

Influence of Age on the Total Lipid, Phospholipid and Cholesterol Contents of Pancreas and Liver of Albino Rats

Pancreatic tissue is rich in lipids, a high proportion of which is due to neutral fat.¹ Extensive fatty infiltration into the pancreas occurs in obesity and lipomatosis². In view of the important functions of the pancreatic tissue, studies on the lipids of pancreas and liver of rats of different age groups were undertaken and the results presented in this report.

Material and methods. Male albino rats from an inbred strain maintained on laboratory stock diet were divided into 3 groups according to age. The first group consisted of young rats of 2 months of age and the second group of adults of 5–6 months of age. Rats over 12 months of age formed the third group. They were sacrificed in the fed state, the pancreas and liver dissected out, weighed, dried in an oven at 80°C for 6–8 h, again weighed after drying, extracted with petroleum ether in a Soxhlet apparatus and the total lipid determined gravimetrically. Total and free cholesterol³ and phospholipids⁴ were also determined.

Results. The water content of the pancreas of 2-month-old rats, which was 78.4 ± 0.34 g/100 g fresh weight of tissue, decreased to 75.1 ± 1.42 g/100 g in 5–6 month old rats and to 61.3 ± 2.47 g/100 g in rats over 12 months of age (Figure 1). However, no alteration in the water content of liver occurred due to age.

The total lipid of the pancreas, which was 23.9 ± 6.20 g/100 g dry weight of tissue in the 2-month-old rats, increased to 27.90 ± 2.70 g/100 g in the 5–6 month-old rats (Figure 2). In the rats over 12 months of age, there was a steep rise in the total lipid to 62.00 ± 2.39 g/100 g. Although the total lipid of the liver of 2-month-old rats, viz. 4.86 ± 0.74 g/100 g, increased to 7.27 ± 0.31 g/100 g in the 5–6-month-old rats, it did not increase any further

in older rats. The total lipid of the liver of rats over 12 months of age was lower than that of the 5–6-month-old rats. Thus the rise in total lipid of pancreas did not always parallel that of the liver as age advanced.

The total cholesterol of the pancreas was highest in the 2-month-old rats, viz. 1107 ± 109 mg/100 g (Figure 3). As age increased, the total cholesterol of the pancreas decreased to 946 ± 111 mg/100 g in the 5–6-month-old rats and to 446 ± 30 mg/100 g in rats above 12 months of age. The ester cholesterol was 364 ± 55 mg/100 g in the pancreas of 5–6-month-old rats which was higher than that of the other groups (Figure 4). In liver, although the 5–6-month-old rats had the highest total cholesterol (Figure 3), ester cholesterol decreased with age (Figure 4).

The pancreas of 2-month-old rats had the highest phospholipid content of 5087 ± 886 mg/100 g (Figure 5). As age advanced, the phospholipid decreased to 3425 ± 226 mg/100 g in the case of 5–6-month-old rats and to 2173 ± 158 mg/100 g in the rats above 12 months of age. The decrease in the phospholipid was thus inversely related to the total lipid of the pancreas. On the other hand, in the liver, age brought about a progressive increase in the phospholipids.

Discussion. Fatty infiltration of pancreas is described as a very common condition, but no clinical significance is

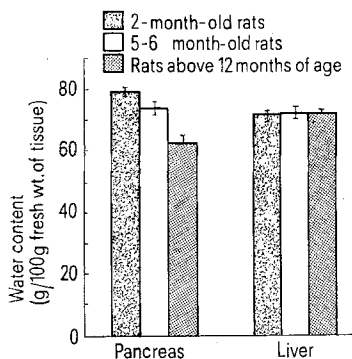


Fig. 1. The water content of the pancreas.

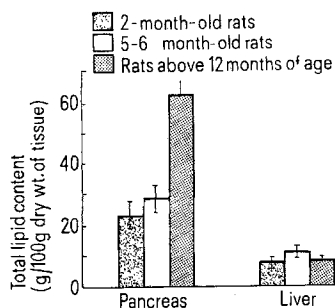


Fig. 2. The lipid content of the pancreas.

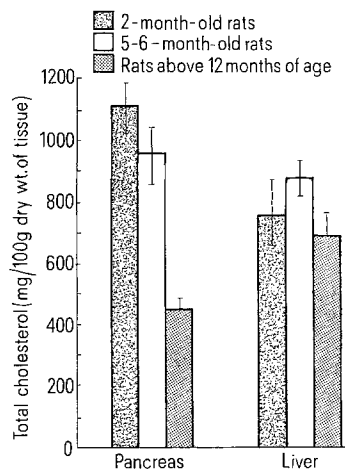


Fig. 3. The cholesterol content of the pancreas.

