

Ineffectiveness of Lyxoflavin as an Antithyrototoxic Factor for the Rat. (19414)

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Available data indicate that water-insoluble liver residue contains a factor(s) distinct from any of the known nutrients (including vit. B₁₂) which is effective in prolonging survival and counteracting the growth retardation and gonadal inhibition of immature rats fed massive doses of thyroid in conjunction with a purified ration containing casein as the dietary protein and sucrose as the dietary carbohydrate(1-4). Recent findings by Emerson and Folkers(5) indicate that lyxoflavin was as effective as liver residue in promoting growth in hyperthyroid rats fed a soybean-meal-dextrose-containing diet. In the present communication data are presented on the comparative effects of lyxoflavin and liver residue on the gain in body weight, survival rate and gonadal weight of immature hyperthyroid rats fed a purified casein-sucrose-containing ration.

Procedure. The basal ration employed in the present experiment consisted of sucrose, 73.0%; casein,* 22.0%; salt mixture,† 4.5%; and U.S.P. desiccated thyroid,‡ 0.5%. To each kg of the above were added the following synthetic vitamins: thiamine hydrochloride, 72 mg; riboflavin, 9 mg; pyridoxine hydrochloride, 15 mg; calcium pantothenate, 67.2 mg; nicotinic acid, 60 mg; 2-methylnaphthoquinone, 5 mg; and choline chloride, 1.2 g. Each rat also received 3 times weekly the following supplements: cottonseed oil (Wesson) 500 mg, alpha-tocopherol acetate 1.5 mg and a vit. A-D concentrate§ containing 50 U.S.P. units of vit. A and 5 U.S.P. units of vit. D. In addition to the basal ration the following diets were also employed, consisting of basal ration plus each of the following

supplements: 1) 30 mg lyxoflavin||/kg of diet 2) 100 mg lyxoflavin/kg of diet, and 3) 10% liver residue powder,¶ added in place of an equal amount of sucrose. A control ration was also employed consisting of the basal ration with thyroid omitted and replaced by an equal amount of sucrose. Sixty female rats of the Long-Evans strain were selected at 22 to 25 days of age and an average weight of 45.9 g for the present experiment. Animals were kept in metal cages with raised screen bottoms to minimize access to feces and were fed the above diets *ad libitum* (20 rats on the basal ration; 10 rats on each of the other diets). After 60 days of feeding surviving animals were autopsied, and ovarian, adrenal and ventricular weights determined. Results are summarized in Table I.

Results. In agreement with earlier findings body and gonadal weight and length of survival were significantly reduced in thyroid-fed rats on the purified basal ration, whereas the ratio of adrenal and ventricular weight per 100 g body weight was increased. Supplements of lyxoflavin at a level of 30 mg or 100 mg per kg of diet were without significant effect either on gain in body weight, survival rate, ovarian weight or the ratio of adrenal and ventricular weight per 100 g body weight. Liver residue, on the other hand, completely counteracted the retardation in body and gonadal weight, increased the survival rate, and significantly reduced the ratio of adrenal and ventricular weight per 100 g body weight. It is apparent from these findings that under

|| We are indebted to Dr. Karl Folkers of Merck and Co. for the crystalline lyxoflavin employed.

¶ Extracted liver Residue (Lot No. 72638), Wilson Laboratories. This liver fraction consists of the coagulated, water-insoluble material remaining after the removal of the extractable water-soluble substances. Considerable variation has been observed in this laboratory in the antithyrototoxic activity of different batches of commercially available liver residue.

* Vitamin Test Casein, General Biochemicals, Inc.

† Hubbel, Mendel and Wakeman Salt Mixture, General Biochemicals, Inc.

‡ Thyroid Powder, U.S.P., Armour and Co.

§ Nopco Fish Oil Concentrate, assaying 800000 U.S.P. units of vit. A and 80000 U.S.P. units of vit. D per g

TABLE I. Comparative Effects of Lyxoflavin and Liver Residue on Gain in Body Weight, Survival Rate and Organ Weights of Immature Hyperthyroid Rats (20 Rats on the Basal Ration; 10 Rats on Each of the Other Diets).

Supplements fed with basal ration	Initial body wt, g	Avg gain in body wt, g, on:		Surviving, %	Ovarian wt, mg	Adrenal wt, mg	Adrenal wt, mg/100 g body wt	Ventricular wt, mg	Ventricular wt, mg/100 g body wt
		28th day	60th day						
None	46.4	52.3 (12)	67.5 (8)	40	21.4	47.1	41.7	850	752
Lyxoflavin, 30 mg/kg of diet	46.1	56.8 (7)	75.7 (5)	50	21	51.2	41.8	982	801
Lyxoflavin, 100 mg/kg of diet	46.6	53.4 (7)	81.5 (2)	20	28.6	64.8	48.3	980	731
Liver residue	44.8	101.6 (10)	159.4 (8)	80	54.6	59.6	26.6	958	467
Basal ration without thyroid	45.2	90.2 (10)	152 (10)	100	47.3	44.5	22.9	658	338

Values in parentheses indicate number of animals which survived and on which averages are based.

conditions of the present experiment the antithyrototoxic activity of lyxoflavin was not equivalent to that of liver residue. No data are available to indicate what factors are responsible for the diverse results obtained by Emerson and Folkers(5) and the present investigator. It is well established, however, that differences in the carbohydrate, protein and fat components of a diet exert a profound effect on the nutritional requirements of the hyperthyroid rat(6). The above investigations differed not only in the carbohydrate, protein and fat components of the diet but in the mineral and vitamin content as well. Differences also existed in the sex and strain of experimental animal employed. These differences may have contributed to the diverse results reported above.

Summary. Experiments were conducted on the comparative effects of lyxoflavin and liver residue on the gain in body weight, survival

rate and ovarian weight of immature hyperthyroid rats fed a purified ration containing casein as the dietary protein and sucrose as the dietary carbohydrate. Liver residue prolonged survival and completely counteracted the retardation in body and gonadal weight observed in thyroid-fed rats on the purified basal ration. Lyxoflavin was without significant effect.

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4. ———, *Arch. Biochem.*, 1950, v28, 359.
5. Emerson, G. A., and Folkers, K., *J. Am. Chem. Soc.*, 1951, v73, 2398.
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Effect of Soya "Lecithin" on Number of Clostridia in Rat Feces. (19415)

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Recent studies with farm animals(1) and rats(2) have indicated that the putrefactive microorganisms of the intestinal flora may be

undesirable. The dietary inhibition of putrefactive intestinal microorganisms has been accomplished by feeding lactose and dextrins