Serum Amylase Activity in Liver Disease

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Serum amylase activity was measured in 15 normal persons and in 60 liver-disease patients. Impairment of liver was assessed by serum bilirubin and thymol turbidity values. Most of the patients had serum amylase values that were well below the normal limits. Amylase activities were related to the degree of liver dysfunction, and serum amylase decreased as the bilirubin and turbidity values increased.

Additional Keyphrases  thymol turbidity test • serum bilirubin • type of disease vs. severity in effect on amylase • hepatic function • origin of serum amylase

Despite the use of serum amylase determination in clinical medicine, very little is known of the origin, function, and regulation of this enzyme in the body (1). Clinical observations of abnormal serum activity of this enzyme in hepatic disease suggested that serum amylase originates in the liver. High values were obtained in some patients with acute hepatobiliary disorders (2–4), low values in others with chronic liver diseases (5, 6). Dreiling et al. (7) suggested that liver contributes to the blood amylase and is an important extrapancreatic site of its regulation. Amylase isolated from human liver differs structurally and immunologically from the salivary and pancreatic amylases (8). However, the experimental observations provide circumstantial evidence for the synthesis of amylase by the liver (9). Information on the relationship between liver diseases and variations in serum amylase levels is still scarce. The present study deals with changes in serum amylase activity in patients with various hepatic disorders, and the correlation of these changes with liver dysfunction.

Materials and Methods

Fifteen normal human subjects and sixty patients with liver diseases were studied. Normal subjects of both sexes were chosen from among the staff and students of Jinnah Postgraduate Medical Centre, Karachi, and had no history of liver disorders. The patients, of both sexes, were selected from the hospital wards and were diagnosed cases of liver dysfunction. The age of the patients varied between 18 to 70 years; most were 30 to 55 years old. The diagnosis was based on the clinical examination. The blood was collected by venipuncture and serum was used for determination of amylase, bilirubin, and thymol turbidity.

Amylase activity was determined and expressed in terms of the amount of reducing sugar formed after incubation with starch at 38°C as described previously, i.e., milligrams of glucose equivalent released by 100 ml of serum in 30 min (10). Bilirubin and thymol turbidity were determined by the methods of Malloy and Evelyn (11) and Madagan (12), respectively.

Results

The patients suffering from various liver diseases showed serum amylase values well below those for the normal individuals (Table 1). This decrease in serum amylase activity in hepatic disease, often

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\text{Bilirubin, mg/100 ml serum} & \text{Thymol turbidity, Mac. units} & \text{Amylase, units/100 ml serum} \\
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\text{Normal persons (15)} & 0.38 \pm 0.06^a & 2.2 \pm 0.50 & 120.0 \pm 9.07 \\
\text{Infective hepatitis (27)} & 6.0 \pm 0.54 & 10.8 \pm 0.78 & 60.3 \pm 4.75 \\
& & & P < 0.05 (s) \\
\text{Cirrhosis (18)} & 7.6 \pm 0.39 & 14.1 \pm 1.24 & 51.3 \pm 6.10 \\
& & & P < 0.01 (s) \\
\text{Jaundice (7)} & 10.2 \pm 0.67 & 16.5 \pm 1.36 & 48.0 \pm 6.07 \\
& & & P < 0.01 (s) \\
\text{Heterogenous group (8)} & 5.9 \pm 1.73 & 13.7 \pm 2.12 & 52.5 \pm 8.33 \\
& & & P < 0.01 (s) \\
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* The amylase values given are the mean of the determinations in each case. Figures in parentheses indicate the number of cases in each group.

\(^b\) Standard error of the mean.

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considerable, could not be attributed to the type of the hepatic disease. By contrast, severity of the hepatic disease appeared important in the diminution of serum amylase levels; patients with more severely impaired hepatic function had lesser serum amylase activity.

The thymol turbidity values were moderately elevated in the group of patients with liver disease, which indicates that hepatocellular damage has occurred. Figure 1 shows that the thymol turbidity values increase with a simultaneous decrease in the serum amylase values. Liver impairment as measured by serum bilirubin values shows that the serum amylase decreases as serum bilirubin increases (Figure 2).

Discussion

A number of diseases are reported to be associated with subnormal amylase value (13). In 1941, Gray et al. (6) claimed that impaired hepatic function was associated with subnormal amylase levels. Cummins and Bockus (2), on the other hand, observed that 21% of patients with viral hepatitis or liver cirrhosis had supranormal serum amylase activity. Gray et al. (6) also stated that in 287 postoperative patients the amylase activity tended to fall to subnormal levels on the third and fourth postoperative days. Dreiling et al. (14) demonstrated decreased blood amylase activity in people with no evidence of pancreatic disease, after the administration of substances that increased carbohydrate metabolism. These results also agree with those of Somogyi (5) and others, who reported low values for serum amylase in cases of hepatitis and cirrhosis of the liver, and concluded that such values for serum amylase were to be found only in those chronic cases of liver diseases that had some form of liver damage and impairment of hepatic function. Chapman and Karl (15) needle-biopsied 25 patients with fatty infiltration of the liver and found serum amylase activities to be less by 50 units in 14 patients.

Alterations of serum amylase activity seen clinically in some patients with chronic liver disease have also been observed in experimental animals. Winawer et al. (16) found a decreased serum amylase activity in rats with chronic liver injury, i.e., fatty liver, fibrosis, and cirrhosis. McGeachin and Potter (17) observed 50% decrease in amylase level of liver and serum after hepatic damage. The mechanism of the decreased serum amylase activity in hepatic diseases is apparently little understood; it may be related to impaired synthesis of serum proteins, a view that agrees with the studies of Mukerjee and Werner (18), who found a correlation between serum albumin concentrations and the amylase activity of the blood in patients with malnutrition and edema. Experimentally, it has been observed by McGeachin et al. (19) and Arnold and Rutter (9), in their perfusion experiments, that liver is capable of synthesizing amylase. In addition, McGeachin et al. demonstrated the ability of puromycin, a specific inhibitor of protein synthesis, to block amylase production by rat liver, both in vitro (20) and in vivo (21). The latter studies have further shown that the 50% decrease in hepatic amylase activity under the influence of puromycin was associated with a corresponding change in the serum amylase activity.

Liver is known to synthesize albumin and α- and β-globulins of the serum proteins. The amylase activity of the serum is associated with the globulin fraction in man (10) and though the globulins are increased in the liver diseases, amylase production is decreased. It is possible that the decreased activity of serum amylase is a direct consequence of inhibition of amylase synthesis. Berk et al. (22) have in fact indicated that although a majority of
serum amylase often occupies the gamma globulin position in the electrophoretic pattern, the enzyme is not necessarily associated with this protein fraction.

Another possibility, as suggested by Comfort and Osterberg (23), is that hepatic disease may be associated with an accompanying pancreatitis. In support of this possibility, the coincidence of pancreatic disease, as evidenced by the pressure of inflammation and necrosis in this organ, was reported by Steigman and Chung (24) in cirrhotic patients with jaundice. However, disease of the pancreas is invariably accompanied by increased rather than decreased serum amylase activity.

References


