Studies of the Phospholipids of Human Bile and Small Intestinal Content

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It has been demonstrated that lecithin is the only phospholipid present in human bile [1,2] and it is generally assumed that the bile lecithin is of importance for the digestion and absorption of fat from the small intestine.

Information as to the fate of the bile lecithin in the lumen of the small intestine during digestion is, however, incomplete, although different lecithin splitting enzymes have been demonstrated in pancreatic extracts and juice [3-5].

From preliminary studies with paper chromatography of small intestinal content collected from human beings by intubation, it appeared that most of the phospholipids present therein was in the form of lysolecithin. The studies were then extended and resulted in the isolation from human small intestinal content of β-palmitoyl-lysolecithin.

Ten ml of intestinal content collected from the upper jejunum of a normal adult human after a test meal free of phospholipids were mixed with 190 ml chloroform: methanol 2:1. After filtration the volumes were adjusted to 200 ml. Determination of total phosphorus [6] indicated a total of 2.40 mg P. The chloroform:methanol extract was mixed with 80 ml 0.9 % saline solution in a separatory funnel and the lower phase containing the lipid P (2.0 mg) passed through a 5 g column of silicic acid [7]. Three fractions were eluted: (I): chloroform, (II): chloroform with 30 volume % of 95 % ethanol, and (III): methanol.

(I) was free of phosphorus and contained neutral fat and free fatty acids [7]. (II) contained less than 5 μg phosphorus and (III) 1 960 μg phosphorus. In model experiment fraction II contains added lecithin and (III) added lysolecithin [8]. The phosphorus containing compound in fraction (III) from the intestinal content was identical with β-palmitoyl-lysolecithin prepared from egg lecithin by the action of *Crotalus adamanteus* venom [12] as indicated by paper chromatography [8,9], ester bond [10] to P ratio and hemolytic activity [11].

Similar results were obtained on several different samples of intestinal content, the percentage lysolecithin ranging from 62 to 100 of the total lipid phosphorus content.

After saponification the fatty acid of the isolated lysolecithin was identified as palmitic acid by chromatography on paper impregnated with liquid paraffin using 85 % acetic acid as the moving phase.

The fatty acid in the α-position of lecithin isolated from human bile was split off using lecithinase A from *Crotalus adamanteus* [12] and subsequently identified as oleic acid by chromatography directly and after hydrogenation.

The lecithin of human bile therefore is α-palmitoyl-β-oleyllecithin, thus conforming with other isolated lecithins in having an unsaturated fatty acid in the α-position and a saturated fatty acid in the β-position [13].

The occurrence of the highly surface-active lysolecithin in intestinal content has to be considered in connection with problems related to the digestion and absorption of fat.

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