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Absorption in Dogs Following Exclusion of Bile and Pancreatic Juice Using I^{131} Labeled Fat. (22147)

MARIUS H. WELLS,* W. W. SHINGLETON, AND AARON P. SANDERS.
(Introduced by Ivan W. Brown, Jr.)

Departments of Surgery and Radiology, Duke University School of Medicine, Durham, N. C.

For the past year this laboratory has utilized I^{131} labeled protein† (albumin) and fat† (glycerol trioleate) in studying absorption and digestion in various disease states, *i.e.* pancreatic disorders, ulcerative colitis, small intestinal disorders such as sprue and Whipple's disease, and in post gastrectomy patients. In comparative studies using radioactive iodinated serum albumin and radioactive iodinated glycerol trioleate in dogs subjected to total pancreatectomy, there was a greater abnormality in digestion and absorption of the radioactive fat than in digestion and absorption of I^{131} labeled albumin as measured by percentage of radioactivity found in blood following the test meal containing these substances(1).

The present study was done to further evaluate the effect of exclusion of bile and pancreatic juice on the pattern of fat digestion and absorption by use of a fat test meal containing I^{131} labeled glycerol trioleate.

Materials and methods. Two types of fat meal were prepared, each identical except that one was emulsified in a Waring blender and contained 2-3 ml of polyoxyethylene sorbitan mono-oleate (Tween 80). The constituents of the meal were: ½ ml of peanut oil‡/kg body weight of the animal, 10 μc of I^{131} labeled glycerol trioleate, the total mixed with equal volume of water. For 3 days prior to the test meal the animals were given .99 g tablet of potassium iodide daily to saturate the thyroid with iodine. All animals were fasted for 12 hours prior to the test. A rubber Levine tube was passed into the stomach of the unanesthetized animal and the test meal given via the stomach tube. 2 ml of venous blood was then drawn at 1, 2, 3, 4, 5, and 6 hours following the test meal into the stomach. Each sample of blood was then assayed for radioactivity in a calibrated sodium iodide thallium activated scintillation crystal well counter. Using measured radioactivity of the 2 ml sample and the calculated blood volume of animal (assumed to be 7.5% of body weight), the total radioactive content of blood was calculated and expressed as percentage of total ingested radio-iodine. From these data a curve was constructed showing the relationship of radioactivity in blood as a function of time. To establish a "normal" pattern of radioactivity of blood following a fat meal of peanut oil containing I^{131} labeled glycerol trioleate, 39 tests were done on 24 normal dogs. In 29 of these tests peanut oil and glycerol trioleate constituting the test meal were emulsified. Ten additional tests were done on 10 dogs in which the constituents were not emulsified. Ten dogs were then subjected to total pancreatectomy under sodium amytal anesthesia, following which they were given a diet as suggested by Markowitz (2) with daily injection of insulin. Two-three weeks following operation these animals

* Post Doctorate Fellow, National Cancer Institute. Presently Department of Surgery, Medical College of S. Carolina and Roper Hospital, Charleston, S. C.

† Obtained from Abbott Laboratories, Chicago, under A.E.C. authorization.

‡ Obtained from Planters Nut and Chocolate Co., Wilkes-Barre, Pa.

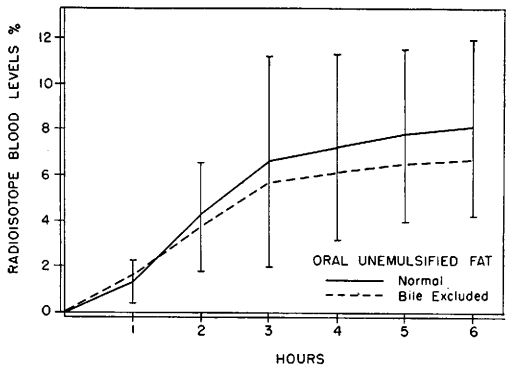

FIG. 1. Graph showing comparison in mean curve of blood isotope percent in 10 normal and 10 bile duct occluded dogs using an I^{131} labeled unemulsified fat test meal.

were tested with the peanut oil and I^{131} labeled trioleate emulsified meal. Fourteen additional dogs had ligation of their common bile duct and two weeks later were tested with the emulsified fat meal. Ten of these duct ligated animals were tested a week later with the unemulsified fat preparation.

Results. The results revealed no statistical difference between normal dogs and dogs with bile exclusion tested with I^{131} labeled unemulsified fat (Fig. 1). Likewise, there was no significant difference between normal and bile duct occluded dogs tested with I^{131} labeled emulsified fat (Fig. 2). There was, however, a striking difference in radioisotope blood level in normal and in pancreatectomized dogs tested with I^{131} labeled emulsified fat (Fig. 2).

