Proceedings
of the
Society
for
Experimental Biology and Medicine

VOL. 43. APRIL, 1940. No. 4.

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Effect of Meat Extract on Fatty Infiltration of Liver in Depancreatized and Duct-Ligated Dogs

ELAINE P. RALLI AND SAUL H. RUBIN.

From the Laboratories of the Department of Medicine, New York University College of Medicine.

Since Fisher[1] and Allan, *et al.*,[2] first reported fatty infiltration of the livers in depancreatized dogs maintained on insulin, the observation has been confirmed repeatedly.[3] Recently, it has been shown in

[1] Fisher, N. F., *Am. J. Physiol.*, 1924, **67**, 634.

[2] Allan, F. N., Bowie, D. J., MacLeod, J. J. R., and Robinson, W. L., *Brit. J. Exp. Path.*, 1924, **5**, 75.

[3] Best, C. H., and Ridout, J. H., in Luck, J. M., *Ann. Rev. Biochem.*, 1939, **8**, 349.

this[4] and other[5, 6] laboratories that ligation of the external pancreatic ducts results in similar fatty changes in the liver. In all of these studies the diet fed to the dogs consisted largely of raw whole meat and glucose.

In the experiments reported here a dried meat powder preparation,* from which the extractives had been removed, was substituted for the whole meat. The diet contained meat powder, cracker meal, milk powder, salts, brewer's yeast, bone ash, cod liver and corn oil. As shown in Table I, little or no fatty infiltration of the liver occurred in 6 depancreatized and in 3 duct-ligated dogs which were fed the diet for periods varying from 6.5 to 19 weeks after operation. The fatty acid content of the whole livers, determined as previously described,[7] averaged 6.2% with a range of 3.12 to 10.5% (Table I). When the meat powder diet was supplemented with 15 ml of a concentrated meat extract* (the combination of meat powder plus extract being equivalent to about 250 g of raw lean beef) the livers of

TABLE I.
Liver Lipids of Depancreatized and Duct-Ligated Dogs Fed Meat Powder or Meat Powder Plus Meat Extract.

Dog No.	Condition of animal*	Meat supplement†		Time after operation, wks	Body wt		Liver		
		Powder, g/day	Extr., ml/day		Initial, kg	Final, kg	Wt, g	Fatty acids, %	Total cholesterol, %
180	D	35	0	6.5	10.3	8.0	358	3.1	.27
176	D	35	0	12	8.0	6.4	232	10.4	.33
192	D	35	0	12	15.8	10.0	470	9.0	.23
196	D	50	0	11	13.0	12.3		3.4	.22
170	D	50	0	13	13.3	12.8	416	3.2	.23
198	D	75	0	19	10.3	11.3	403	4.4	.24
147	L	35	0	14	13.0	7.4	212	10.5	.35
193	L	35	0	13.5	11.8	10.0	273	3.7	.29
189	L	50	0	12	11.8	9.8	267	8.2	.32
216	D	50	15	5	9.8	6.8	377	19.5	.25
214	D	75	15	7	9.8	7.0	456	18.3	.29
203	L	50	15	9	9.3	6.8	294	19.8	.23

* D = depancreatized; L = duct-ligated dog.
† 60 g meat powder + 15 ml extract ≏ 250 g whole meat.

[4] Ralli, E. P., Rubin, S. H., and Present, C. H., *Am. J. Physiol.*, 1938, **122**, 43.

[5] Person, E. C., Jr., and Glenn, F., *Arch. Surg.*, 1939, **39**, 530.

[6] Montgomery, M. L., Entenman, C., and Chaikoff, I. L., *J. Biol. Chem.*, 1939, **128**, 387.

* Dried meat powder and concentrated meat extract were purchased from the Valentine Meat Juice Company, Richmond, Va. The meat extract is a hot water extract of lean beef. It contains 4.5% proteose and peptone after it has been concentrated. This concentrated extract is what was used. Practically all of the protein and fat of the beef is in the powder.

[7] Rubin, S. H., Present, C. H., and Ralli, E. P., *J. Biol. Chem.*, 1937, **121**, 19.

one duct-ligated and 2 depancreatized dogs contained 18.3 to 19.8% fatty acids after 5 to 9 weeks (Table I). It is therefore concluded that the fatty liver of these dogs is due in large measure to some substance or substances present in the extractive fraction of meat.

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Analysis of the Bile of the Capuchin Monkey.

FRANCES F. BECK. (Introduced by John C. Krantz, Jr.)

From the Department of Pharmacology, School of Medicine, University of Maryland.

Studies in this laboratory in recent years have been concerned with the hydrogen-ion concentration of the bile of the guinea pig[1] and dog[2] with respect to the dissolution of human gall stones. Having available a series of Capuchin monkeys *(Cebus fatuellus)* upon which metabolism studies had been conducted, it was deemed of interest to study the bile of this species of monkey. The animals were narcotized with sodium amytal; the bile was drawn from the gall bladder without exposure to air. The hydrogen-ion concentration was determined by means of a glass electrode at 25° and an analysis of the principal constituents was carried out according to the Douglas-Sauermann[3] method. The results on 10 animals are shown in Table I.

The average pH of the bile and the percentage of various constituents present in the Capuchin monkey are similar to these data on the gall-bladder bile of dogs.[2] Also as with the bile of the dog it was observed that the correlation between a high pH and high total solids content is great.

TABLE I.
Constituents of Monkey Gall Bladder Bile.

	pH	Total solids, %	Mucin, %	Ash, %	Alkalinity of ash as % Na_2CO_3 in bile	Lipoids, %	Bile acids as cholic and desoxycholic, %
Aver.	6.3	20.8	0.81	1.65	0.65	7.95	6.05
Low	5.6	10.3	0.46	1.04	0.26	3.81	4.30
High	6.9	28.8	1.15	2.06	0.99	11.30	10.00

[1] Krantz, J. C., Jr., Feldman, M., Morrison, S., and Carr, C. J., PROC. SOC. EXP. BIOL. AND MED., 1936, **35**, 48.

[2] Beck, F. F., Krantz, J. C., Jr., Feldman, M., and Carr, C. J., PROC. SOC. EXP. BIOL. AND MED., 1937, **37**, 357.

[3] Douglas-Sauermann, A. G., *Z. Physiol. Chem.*, 1935, **231**, 92.