1. Talmage, D. W., Baker, H. R., and Akeson, W., *J. Infect. Dis.*, 1954, v94, 199.

2. Pressman, D., Sherman, B., and Korngold, L., *J. Immunol.*, 1951, v67, 493.

3. Korngold, L., and Pressman, D., *ibid.*, 1953, v71, 1.

4. Bale, W. F., Spar, I. L., Goodland, R. L., and Wolfe, D. E., *Univ. of Rochester Atomic Energy Proj. Rep.*, UR-397, 1955.

5. ———, PROC. SOC. EXP. BIOL. AND MED., 1955, v89, 564.

6. McFarlane, A. S., *Biochem. J.*, 1956, v62, 135.

7. Waugh, D. F., *Advances in Protein Chemistry*, 1954, v9, 325.

8. Neurath, H., Cooper, G. R., and Erickson, J. O., *J. Biol. Chem.*, 1942, v142, 265.

9. Kleinschmidt, W. F., and Boyer, P. D., *J. Immunol.*, 1952, v69, 257.

10. Coburn, A. F., and Kapp, E. M., *J. Exp. Med.*, 1943, v77, 173.

11. Friend, C., *J. Immunol.*, 1953, v70, 141.

12. Gostev, V. S., *Zhur. Mikrobiol. Epidemiol. Immunobiol.*, 1953, v5, 26.

13. Lepper, M. H., Caldwell, E. R., Jr., Smith, P. K., and Miller, B. F., PROC. SOC. EXP. BIOL. AND MED., 1950, v74, 254.

14. Pappenheimer, A. M., Jr., Lundgren, H. P., and Williams, J. W., *J. Exp. Med.*, 1940, v71, 247.

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Use of I^{131} Labeled Oleic Acid in Study of Gastrointestinal Function.* (23095)

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Previous work using I^{131} labeled neutral fat suggested that use of a radioactive labeled fatty acid could prove valuable in studying gastrointestinal function. This report concerns use of I^{131} labeled oleic acid in the further investigation of certain physiological aspects of digestion and absorption in normal and abnormal subjects.

Procedure. Human subjects. Thirteen humans with no evidence of abnormality related to the digestive tract were used as controls. After 4 hours of fasting, each was given a gelatin capsule containing 0.5 cc of oleic acid which included 25 μc of I^{131} labeled oleic acid. They were then given 20 drops of Lugol's solution and 3 gelatin capsules containing barium sulfate powder. This was taken with small amounts of water. A fasting state was then maintained for the following 6 hour period. Two ml venous blood samples were drawn at hourly intervals at second through sixth hour following ingestion of the capsules. At the third hour fluoroscopic examination of the abdomen was made to determine gastric emptying and location of the barium. The subjects were allowed to return to their normal eating habits after the 6 hour period. All feces passed within 48 hours after the test was collected in individual containers. Blood samples were analyzed for radioiodine content and total radioiodine blood levels were determined and expressed as percentage of ingested material as described by Baylin *et al.* (1). Fecal samples were individually ana-

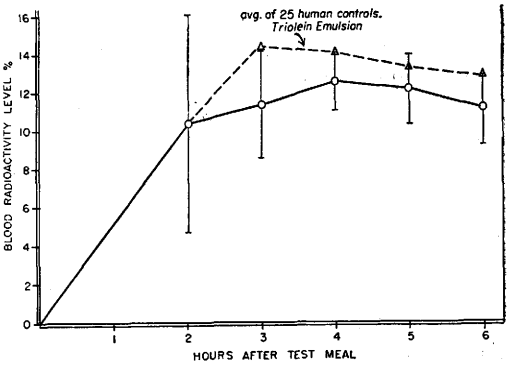

FIG. 1. Blood radioactivity levels (avg of 13 human controls with standard deviation).

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TABLE I.

	Triolein emulsion				Oleic acid			
	Blood radioactivity levels (%)			Recovered in feces	Blood radioactivity levels (%)			Recovered in feces
	4 hr	5 hr	6 hr	(%)	4 hr	5 hr	6 hr	(%)
Normal (avg)	14.1	13.3	12.4	.6	12.8	12.2	11.2	.7
Ca of pancreas	4.7	4.7	3.8	49.0	10.4	11.3	11.7	10.0
Pancreatectomy	2.4	3.2	2.8	64.7	8.9	7.6	6.6	2.3
Sprue (in relapse)	3.3	3.3	4.0	32.0	3.8	7.7	7.8	15.9
Regional enteritis	3.7	3.5	3.3		6.9	5.5	5.1	48.3
Amyloidosis with marked diarrhea	5.2	5.2	4.9		1.0	.5	1.1	
Gastric resection, Hofmeister								
(1) Without evidence of malnutrition	10.6	12.0	10.9		9.4	9.3	8.9	1.3
(2) With evidence of malnutrition	3.6	3.8	3.8	72.3	11.9	10.5	9.3	.2

lyzed for radioiodine content, and the total expressed as percentage of the administered radioactivity as described previously(2). Seven patients having proven gastrointestinal disease were studied in the same manner.

Animals. Fourteen healthy dogs were used as controls. After 4 hours fasting, each control was given a gelatin capsule containing 0.5 ml of oleic acid which included 25 mc of I^{131} labeled oleic acid. Two ml venous blood samples were drawn at hourly intervals for the second thru the fifth hours following ingestion of the capsule. No attempt was made to collect the feces. Blood samples were analyzed as described above. Identical procedures were carried out on 7 dogs that were not fasted prior to the test. Two pancreatectomized dogs and 2 dogs in which pancreatitis was produced by vinylite infusion into the main pancreatic ducts(3) were tested in identical manner as the 14 control dogs.

