ACTION OF VITAMIN B_6 ON Fe^{59} UTILIZATION BY PRONORMOBLASTS AND NORMOBLASTS OF PATIENTS WITH IRON-DEFICIENCY ANEMIAS

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UDC 616.155.194.8-07:616.155.1.02-008.927.2-074

Experiments on cultures of bone marrow from patients with various forms of iron-deficiency anemia showed that vitamin B_6 stimulates erythroid cell function: absorption of Fe^{59} by erythroid cells is increased and their content of nonheme iron is decreased.

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The object of this investigation was to study the effect of vitamin B_6 on the intensity of iron uptake into nucleated erythroid cells and the dynamics of changes in the sideroblast picture in cultures of bone marrow from patients with iron-deficiency anemia.

EXPERIMENTAL METHOD

The technique of cultivation of the bone marrow and of microautoradiography was described in an earlier paper [1]. In all the experiments 1 μCi $Fe^{59}Cl_3$ (specific activity 1 μCi/μg) and 0.01 mg pyridoxin were added to 1 ml of bone marrow suspension. The use of pyridoxin in the culture procedure is justified because the ability of various mammalian tissues to synthesize phosphopyridoxal in vitro if they are incubated with pyridoxin has been demonstrated [3-6]. All details regarding calculation of the mean index of incorporation (MII) and evaluation of the intensity of labeling of the cells with Fe^{59} during cultivation for different periods have been fully described previously [2]. To study the further fate of the iron absorbed by the erythropoietic cells, the dynamics of changes in the sideroblast picture were studied. Altogether 18 patients with different forms of iron-deficiency anemia were studied, 5 with chronic posthemorrhagic anemia unconnected with endocrine pathology, 8 had essential iron-deficiency anemia, and 5 had juvenile chlorosis. When determining the action of vitamin B_6 on erythroid cell function, all these patients were considered together as one group, because of earlier observations showing that in these types of iron-deficiency anemia the dynamics of changes in the sideroblast picture is identical and the values of iron absorption by cells in marrow cultures are very close [2].

EXPERIMENTAL RESULTS

The experimental results (Table 1) showed that after addition of pyridoxin to the incubation medium the absorption of iron by erythropoietic cells increased by 30-50%. This change in MII was due both to an increase in the intensity of Fe^{59} incorporation in cells with a low level of iron absorption (an increase in the relative percentage of labeled cells), and to potentiation of iron incorporation in normoblasts which were already labeled in the absence of vitamin B_6 in the cultures (an increase in the number of highly labeled cells). However, the effect of a substance in stimulating absorption of iron by erythroid cells can be judged only when the increased uptake of iron which it produces is not accompanied by an increase in the reserves of nonheme intracellular iron or when its content is reduced. As the results showed (Table 2), under the influence of vitamin B_6 the total number of sideroblasts in the cultures was reduced approximately by 33%, mainly on account of cells of types I and II. It may accordingly be concluded that in patients with iron-deficiency anemia, vitamin B_6 facilitates the utilization of iron for heme synthesis and, consequently, the use of pyridoxin in combination with iron preparations is indicated for the treatment of patients with these forms of iron-deficiency anemias.

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TABLE 1. Increase in Intensity of Fe^{59} Absorption by Erythropoietic Cells under the Influence of Vitamin B_6 (M±m)

Duration of incubation	Erythroid cells		MII without vitamin B_6	Increase in MII under influence of vitamin B_6 (in %)	P	Percentage of labeled cells in cultures without vitamin B_6	Diff. in content of labeled cells in cultures with and without vitamin B_6 (in %)	P	Percentage of highly labeled cells in cultures without vitamin B_6	Diff. in content of highly labeled cells in cultures with and without vita. B_6 (in %)	P
4 h	Pronormoblasts		0,84±0,12	24,5±14,2	> 0,1	47,6±8,3	15,8±7,7	> 0,05	11,2±8,2	1,5±6,7	> 0,5
	Basophilic normoblast	large nucl.	0,54±0,04	49,0±16,0	< 0,02	33,6±4,1	19,5±6,7	< 0,02	0,8±0,8	10,5±6,0	> 0,1
		medium nucl.	0,39±0,03	59,0±17,1	< 0,01	11,3±3,4	21,7±6,8	< 0,01	0,8±0,8	1,6±1,6	> > 0,2
24 h	Polychromatophilic normoblast	large nucl.	1,36±0,06	47,0±11,4	< 0,01	97,5±1,6	2,7±1,8	> 0,1	36,4±6,0	34,4±6,8	< < 0,001
		medium nucl.	1,24±0,08	31,0±10,2	< < 0,02	92,0±3,0	6,5±3,1	> > 0,05	28,1±6,9	27,8±9,3	< < 0,02
		small nucl.	0,80±0,06	37,3±10,9	< 0,01	54,7±5,5	20,9±6,2	< 0,01	8,0±2,7	12,2±5,1	< < 0,05
	Oxyphilic normoblast	small nucl.	0,75±0,06	44,0±11,0	< 0,01	54,6±5,5	22,8±6,1	< 0,01	6,3±2,9	14,4±4,5	< 0,01

TABLE 2. Effect of Vitamin B_6 on Dynamics of Changes in Sideroblast Picture (M±m)

Type of sideroblasts	No. of sideroblasts presents (in %)		Diff. in content of sideroblasts in cultures with and without vitamin B_6 (in %)	P
	before incubation	after incubation for 24 h without vitamin B_6		
I	1,5±0,6	2,4±0,3	1,0±0,4	< < 0,05
II	0,5±0,2	5,2±0,9	2,4±0,9	< < 0,02
III	0,0	2,4±0,8	0,1±0,8	< > 0,5
Total	2,0±0,9	10,0±1,5	3,6±1,6	< 0,05

LITERATURE CITED

1. S. V. Kanaev and A. V. Kuleshov, Lab. Delo, No. 7, 430 (1964).
2. S. V. Kanaev, É. I. Shcherban', and G. D. Shostka, Tsitologiya, No. 3, 345 (1968).
3. A. V. Trufanov and V. A. Kirsanova, Byull. Éksperim. Biol. i Med., 22, No. 6, 40 (1946).
4. A. V. Trufanov, V. A. Kirsanova, and Z. I. Solov'eva, Biokhimiya, No. 6, 482 (1947).
5. A. V. Trufanov, V. A. Kirsanova, and Z. I. Solov'eva, in: Problems in Medical Chemistry [in Russian], Vol. 1, Moscow (1949), p. 108.
6. A. V. Trufanov and Z. I. Solov'eva, in: Problems in Medical Chemistry [in Russian], Vol. 2, Moscow (1950), p. 176.