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## Influence of Chicken Liver Feeding on Depancreatized Dogs.

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The observations of Blotner and Murphy<sup>1, 2</sup> seemed to indicate that certain aqueous liver extracts, as well as liver itself, contain a substance which, when given by mouth, reduces the insulin requirement of diabetic patients. More recently, de Pencier, Soskin and Best<sup>3</sup> stated that the findings of Blotner and Murphy were not substantiated by observations on depancreatized dogs. In all of the work done by both of the above groups, calves' liver was used. The fact that chickens and ducks do not develop a typical Von Mering-Minkowski diabetes<sup>4-8</sup> suggested that chicken liver be tried instead of calves' liver. At the same time it seemed to be desirable to repeat the work of de Pencier, Soskin and Best.

Two dogs were totally depancreatized. Two accurately weighed meals were fed each day, the hour being constant at all times. Urine was collected at exactly the same time every day, and quantitative sugar determinations were made by the Benedict method. Minced calf-pancreas was added to the diet. Insulin was given hypodermically before each meal, the dog being standardized to a dosage of insulin which allowed the excretion of a small amount of sugar.

The liver (200 gm.) was added to the control meal, the theory being that if the liver were sufficiently effective to warrant positive results, it would be able to take care of itself as regards its potential carbohydrate content. The control meal consisted of 200 gm. lean meat, 200 gm. calves' pancreas, and 250 cc. of whole milk, and yielded 756 calories. The addition of the liver to this diet gave it a calorific value of 1050. The lean meat used was the same through-

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<sup>1</sup> Blotner, H., and Murphy, W. P., *J.A.M.A.*, 1929, **92**, 1332.

<sup>2</sup> Blotner, H., and Murphy, W. P., *J.A.M.A.*, 1930, **94**, 1811.

<sup>3</sup> de Pencier, M. T., and Soskin, S., and Best, C. H., *Am. J. Physiol.*, 1930, **94**, 548.

<sup>4</sup> Weintraud, W., *Arch. f. Exper. Path. u. Pharm.*, 1894, **34**, 303.

<sup>5</sup> Kausch, W., *Arch. f. Exper. Path. u. Pharm.*, 1896, **34**, 274.

<sup>6</sup> Koppanyi, T., Ivy, A. C., Tatum, A. L., and Jung, F. T., *Am. J. Physiol.*, 1926, **78**, 666.

<sup>7</sup> Seitz and Ivy, *Proc. Soc. Exp. Biol. and Med.*, 1929, **26**, 463.

<sup>8</sup> Seitz, *Am. J. Physiol.*, 1930, **93**, 686.

out, a large stock being on hand. The composition of the milk and pancreas probably varied slightly daily.

The dogs remained in excellent general condition and consumed all the food given.

The results may be briefly summarized as follows: During a period of 6 days on the control diet the average daily excretion of sugar was 3.1 gm. (body wt. 23 lb., 22 u. of insulin per day). During the subsequent 10 days with liver added to the diet, the average daily excretion of sugar was 7.4 gm. (body weight 26 lb., 22 u. of insulin daily). During the following 10-day period red beef muscle in an amount of approximate caloric value to the liver was substituted for the chicken liver. The average daily sugar excretion was 7.3 gm. (body weight 25 lb., 22 u. of insulin daily). The repetition of this experiment using longer test periods yielded analogous results. The same was true for dog 2, in which one experiment was performed.

On averaging the results of the 3 experiments, the extra-sugar excreted, when 200 gm. of chicken liver were fed, a figure of 10.37 gm. was obtained. However, the calculated glucose equivalent of 200 gm. of chicken liver is 31.6 gm. of glucose. Since a gain in weight occurred on the addition of liver, it was evident that retention resulted. Recalling that Soskin<sup>9</sup> found a retention of as much as 50% of 50 gm. of the glucose fed to depancreatized dogs receiving no insulin, we decided to give our dogs, while on the control diet and "controlled" with insulin, 31.6 gm. of glucose, divided into 2 portions and given with the meals, 9-day test periods being used. When the results of the 2 experiments were averaged, it was found that the administration of 31.6 gm. of glucose yielded only 10.38 gm. of extra urinary glucose, *i. e.*, two-thirds of the extra-glucose fed was retained or unaccounted for by examination of the urine.

These results show that a depancreatized dog "controlled" with insulin does not quantitatively excrete glucose added to the diet or the calculated glucose equivalent of food added to the basal diet. This is not surprising in view of Allan's<sup>10</sup> work showing that the glucose equivalent of a unit of insulin increases up to a certain point on increasing the carbohydrate intake. This, we believe, explains the apparent "insulin-sparing" action of liver. The observation that chicken liver has no "insulin-sparing" action in depancreatized dogs confirms the findings of Pencier, Soskin and Best<sup>3</sup> for calves' liver.

<sup>9</sup> Soskin, *J. Nutrition*, 1930, **3**, 99.

<sup>10</sup> Allan, *Am. J. Physiol.*, 1924, **67**, 275.