Effect of a Pantothenic Acid-Deficient Diet on Monoamine Oxidase (MAO) and Deoxyribonucleic Acid (DNA) in Rat Liver

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Livers of rats maintained for 20 days on a pantothenic acid-deficient diet plus a molecular antagonist showed lower MAO activity and higher DNA content than those of the rats receiving a basic diet plus pantothenic acid. The biochemical changes reported are not understood.

During the course of investigation on MAO activity and DNA content in human liver the opportunity arose to assay MAO in the livers of Sprague-Dawley rats that had been maintained on a diet devoid of pantothenic acid (1). Pantothenic acid is an important constituent of coenzyme A (CoA); its deficiency in laboratory animals causes disorders of carbohydrate, fat, sterol, and steroid metabolism and produces lesions of the skin, adrenals, nerves, spinal cord, and entire gastrointestinal tract (2).

To assure that the effect of any indigenous pantothenic acid was eliminated, experimental rats received a molecular antagonist, ω-methyl pantothenic acid (3). Control rats were fed the basic diet plus pantothenic acid. The animals were sacrificed after 20 days and their livers immediately placed in the cold until analyzed. MAO activity was determined on liver homogenates by the method of Sjoerdsma *et al.* (4), a method based on the colorimetric determination of substrate (tyramine) disappearance. DNA content was assayed by the method of Webb and Levy (5), a colorimetric procedure based on the reaction of DNA with *p*-nitrophenylhydrazine. The data obtained from the analysis of the liver specimens are given in Table I. Statistical evaluation was by Student's *t* test.

Table I.—Normal and Pantothenic Acid-Deficient Rat Livers

	MAO Units[a]	DNA, mcg./Gm. Liver
	Normal Livers	
1	3225	2008
2	2925	2681
3	3105	2146
4	3165	2597
5	3450	2666
6	3015	2239
Mean	3147.5	2389
S.D.	±182	±294
	Pantothenic Acid-Deficient Livers	
1	2385	3777
2	2115	3556
3	2220	3468
4	2145	3596
5	1860	3369
6	1650	3268
Mean	2062	3506
S.D.	±250	±179
	$P < 0.001$	$P < 0.001$

[a] One unit is amount of MAO causing the disappearance of 1 mcg. tyramine/Gm. tissue/hr.

The liver of the rat maintained on the pantothenic acid-deficient diet plus ω-methyl pantothenic acid shows a significantly lower MAO activity and significantly higher DNA content than the normal rat liver. This relationship of low MAO activity and high DNA content in normal and pathological human liver has been also observed (1). Under pantothenate deficient conditions, CoA of rat liver has been shown to be reduced to 35–40% of normal after 9 weeks and CoA of duck liver has been observed to be depleted 40% of normal after 5 days (6). Lipmann *et al.* (7) demonstrated that pantothenic acid is a constituent of CoA. The present data suggest that pantothenic acid might also be a part of MAO.

As the determination of MAO activity and DNA content is based on Gm. of liver tissue, the higher content of DNA might be attributed to the dehydration of pathological liver (that is, a greater number of cells/Gm. of liver tissue than is normal). However, if the above is true, MAO activity of pathological liver should be more than the normal. The data reported in the paper indicate that this is not so.

Since the DNA content per cell is known to remain constant (8), the increased DNA content suggests an increase in the number of liver cells, possibly as a natural defense mechanism. Increased numbers of liver cells have been observed in other pathological states, such as in inflammation.

Since MAO as yet has not been isolated in pure form, its chemical structure is unknown, and hence, the biochemical changes involved in the presently reported phenomenon are not understood.

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