Results. The results obtained in the 13 human controls are presented in Fig. 1. Average blood radioactivity levels and associated standard deviation are shown as a function of time after the test meal. Average fecal recovery for this group was 0.7%, with a range of 0 to 2.8%. For comparison the average curve of the human control with triolein test meal is shown.

Table I shows the results obtained in 7 patients tested with neutral fat (triolein emulsion) and with oleic acid.

The results obtained in the group of control dogs are shown in Fig. 2. The average curve of human controls with oleic acid test meal is presented for comparison. Table II shows data obtained in the 4 dogs in which pancreatic insufficiency was produced.

The 7 dogs tested under a non-fasting condition yielded radioactive blood levels which were not uniform, were unpredictable and did not conform to the reproducible curves seen in fasted animals.

The studies with normal humans and dogs have shown that characteristic and reproducible curves of blood radioactivity levels are obtained when I^{131} labeled oleic acid is given as described above. Similar results have been reported by other investigators(4). Theoretical consideration of the physiology of the G. I. tract would indicate that use of both

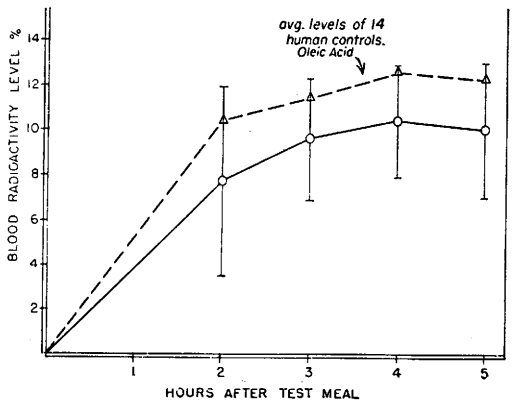

FIG. 2. Test material—½ ml oleic acid in capsule (avg levels of 13 normal dogs).

TABLE II. Blood Radioactivity Levels in Dogs.

Triolein emulsion			Oleic acid capsule		
4 hr	5 hr	6 hr	4 hr	5 hr	6 hr
(%)					
Pancreatitis—vinylite					
1.5	1.3	1.5	1.1	6.5	7.8
1.5	3.4	4.4	6.5	7.0	8.0
Pancreatectomy					
—	5.3	1.2	10.6	10.1	7.6
0	.3	0	11.3	14.7	4.5
1.6	2.0	2.2	11.7	12.0	9.0

neutral fat and fatty acid test might differentiate between abnormalities of digestion and absorption.

This assumption was tested in the 4 dogs in which pancreatic insufficiency was produced. As seen in Table II post operative neutral fat blood radioactivity levels were markedly depressed. These results attest to the pancreatic insufficiency as demonstrated previously(5). In contrast, blood radioactivity levels following oleic acid test were within the range of normal. The 2 patients with known pancreatic disease (Table I) gave results similar to those obtained in the pancreatic deficient animals. In the few patients with known small bowel disease tested, both triolein and oleic acid curves were depressed (Table I).

The results obtained in the experimental animals and the small number of patients with known gastrointestinal abnormalities suggest the probability that neutral fat and fatty acid will prove helpful in differentiating between abnormalities of digestion and absorption. Similar conclusions have been recently reported by others(4,6).

Summary and conclusion. 1. Constant and reproducible curves of blood radioactivity levels are found in normal humans and dogs after an oleic acid test. 2. Following pancreatectomy and induced pancreatitis in dogs, the curves obtained with oleic acid test were within normal range while those obtained with triolein were depressed.

1. Baylin, G. J., Sanders, A. P., Isley, J. K., Shingleton, W. W., Hymans, J. C., Johnson, D. H., and Ruffin, J. M., PROC. SOC. EXP. BIOL. AND MED., 1955, v89, 54.

2. Sanders, A. P., Isley, J. K., Sharpe, K., Baylin, G. J., Shingleton, W. W., Hymans, J. C., Ruffin, J. M., Reeves, R. J., *Am. J. Roentgenol., Radium Ther. and Nuclear Med.*, vLXXV, 387.

3. Anlyan, W. G., *et al.*, in press.

4. Malm, J. R., Riemstma, K., and Barker, H. G., PROC. SOC. EXP. BIOL. AND MED., 1956, v92, 471.

5. Shingleton, W. W., Wells, M. H., Baylin, G. J., Ruffin, J. M., and Sanders, A. P., *Surgery*, 1955, v38, 134.

6. Turner, D. A., Parker, O., Coffey, J., and Duffey, B. J., Jr., *Clinical Chemistry*, 1956, v2, 274.

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Hormonal Influences on Growth and Somatotropic Actions of Autonomous Mammotropes.* (23096)

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Estrogens stimulate secretion and proliferation of mammotropes (Mt) of the anterior pituitary gland(1-3). Mammotropic tumors (MtT) can be induced in rats by prolonged estrogen treatment; they are readily transplantable to estrogen-treated and, occasionally, to normal rats. Upon successive transplantation, the former, that is, dependent MtT, invariably gives rise to autonomous variants. Extracts of such tumors contain mammotropin (MtH; synonym: prolactin)(4). All transplanted mammotropic tumors thus far studied have had a pronounced somatotropic effect and were markedly responsive to estrogens. The present study was undertaken to investigate more precisely the role of hypo-

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