THE INFLUENCE OF VITAMIN A ON NUCLEIC ACID CONTENT AND PROTEIN SYNTHESIS IN THE ORGANISM

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Lesions characteristic of A-avitaminosis are keratinization of cellular elements, degeneration of lachrymal glands and mucous membranes, epithelial cornification in the lungs, intestine, renal pelvis, urinary bladder, uterus and ovaries. In the absence of vitamin A the process of transformation of collumnar epithelium into squamous is impaired. This indicates that vitamin A is essential, above all, for the cells of epithelial tissue where processes of regeneration play a particularly important part [1].

V. N. Bukin and L. Ya. Areshkina [2] used fractional separation of hydrolysate from fish livers to show that the bulk of vitamin A contained in the liver was bound with proteins. This combination with proteins is in the nature of adsorption or association rather than chemical linkage and is fairly easily disrupted.

Our work has shown that deposition of vitamin A in the liver of white rats depends on the amount of protein in the diet; increasing the amount of protein leads to increased deposition of vitamin A in the liver; decreasing the amount of dietary protein (below normal) is accompanied by depletion of vitamin A stores [3]. Moreover, when the diet is deficient in protein the transformation of carotene into vitamin A in the organism is impaired.

These data, as well as the effect of vitamin A on growth and on tissue regeneration suggested the question concerning the influence of vitamin A on the synthesis of protein in the organism, particularly in the liver. The connection observed between protein synthesis and nucleic acids suggested the need to determine the content of the latter in liver tissue under conditions of vitamin A deficiency.

EXPERIMENTAL METHODS

The content of ribonucleic acid and desoxyribonucleic acid in rat liver was determined by the Thannhauser and Schmidt method modified by O. P. Chepinoga et al. (based on the amount of ribonucleic acid and desoxyribonucleic acid phosphorus) [4]. The experiments were performed on white male rats. The initial weight of animals was 50 g. The experimental animals were given the usual synthetic diet, free from vitamin A, while the control animals received the same diet but with addition of vitamin A.

EXPERIMENTAL RESULTS

Table 1 shows the content of ribonucleic acid and desoxyribonucleic acid in the liver of animals with A-avitaminosis and of control animals. The former show increased content of both acids. Parallel with this,

the content of total phosphorus in the fraction containing ribonucleic acid, desoxyribonucleic acid and nucleoproteins was determined in the liver of animals with A-avitaminosis. These data are presented in Table 2.

TABLE 1

Ribonucleic Acid and Desoxyribonucleic Acid Content of Liver in Animals With A-Avitaminosis and in Normal Animals (in mg %)

No.	Experiment		Control	
	DNA	RNA	DNA	RNA
1	51.2	142.0	24.8	149
2	51.0	136.0	20.8	147.8
3	42.0	174.0	18.2	144.0
4	31.0	166.0	26.9	178.0
5	31.0	185.0	20.9	148.0
6	34.0	181.0	21 8	143.3
7	43.3	169.0	25.6	106 0
8	46.2	200.9	23.5	141.0
9	50.0	161.9	24.6	144.0
10	42.0	166.2	26.9	150.9
11	39.6	—	—	167.4
12	37.3	—	—	160
13	41.0	—	—	—
Average	41.5	168.2	23.39	148.2

As can be seen from Table 2, when vitamin A is deficient rat liver shows increased phosphorus content in the fraction containing nucleoproteins, ribonucleic acid and desoxyribonucleic acid. At the same time vitamin A deficiency is associated with arrest of the animal's growth and it would have been difficult to expect increased protein synthesis under these circumstances. To elucidate this question experiments were performed to determine the rate of synthesis of serum albumin by chick liver slices. The experiments were carried out on liver slices using the immunochemical method as used by I. S. Severina [5].

TABLE 2

Total Phosphorus (in mg %) in Fraction Containing Ribonucleic Acid, Desoxyribonucleic Acid and Nucleoproteins in Liver of Animals with A-Avitaminosis and Control Animals

No.	Total P	
	Experiment	Control
1	210.4	176
2	204.0	169
3	203.0	163.2
4	222.3	163.6
5	221.0	188
6	196.8	173
7	203 3	182.9
8	—	126.7
9	—	166
Average	208.6	167.6

The data obtained showed that in chicks deprived of vitamin A synthesis of serum albumin was practically absent whereas in the control animals which were given vitamin A such synthesis was sufficiently well marked (Table 3).

TABLE 3

Synthesis of Serum Albumin by Liver Slices from Chicks with A-Avitaminosis and Control Chicks During Three Hours' Incubation (in μ g per 1 g Tissue)

No.	Control			Experiment		
	Serum albumin content			Serum albumin content		
	initial	after incubation	increment	initial	after incubation	increment
1	525	740	215	200	240	40
2	240	390	150	540	540	0
3	460	800	340	570	600	30
4	230	430	200	420	420	0
5	910	1200	290	740	750	10
6	900	1065	255	210	210	0
7	560	700	140	430	430	0

It would be premature to correlate the data presented here concerning the increase in nucleic acid content of rat liver and depression of albumin synthesis in chick liver under conditions of A-avitaminosis because of the heterogeneity of experimental material.

Further work on more detailed elucidation of these questions is at present in progress.

SUMMARY

The present work was performed on rats with the aim of clearing up the question of the influence of vitamin A on the contents of nucleic acid.

Lack of vitamin A causes increase of content of ribonucleic acid, as well as of desoxyribonucleic acid.

The second task of this work was to study on chickens the influence of vitamin A deficiency upon the spleen of synthesis of serum albumin.

Under the conditions of vitamin A deficiency the synthesis of serum albumin is negligible.

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