Methods for Measuring Fat Absorption.*† (22882)

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A recent investigation(1) in this laboratory included a study of results from direct(2,3) and indirect methods(4,5) for measurement of rate of intestinal absorption of fat. The results from 3 indirect methods indicated a significant relationship exists between them. However, close agreement was not obtained between results of the indirect methods and a direct one, employing a modified Cori technic. Further studies have revealed that gastric retention associated with recovery of unabsorbed fat from the entire gastrointestinal tract could at times lead to erroneous conclusions, especially after relatively short absorptive periods.

Methods. Male Sprague-Dawley rats were fasted 48 hours and were administered by tube, a standard amount of fat according to their body surface. Equivalent amounts of fatty acids in the mono- or triglyceride form were fed at 2 levels of intake, equal to the fatty acids in 0.10 or 0.15 ml of olive oil. Sodium taurocholate alone and in combination with albumin were used as emulsifying agents to prevent a water-in-oil gel formation of the monoglyceride. Lipids which remained in the stomach and intestine were recovered (3) separately after a 3 hour absorptive period. This method permits calculation of the percentage of lipid absorbed on the basis of (a) the lipid which had passed through the stomach and was therefore readily available for absorption as well as on the basis of (b) the total ingested fat. Although the same amounts of fatty acid were administered in the form of 2 lipids, any retention of one lipid in the stomach would make less of it available for absorption than the other. In all cases, the lipid absorption was calculated as percentage of total fed and in mg/dm^2/hr.

Results. As can be seen in Table I, the amount of glyceride remaining in the stomach at the end of 3 hours following ingestion is greater in the case of the monooleate than the olive oil. A similar finding was obtained when intake of the 2 lipids was increased, with both lipids in an emulsified form. Hence there are marked differences in rates of absorption of the 2 lipids, whether calculated as proposed by Irwin *et al.*(2) as per cent absorbed, or by Deuel(3) in mg absorbed/dm^2/hr.

The smaller percentages of unabsorbed monoglyceride in the intestine, in contrast to the stomach, suggested that the fraction which had passed into the intestine might be as rapidly absorbed as that of the triglyceride. Hence absorption was again calculated on the basis of fat fed minus amount remaining in the stomach. Surprisingly similar values for absorption rates of both glycerides were obtained (84-89%) when only the amount actually available for absorption is considered instead of the total amount fed. Usually rates of fat absorption are considered comparable only when animals are fed similar amounts of fat, based either on amounts of fat administered or the size of the animal. However, unlike the values from the other methods at 2 levels of fat intake, similar and apparently more correct results are obtained if corrections are made for the glyceride not readily available for absorption.

The results suggest that quite misleading data may be obtained from the methods generally used for measuring relative rates of fat absorption if fat should be retained in the stomach. The retention might be the result of either some effect of the fat itself or the physical or emotional state of the experimental animal. Some correction for this unavailable fat seems necessary when comparing absorptive rates shortly after ingestion of 2 lipids which have different gastric emptying times.

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TABLE I. Measurement of Rates of Glyceride Absorption.

No. of rats	Glyceride* and supplements	Amt fat fed, mg/dm²	% lipid recovered from		Lipid absorbed†		
			Stomach	Intestine	Abs. amt, mg/dm²/hr	% of fed	% of avail.
8	TG with bile and albumin	90.4	20	13	20.1 ± 3.4	67 ± 11	84 ± 4
8	MG emulsified with bile and albumin	103.7	44	6	16.1 ± 5.3	50 ± 11	89 ± 4
9	TG emulsified with bile and 1/5 MG	135.6	41	9	22.9 ± 7.9	51 ± 17	85 ± 6
11	MG emulsified with bile	160.3	60	6	16.2 ± 8.6	34 ± 15	85 ± 6

* MG and TG represent glyceryl monooleate and triglyceride (olive oil), respectively. The former was supplied by Distillation Products Industries.
† Including stand. dev.

These findings do not imply that both the indirect and direct methods as they are now used are not valid measurements of rate of fat absorption when gastric retention does not occur. However, the more consistent results, obtained when considering only the fat which is readily available for absorption, do suggest that a greater gastric retention in a few of a series of animals may aid in accounting for some of the variations in results. Hence separate recoveries of unabsorbed lipid from both gastric and intestinal contents should give more exact information about the absorptive process.

Summary. Gastric retention of a lipid may lead to erroneous conclusions when rates of fat absorption are measured by the generally accepted methods. Separate recoveries of the remaining lipids from the stomach and intestines after an absorptive period permits a correction for the lipid unavailable for absorption in relative rate calculations.

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Isolation of a Sulfated Mucopolysaccharide from Blood Platelets of Rats.* (22883)

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It has been observed(1) that blood platelets of rats incorporate S^{35}-labeled sulfate; and cytochemical evidence indicates that platelets contain mucopolysaccharides(2). Since it is known that sulfate becomes incorporated into mucopolysaccharides(3-5) but is not incorporated(6,7), or incorporated in only negligible amounts(8), into sulfur-containing amino acids of rats, we undertook this study to determine whether the S^{35}-sulfate in rat platelets is present in a mucopolysaccharide.

Materials and methods. Male Sprague-Dawley rats, 9-11 months old and weighing 410-538 g, were used as platelet donors. The platelets were labeled by injecting each rat intraperitoneally with 1 mc of $S^{35}O_4^{--}$ daily

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