

3658

Dependence of Nephropathy Upon Concentration, Kind, and Duration of Feeding of Protein.

L. H. NEWBURGH AND A. C. CURTIS.

From the Department of Internal Medicine, University of Michigan.

In 1919¹ and again in 1923² we reported data which led us to conclude that diets high in protein injure the kidneys of the rabbit; and we offered the hypothesis that the injury was caused by the products of the increased amino-acid metabolism. The work was criticized on two scores: (1) The rabbit is a poor test object for experiments of this type; (2) There was no assurance that the diets contained all of the essential accessory factors and the proper distribution of mineral constituents.

Our further work accordingly dealt with the effect of the intravenous injection of various amino-acids on the kidneys of dogs and with the feeding of properly constituted diets, whose protein content varied from 8 per cent to 75 per cent, to rats. The injection experiments³ showed that the presence in the blood of certain amino-acids in excess of the normal is quickly followed by severe injury of the kidneys.

A preliminary report follows of the data obtained from feeding rats diets containing different amounts of protein.

The diets all contained 3 per cent cod liver oil, 4.5 per cent of the Osborne and Mendel salt mixture, 50 mg. dried yeast extract, lard, corn starch and protein. As the protein increased, the carbohydrate and finally the fat decreased.

Part of the animals represented in the table received casein, the others dried powdered beef as the protein. It is clear that the degree of injury is roughly proportional to the concentration of the protein

TABLE I.

Protein	240 days			480 days		
	Animals	Animals showing casts	Casts in 24 hrs.	Animals	Animals showing casts	Casts in 24 hrs.
Per cent	No.	No.	Av. No.	No.	No.	Av. No.
12	3	0	0	5	1	4
18	11	1	3	10	1	4
25	8	0	0	6	5	83
32	7	5	44	12	12	393
39	9	9	53	10	10	552
75	8	8	2148			

and the duration of the feeding. Histological examination of the kidneys disclosed damage which did not occur before six months, and then only with the higher concentrations of protein.

Furthermore, our data show that the extent of the injury is greatly influenced by the type of protein fed, thus a diet containing 75 per cent of casein fed 8 months caused an average albuminuria of 0.2 per cent and 1100 casts in 24 hours, whereas the same amount of beef proteins for the same length of time, caused 0.6 per cent of albumin and 3200 casts. Finally 11 young rats that ingested the usual amounts of diet containing 75 per cent of lactalbumin, died, without exception, in 7 days or less. All of the urines examined contained large numbers of casts and albumin.

This is a preliminary report.

¹ Newburgh, L. H., *Arch. Int. Med.*, 1919, xxiv, 359.

² Newburgh, L. H., and Clarkson, S., *Arch. Int. Med.*, 1923, xxxii, 850.

³ Newburgh, L. H., and Marsh, P. L., *Arch. Int. Med.*, 1925, xxxvi, 682.

3659

The Type of Fuel Used in Muscular Exercise.

DAVID RAPPORT AND ELAINE P. RALLI.

From the Department of Physiology, Western Reserve University School of Medicine

In recent papers from the laboratory of A. V. Hill, the moot question of the type of fuel used in muscular exercise has again been raised. The evidence obtained led, in an earlier paper,¹ to the tentative conclusion that "muscular exercise, of such short duration that it does not seriously affect the general metabolism of the body, may be paid for primarily by the oxidation of carbohydrates." In a later communication, Furusawa² states that whether the subject be on a carbohydrate or on a fat rich diet, short lived muscular exercise is performed only at the expense of carbohydrate. In more severe exercise, or in exercise of long duration, he postulates a conversion of fat to carbohydrate to replenish the depleted carbohydrate stores. The low respiratory quotients obtained during exercise on a high fat diet by Krogh and Lindhard³ are, on this conception, due to the latter phenomenon, and would not, presumably, occur in mild exercise. The experiments of Anderson and Lusk,⁴ who obtained R. Q.'s approaching those of fat in exercise during