of vitamin-treated and control white mice to white plague toxin had been introduced, we forced in within 2-3 hours rather than within 18 hours; in the experiments in vitro the toxin was introduced in a dose equal to LD_{50}. In other respects the method of work corresponded in full with that described earlier.

Table 1

The Influence of Plague Toxin on the Decrease of Racemic Acid and the Consumption of Oxygen by Liver Homogenates of Vitamin-Treated and Untreated Animals. (in vivo)

Animals	Consumption of O_2 (in mkmols)			Decrease of pyruvates (in mkmols)
	In tests with pyruvate (A)	In tests without pyruvate (B)	At the expense of pyruvate (A-B)	
Control mice*	13.3 ± 0.69	10.6 ± 0.71	2.7 ± 0.6	16.6 ± 1.1
Vitamin B_1 treated mice*	15.2 ± 0.97	10.6 ± 0.75	4.6 ± 0.81	19.6 ± 0.81
Toxin poisoned mice**	11.9 ± 0.23	11.4 ± 0.41	0.4 ± 0.15	11.9 ± 1.51
Vitamin B_1 treated mice poisoned by toxin**	16.3 ± 0.67	9.1 ± 0.9	6.9 ± 1.6	19.6 ± 1.3

Average data: * - 11 experiments; ** - 6 experiments.

In Table 1, 2 the average measure ($M \pm m$) of the sum of the data for the entire period of the work is given.

Table 2

The Influence of Plague Toxin on the Decrease of Racemic Acid and the Consumption of Oxygen by Liver Homogenates of Vitamin-Treated and Untreated Animals. (in vivo)

Animals	Consumption of O_2 (in mkmols)			Decrease of pyruvates (in mkmols)
	In tests with pyruvate (A)	In tests without pyruvate (B)	At the expense of pyruvate (A-B)	
Mice not receiving Vitamin B_1*	11.9 ± 0.86	10.9 ± 0.87	1.0 ± 0.29	13.4 ± 1.51
Mice receiving Vitamin B_1**	15.8 ± 1.8	10.6 ± 0.93	5.2 ± 1.1	22.5 ± 2.7

Average data: * - 10 experiments; ** - 7 experiments.

The Results of the Investigations and Their Discussion

As a result of the daily application of the white mice of 4 mkg of Vitamin B_1, the content of it in the liver homogenates of the animals, starting from the seventh day, increases. It can be seen in Table 1 that with this the intensity of the metabolism of racemic acid grows significantly: liver homogenates of vitamin-treated white mice require more oxygen than those of the control mice (probability of error $P < 0.05$); oxidation of racemic acid by liver homogenates of vitamin-treated white mice is more intensive than by the liver homogenates of animals not treated with the vitamin ($P < 0.05$).

However, of special interest is the fact that inhibition of the process of racemic acid oxidation by the toxin, which takes place in the case of liver homogenates of non-vitamin treated white mice, is completely absent in the conduct of the experiments with the liver homogenates of vitamin-treated animals; the quantity of oxygen consumed and the decrease of racemic acid in tests with liver homogenates of vitamin-treated

animals before and after introduction of plague toxin remain on the same level as the experiments in vivo, just as in the experiments in vitro (see Table 1 and 2).

It remains difficult to explain the absence of the effects of toxin on the racemic acid metabolism in animals treated with Vitamin B_1. It is possible that it is explained by the effect of the existence of the concurrent relations between the toxin and the coferment of the dehydrogenase of racemic acid. Further investigations will determine the accuracy of this hypothesis.

Conclusions

1. The accumulation of Vitamin B_1 in the liver of animals leads to an increase in the consumption of oxygen and racemic acid with liver homogenates of vitamin-treated animals.

2. Plague toxin rarely inhibits the metabolism of racemic acid in control white mice and absolutely does not act on such in animals, an organism of which is saturated with Vitamin B_1.

Literature

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