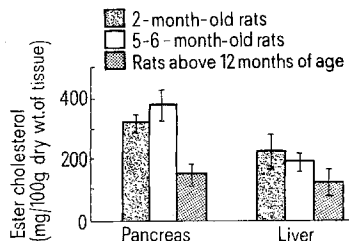


Fig. 4. The ester cholesterol content in the pancreas.

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attached to it². In obesity, this fat often completely replaces large areas of the parenchyma cells of the pancreas.

In the present study, the total lipids of the pancreas show a steep rise with age. Such a rise in the total lipid in relation to age was observed in guinea-pigs by other workers^{5,6}, this rise being due to triglyceride. The results of the present study with rat pancreas corroborate their findings.

The phospholipid content of the pancreas is highest in very young rats. It decreases with age and is inversely proportional to the level of total lipids. The functions of phospholipids in pancreatic tissue are not clearly understood. Apart from a structural function as a constituent of cell membrane and mitochondria, phospholipids are believed to have a role in protein secretion. HOKIN and HOKIN^{7,8} have shown that when protein secretion is stimulated in pancreatic slices, isotopic precursors are increasingly incorporated into phospholipids. During secretion, the rate of labelling of RNA and phospholipids in pancreas is increased without affecting the total lipid content⁹.

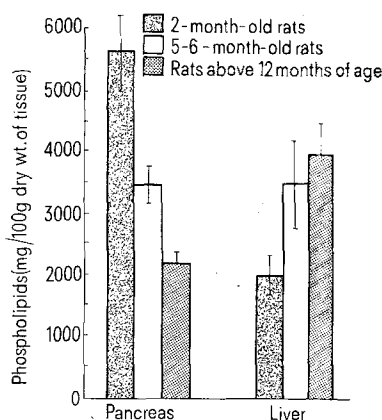


Fig. 5. The phospholipid content in the pancreas.

Both free and total cholesterol of pancreas decrease with age, as observed in the present study. Ester cholesterol, although it rises during growth, diminishes to 50% of its original level in old rats. The diminution of total cholesterol of pancreas due to age parallels that of phospholipid. Further work alone can explain how a diminution of both cholesterol and phospholipid can occur along with increased accumulation of fat with age.

In the liver, the phospholipid is increased while the cholesterol ester is diminished due to age. This is in agreement with the findings of WILLIAMS et al.¹⁰ who made a similar observation with growing rats. However, these workers have not made the study in older rats and the results presented here may therefore be useful for further probe.

Résumé. Le cholestérol et les phospholipides du pancréas des rats diminuent à mesure que l'âge avance, tandis que le contenu total de lipides augmente sensiblement. Dans le foie, les phospholipides augmentent avec l'âge, mais le contenu total de lipide et de cholestérol n'augmentent pas dès que les souris atteignent l'âge de 5 à 6 mois.

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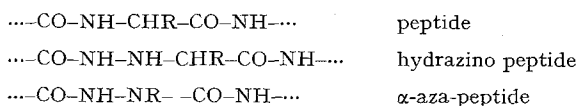
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Retarded Enzymatic Degradation of Heterologous Eleodoisin Sequences

To protect biologically active peptides against physiological enzymatic degradation, it is suitable to substitute amino acid residues by non-protein constituents, specially in N-terminal position. For example in the case of ACTH, a β -amino acid, or a D-amino acid has been used to get an enhanced activity^{1,2}.

Recently we were engaged in synthesis and biological testing of hydrazino acids ($H_2N-NH-CHR-COOH$)^{3,4}. They may be interpreted as 'NH-amino acids'. Their introduction in peptides will give 'hydrazino peptides'. As compared with peptides, they contain an additional nitrogen in the peptide backbone.

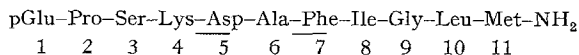
Replacement of the α -carbon in amino acid residues by nitrogen leads to α -azapeptides, the second type of heteropeptides used in these investigations.



Synthesis of hydrazino or aza analogues of 5-asparagine-eleodoisin peptides^{5,6} mentioned here and their biological

activity in isolated organs and on blood pressure in fowl, guinea-pig, and rat were published earlier⁷.

Eleodoisin:



(positions of the heteroconstituents are underlined).

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