

tissues. 4) the increased release of pancreatic enzymes from extrapancreatic sources. However, it is generally accepted that age-related increase of serum pancreatic enzymes is due to a decline of renal function^{1,3)}. The previous study showed that total amylase, P-amylase, trypsin(ogen), PLA₂ were vulnerable to impaired renal function¹²⁾. Why PLA₂ is not influenced by age is not clear. Most of PLA₂ in blood seem to be derived from the pancreas since PLA₂ is present only a little in organs other than the pancreas¹³⁾. Moreover, the previous studies suggested that the pancreatic enzyme content of pancreas decreased with age^{14,15)}, and that the extent of decrease of the enzymes was different¹⁵⁾. Therefore, a possible explanation for why PLA₂ is not influenced by age is that the release of PLA₂ from the pancreas may decrease with age more severely than that of the other pancreatic enzymes. Thus, PLA₂ may not be elevated in blood with age. Serum elastase I levels also increased with age. Elastase I in the blood stream is present as complex forms with inhibitor proteins, such as α_1 -antitrypsin and α_2 -macroglobulin^{16,17)}, which can hardly pass through glomeruli and are mainly cleared by extrarenal metabolic pathways^{18,19)}. Some studies have shown that serum elastase I levels are less affected by renal dysfunction, suggesting that it is cleared mainly by extrarenal metabolic pathway such as the reticuloendothelial system^{12,20,21)}. We previously reported that serum elastase I was significantly elevated only in patients with severe renal dysfunction (creatinine clearance ≤ 10 ml/min)¹²⁾. Subjects with moderate to severe renal dysfunction were excluded in this study. Therefore, extrarenal metabolic pathway, such as the reticuloendothelial system, also seems to be involved in the increase of serum levels with age. However, we cannot completely exclude the possibility that the sources of elastase I other than the pancreas may

contribute to the significant age-related changes in serum levels because the enzyme is still detectable in pancreatectomized patients¹⁹⁾, and it often increases in nonpancreatic diseases such as ileum-colon disease¹⁹⁾.

The present study showed that total amylase and P-amylase levels only were affected by gender. Although Moller-Petersen and Pedersen¹¹⁾ reported that trypsin(ogen) was affected by gender, we did not confirm their results in this study. It is not clear why amylase is apt to be affected by gender. Kasperczyk et al²²⁾ reported the significant change of amylase activity in the ovary of rats during sex cycle, suggesting the involvement of sex hormone. The difference in amylase levels between male and female could not be explained only by the differences in renal function between male and female, because trypsin(ogen) and PLA₂, which are vulnerable to renal dysfunction, were not affected by gender. The sex difference of P-amylase in the 40-49 age group may be related to menopause. The etiology of the sex difference of total amylase in the ≥ 60 age group is not clear.

Finally, no studies on the gender-related difference in extrarenal metabolic function have been undertaken. The present study did not demonstrate the gender-related difference, since there was not any significant difference in serum elastase I levels between male and female.

In conclusion, PLA₂ and amylase (total and P-amylase) proved to have particular properties among the six pancreatic enzymes. PLA₂ only did not show age-related change. The age-related changes of the other enzymes may reflect a decline of renal and extrarenal clearance of enzymes with age. Amylase (total and P-amylase) only was significantly affected by gender. The etiology of the sex difference of amylase requires further investigation.

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6種類の血中膵酵素値に及ぼす加齢および性の影響

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ある種の血中膵酵素値は加齢や性により影響を受けることが知られている。現在膵疾患の診断に利用されている6種類の膵酵素, アミラーゼ, P-アミラーゼ, リパーゼ, トリプシン, フォスホオリパーゼA₂ (PLA₂), そしてエラスターゼIの血中値に及ぼす加齢および性の影響を比較検討した。

健常者327名(男性:155名, 女性:172名, 年齢:20-79歳)を対象として, 年齢および性により層別化して検討した。PLA₂とエラスターゼIはRIA, トリプシンはEIA, そして他の酵素は活性を測定した。PLA₂以外の血中膵酵素値は加齢とともに有意に上昇した。しかし男性では60代以降低下した。性差はアミラーゼとP-アミラーゼとに有意差が認められた。すなわち, アミラーゼは60代以降に, P-アミラーゼは40-49歳群でそれぞれ男性より女性において有意の高値を示した。PLA₂以外の血中膵酵素値を評価する際には加齢による影響を考慮すべきであり, アミラーゼおよびP-アミラーゼの血中値を評価する際には性を考慮すべきである。