ROLE OF PANCREAS AS A SOURCE OF SERUM AMYLASE IN CHICKEN

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Serum and pancreatic amylases of the chicks of different ages were determined. Failure of a gradual increase in the pancreatic amylase levels of the chicks of increasing age, associated with a parallel gradual increase in the serum amylase levels, suggested that pancreas was probably not involved in contributing amylase to the blood under normal conditions. Hyperamylasemia, therefore, could possibly occur in extra-pancreatic conditions and may not be a test of diagnostic significance specific for pancreatic damage.

INTRODUCTION

Changes in the levels of certain enzymes may be of diagnostic significance in certain disease conditions. Amylase is such an enzyme. The diagnostic significance of this enzyme rests primarily upon its level in the blood. During acute pancreatitis the serum amylase level rises within a few hours and returns to normal from 2 to 6 days (Coles, 1967). The principal source of amylase in the body is the pancreas, acinar cells of which synthesise and release amylase into the duodenum as a component of pancreatic juice. The mechanism of transport of the additional amylase to the blood during pancreatitis is not completely understood. It is generally believed that damage to the acinar cells of pancreas causes the release of cellular enzymes which are absorbed into the blood capillaries of pancreas (Grossman, 1955), peritoneum (Egdehl, 1958) or lymph (Popper and Necheles, 1940) resulting in an increase in the serum amylase level.

Hyperamylasemia could be considered a useful diagnostic aid in pancreatic diseases, if it had not been known that an increase in the serum amylase levels may also occur during certain nonpancreatic conditions. Included among these are intestinal strangulation (Byrne and Boyd, 1957; Hiatt, 1959), acute infection of parotid glands (Dunlop, 1933), impaired function (Harrison and Lawrence, 1923), and administration of such chemicals as morphine (Bogoch *et al.*, 1954), codeine (Gross *et al.*, 1951) adrenocorticotrophic harmone (ACTH) (Challis *et al.*, 1957) and carticosteroids (Dreiling *et al.*, 1959). Since an increase in the serum amylase level may occur in the conditions unrelated to pancreas, it appears likely that certain extra-pancreatic tissues may contribute amylase

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to the blood. The diagnostic significance of hyperamylasemia as a test specific to the pancreatic damage, therefore, becomes questionable. The present study was undertaken to assess the role of pancreas as a source of serum amylase in an effort to clarify the confusion relating to the diagnostic significance of hyperamylasemia.

REVIEW OF LITERATURE

Many of the studies on the role of pancreas as a source of serum amylase involved pancreatectomy. The effects of such operation on serum amylase levels, however, were not uniform. In some cases there was no significant change in the serum amylase levels following the removal of pancreas (Markowitz and Hough, 1925; Reid *et al.*, 1933), while others observed either an increase (Karmer *et al.*, 1921) or a decrease (Friedman and Thompson, 1936) in these levels following pancreatectomy.

In electrophoretic studies, the mobility of one of the two fractions of human serum amylase were shown to correspond to the electrophoretic mobility of amylase of pancreatic origin. It was suggested that at least a part of human serum amylase originated from the pancreas (Berk *et al.*, 1966). However, in certain other studies the pancreatic and serum amylases were shown to be unidentical electrophoretically (Joseph *et al.*, 1966; McGeachin and Lewis, 1959).

The preparation of anti-amylase to a particular isoenzyme and its use, in immunological reactions, with the amylase derived from serum or other body tissues, has helped in the identification of amylases of different sources. Anti-serum to the hog pancreatic amylase had been found to inhabit the amylase of hog serum (McGeachin, 1959). Recently, however, hog-pancreatic amylase was reported to be different from the hog and dog serum amylase on the basis of immunologic studies. The anti-hog pancreatic amylase failed to react with the serum amylase of hog and dog (Zaidi, 1968). It was proposed that serum amylase originated from an extra-pancreatic source.

MATERIAL AND METHODS

Sixty-four one-day old chicks were randomly divided into 8 groups of 8 chicks each. Chicks of group 1 were exsanguinated on the first day of their life, and blood and pancreas were collected. Chicks of group 2, 3, 4, 5, 6, 7 and 8 respectively were, likewise exsanguinated and blood and pancreas removed on the 3rd, 5th, 7th, 14th, 21st, 28th and 35th day of their life. Eight chickens of more than one year of age were used in group 9 to obtain blood and pancreatic samples. Amylase levels of the serum and pancreatic extracts were determined, by the method of Loeb and Edge (1962).

RESULTS

Mean values of the levels of serum and pancreatic amylases of chicks of one-day to 35 days old chicks and adult chickens are presented in Table 1.

TABLE 1. *Mean Values of the Serum and Pancreatic Amylase Levels of the Birds of Different Ages*

(*Caraway Units*/100 *ml*)

Age in days	Serum Amylase level	Pancreatic Amylase level
1	352	485
3	331	528
5	374	611
7	400	644
14	330	673
21	360	652
28	367	724
35	314	722
Adult	346	999

DISCUSSION

The results indicated existence of amylase in the serum as well as in the pancreas of one-day old chicks.

The level of pancreatic amylase continued to increase gradually from one-day to 35th day of age. Mean value of the pancreatic amylase levels of chicks in group 1 was 485 Caraway units/100 ml of the pancreatic extract. Chicks of group 2, 3, 4 and 5 showed a progressive increase in their pancreatic amylase levels. Mean pancreatic amylase level of the group 9 (adult chickens) was 999 units/100 ml of the pancreatic extract. This level was 106 per cent higher than the mean pancreatic amylase level of one-day old chicks in group 1. Concentration of the pancreatic amylase, therefore, continued to increase gradually with age until it more than doubled in the adult chickens.

One-day old chicks of the experimental group 1 showed a mean value of 352 units of amylase per 100 ml of the serum. Mean values of the serum amylase of other groups ranged from 330 to 400 units/100 ml of serum. Mean

serum amylase level of group 9 (adult chickens) was 346 units/100 ml. It was obvious from the results that the progressive increase in the serum amylase did not occur with the advancing age.

If pancreas were considered to be the organ contributing amylase to the blood stream, it would be expected that changes in the pancreatic amylase levels would be reflected by parallel changes in the blood amylase levels. An increase in the pancreatic amylase, therefore, would be expected to be accompanied by an increase in the serum amylase level. In the present study, since the gradual increases of pancreatic amylase levels was not found to be associated with a parallel gradual increase in the serum amylase level of the growing chicks, the findings strongly suggested that pancreas was probably not involved in contributing amylase to the normal blood.

If the normal serum amylase was maintained by an organ other than pancreas, hyperamylasemia could possibly occur in extra-pancreatic conditions and may not be a test of diagnostic significance specific for pancreatic injury.

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