

## X. Intestines

### Digestion and Absorption of Medium Chain Triglyceride (MCT), in Vivo and in Vitro, in Comparison with Long Chain Triglyceride (LCT)

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Recently medium chain triglyceride has been used for the treatment of fat malabsorption syndromes, as it has been widely thought that MCT is more easily hydrolyzed and absorbed than LCT.

Test meals containing trioctanoin-1-<sup>14</sup>C or tripalmitin-1-<sup>14</sup>C were administered into the duodenum of the male albino rats weighing 120–150g. Lipids of intestinal contents, intestinal wall and portal blood were extracted, assayed radioactivity and then analyzed by thin-layer chromatography and autoradiography thereof. In the other series of experiment in vitro, trioctanoin-1-<sup>14</sup>C or tripalmitin-1-<sup>14</sup>C were incubated with albumin solution (phosphate buffer, pH 7.4), varying taurocholic acid concentration, varying steapsin concentration, at 37.0°C and analyzed with florisil column chromatography. On the further experiments, steapsin was replaced by the rat pancreatic juice or the rat intestinal mucosal

homogenates.

MCT is mostly hydrolyzed by pancreatic lipase with the aid of bile acid in the intestinal lumen, and a small amount of intact MCT and its lower glycerides, which are not hydrolyzed in the intestinal lumen, are hydrolyzed completely by intestinal lipase in mucosa.

Most of released FA from MCT enter the portal vein. It is thought that a little of intact MCT enter the intestinal mucosa, but it cannot enter the portal vein. Taurocholic acid and steapsin show lipolytic activity to MCT as equal as to LCT. Rat intestinal mucosal homogenate (intestinal lipase) has low lipolytic activity to triglyceride.

The mechanism, by which MCT is more easily and rapidly absorbed than LCT, is that the released FA from MCT is transported via portal flow, which is more rapid than lymphatic flow.

### Reesterification of Medium Chain Triglycerides in Mucosal Cells during Their Intestinal Absorption

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The absorption and subsequent intracellular reesterification of medium chain fatty acids have received less extensive attention, espe-

cially incorporation of MCT to LCT.

The present investigation was undertaken to define more clearly the mechanism of

intramucosal reesterification of MCT to LCT. This present study was carried out on the *in vitro* metabolism of  $^{14}\text{C}$ -octanoic acid by rat intestinal everted sacs. The incubation solutions were followings; Krebs Ringer bicarbonate buffer (pH: 7.4) containing 2% bovine serum albumin 5 ml, octanoate  $9\ \mu$  mole, sodium octanoate  $1\text{-}^{14}\text{C}$   $2\ \mu\text{Ci}$ , glycerol  $60\ \mu\text{g}$ , ATP  $10^{-4}\text{M}$ , CoA  $10^{-4}\text{M}$ , (final conc.) Incubation was carried out under 95%  $\text{O}_2$  plus 5%  $\text{CO}_2$  at 60 min. The tissues were extracted according to Folch & Lees. Extracted lipids were analysed by silicic acid column chromatography.

Significantly, considerable amount of octanoic acid was esterified to triglyceride. Interestingly, the triglyceride labelled from  $^{14}\text{C}$ -

octanoic acid was identified with long chain triglyceride by silica gel thin-layer chromatography.

Further analysis of the labelled triglyceride by gas chromatography and radio-gas chromatography demonstrated that  $^{14}\text{C}$ -octanoic acid was incorporated in the form of octanoic acid into a part of fatty acid moiety of long chain triglyceride.

Hydrolysis of labelled triglyceride by pancreatic lipase indicated that octanoic acid was esterified at 1 and/or 3 position of glycerol backbone.

This suggests that possible lymphatic transport of  $^{14}\text{C}$ -octanoic acid which was incorporated to long chain triglyceride will occur.

## Experimental Studies of the Effect of X-Ray Irradiation to the Abdomen (Use of $^{131}\text{I}$ -PVP to Understand the State of Protein Losing)

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This is report on the evaluation of the effect of fractionate dose of X-ray irradiation to the abdomen on intestinal protein losing in rabbits with the use of  $^{131}\text{I}$ -PVP. This method of applying (Gordon-test), which has recently been used owing to its usefulness and accuracy in order to evaluate, to some degree, the function of the gastrointestinal organ with regards to protein losing gastroenteropathy.

### Results:

The losing rate of  $^{131}\text{I}$ -PVP in the feces in the control group was about 1%. The rate of the group which was subject to one-time irradiation of 2,000 rad to the lower abdomen was 8.8%. The rate of the group which received 200 rad irradiation daily was 4.5% at 2,000 rad, 1.8% at 4,000 rad, and 1.3% at 6,000 rad.

The losing rate of  $^{131}\text{I}$ -PVP in the gastric juice in the control group was within 0.005% (percent of dose per millilitre). In the greater part of irradiation group to the upper ab-

domen was seen above 0.005%. Particularly, the group which was given one-time irradiation showed the increased rate by about ten times as compared with control group.

In the control group, serum total protein was 6.0 gram per decilitre; albumin was 70.0%;  $\gamma$ -globulin was 11.5%. All of them decreased remarkably in the group of one-time irradiation of 2,000 rad. And in the group of 200 rad irradiation daily, total protein decreased slightly; the rate of  $\gamma$ -globulin decreased markedly. These, however, showed a tendency to recover at 6,000 rad.

### Summary:

The results were as follows. The losing rate of  $^{131}\text{I}$ -PVP in the feces decreased more gradually as the dose of irradiation interested in the group of irradiation daily. In addition, the difference in the change of serum protein between the group of one-time irradiation of 2,000 rad and that of 200 rad daily gave an interesting suggestion to this study.