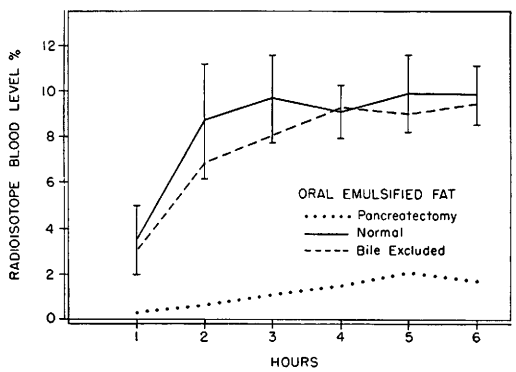

FIG. 2. Graph showing comparison in mean curve of blood isotope percent in 14 normal, 14 bile duct occluded, and 10 pancreatectomized dogs, all tested with an I^{131} labeled emulsified fat test meal.

Previous studies, using different technics have indicated that bile is quantitatively concerned in the digestion and absorption of fat (3-5) and that exclusion of bile reportedly results in decreased fat absorption(6). Further, previous studies have indicated that exclusion of pancreatic secretion produces a more marked alteration of fat digestion and absorption. Several investigators have used an iodized fat in studying fat digestion(7-10). Earlier studies(11-13) showed that although an iodized fat is unnatural, its digestion, absorption and metabolic fate closely followed that of neutral fat after oral administration. The glycerol trioleate used in the present study is a long chain, predominantly saturated fat. The peanut oil is a mixture consisting of mainly unsaturated fatty acids of high iodine index. From a chemical standpoint the bond between the I^{131} and the fat molecule theoretically is a firm one. Although the exact nature of fat digestion and absorption is not known, one theory holds that when a fat, as used in this study, enters the normal gut, hydrolysis of the fat molecule occurs, yielding glycerol and fatty acids, to which the I^{131} remains bound. Glycerol and fatty acids supposedly then re-unite in the wall of the gut to form again a fat molecule before entrance into the lacteals. Studies in this laboratory, to be reported elsewhere, show that undigested portion of administered fat passes in the stool, carrying with it the equivalent proportion of bound I^{131}. Furthermore, pancreatectomy had no influence on rate of absorption of ionic I^{131}, but has a profound influence on the rate of entrance of I^{131} into blood when it is chemically bound to the fat molecule.

The present study indicates that addition of an emulsifier produced little or no effect on fat digestion and absorption in the normal animal. Exclusion of bile made little difference in rate and in total amount of radioactive labeled fat entering the blood during the 6-hour period of the test, whether the fat was emulsified or unemulsified. On the other hand, exclusion of pancreatic juice caused a marked depression in the amount of radioactive labeled emulsified fat which entered the blood during the test period.

Summary. Using a fat test meal containing a radioactive labeled fat, a study has been carried out in dogs to assess the rate and total amount of radioactive labeled fat entering the blood in normal dogs and in dogs with exclusion of bile and pancreatic juice during a 6-hour period after administration of the meal. These studies indicate that bile plays a minor role and pancreatic juice a major role in fat digestion and absorption. This study suggests the use of a similar test for clinical use in evaluating pancreatic function in suspected pancreatic disease.

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Experimental Hydro-uteri (Hydrometra) in Rodents and Some Factors Determining Their Formation.* (22148)

F. HOMBURGER, M. S. GROSSMAN, AND A. TREGIER.

Cancer Research and Cancer Control Unit, Tufts University School of Medicine, Boston, and the Roscoe B. Jackson Memorial Laboratory, Bar Harbor, Me.

In mice of the English Silver Strain, and occasionally in other strains there occurs a condition of imperforate vagina which leads to a marked distention of uteri with accumulation of fluid up to 15 ml or more per mouse. Yet normal function of the uterus is preserved, since such animals become pregnant if the membrane occluding the vagina is removed(1). Existence of huge hydro-uteri in the presence of imperforate vaginas suggested that simple ligation of the cervix in rodents might likewise induce formation of hydro-uteri. This new technic not only provides a large uterine receptacle for tumor transplants but also permits the collection of large amounts of uterine secretions in small animals.

This paper reports studies on production of hydro-uteri in mice, rats and hamsters and on hormonal and other factors which play a role in development of experimental hydro-uterus.

Methods. The cervix of the uterus was ligated under nembutal anesthesia through a supra-pubic incision in 456 mice, in a smaller number of rats (Wistar) and Syrian hamsters. The variables for this study of effects on development of hydro-uteri were strain of mouse, endocrine status and time elapsing between uterine cervix ligation and autopsy. The strains of mice and types of animals used are shown in Tables I and II. Eighty-four mature white Swiss mice, 40 DBA/1 and 40 C57BL/10J mice were castrated and their cervices ligated (Table I). Forty-seven immature intact white Swiss mice underwent

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