

IN VIVO RELATIONSHIPS BETWEEN VITAMINS A AND E

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Prolonged administration of large doses of vitamin A to guinea pigs led to the appearance of manifestations of vitamin E deficiency in the animals: anemia, an increased tendency toward hemolysis of erythrocytes, and degenerative changes in the composition of sarcoplasmic protein fractions of skeletal muscles.

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The literature on synergism between the action of vitamins A and E, based on the antioxidant properties of α -tocopherol, is extensive. The effect of supplementary administration of axerophthol on the metabolism and requirement of vitamin E has received much less study.

In the present investigation the vitamin E requirement was studied in animals receiving excessive doses of vitamin A.

EXPERIMENTAL METHOD

Male guinea pigs (21) weighing about 400 g were given vitamin A for 15-18 days in a daily dose of 150 000 i.u. Healthy guinea pigs not receiving additional vitamin A (21) were used as controls. The animals were killed by decapitation. The vitamin A content in the liver was determined by the Carr-Price method. Resistance of the erythrocytes to the action of hydrogen peroxide and dialuric acid was studied by the methods of Györgyi and co-workers and Bunyan and co-workers. The hemoglobin concentration and erythrocyte count were determined. The ratio between water-soluble muscle proteins was investigated by electrophoresis on paper.

TABLE 1. Effect of Hypervitaminosis A on Degree of Hemolysis of Erythrocytes ($M \pm t$)

| Degree of hemolysis of erythrocytes (in %) | | | | Vitamin A in liver of guinea pigs (i.u./mg) | |
|--|-------------|-------------------|--------------|---|------------|
| dialuric acid | | hydrogen peroxide | | | |
| control | experiment | control | experiment | control | experiment |
| 12.8 ± 0.60 | 37.0 ± 1.78 | 11.5 ± 0.25 | 49.16 ± 5.30 | 0.13 ± 0.005 | 2.5 ± 0.26 |
| P < 0.001 | | P < 0.001 | | P < 0.001 | |

TABLE 2. Fractional Composition of Sarcoplasmic Proteins of Skeletal Muscles of Guinea Pigs (in %)

| Group | Myoalbumins (h) | Proteins with phosphorylase activity (k_1 and k_2) | | Proteins with aldolase and triose phosphate-dehydrogenase activity (l, m, n) |
|--------------------|-----------------|--|---------|--|
| | | α | β | |
| Control | 4.7 | 6.4 | 12.0 | 76.9 |
| Avitaminosis E | 12.6 | 17.5 | 15.4 | 54.5 |
| Hypervitaminosis A | 10.2 | 11.3 | 14.0 | 64.5 |

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EXPERIMENTAL RESULTS

Administration of an excess of vitamin A caused a decrease in the hemoglobin concentration and erythrocyte count of the experimental animals ($P < 0.05$). The results of the hemolytic test and estimation of the vitamin A content in the liver are given in Table 1.

Vitamin A poisoning thus caused a marked increase in the degree of hemolysis of the erythrocytes, one of the criteria of avitaminosis E.

The results given in Table 2 show that in hypervitaminosis A there is an increase in the myoalbumin fraction and in the group of k_1 and k_2 proteins, characteristic of avitaminosis E. The anemia, increased tendency toward hemolysis of the erythrocytes, and the degenerative changes in the muscles thus indicate the presence of an α -tocopherol deficiency under the conditions of vitamin A poisoning.