

*Article***Serum amylase and lipase levels in type 2 diabetes mellitus**

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**Abstract**

**Background:** In diabetes mellitus, impaired pancreatic endocrine activity may affect its exocrine function causing mal digestion and malnutrition. **Objective:** To assess serum amylase and lipase levels in subjects with type 2 diabetes mellitus (T2DM). **Methods:** This cross sectional study was conducted in the Department of Physiology, Dhaka Medical College, Dhaka from January 2015 to December 2015. Fifty type 2 diabetic subjects with age ranging from 40 to 55 years of both sexes were enrolled in this study and 50 age matched healthy subjects were control group. Patients were enrolled from Outpatient Department of Endocrinology, Dhaka Medical College Hospital, Dhaka. Serum amylase and serum lipase levels were estimated by spectrophotometry. For statistical analysis, unpaired Student 't' test was done. **Results:** In this study, serum amylase and lipase levels were significantly lower ( $P < 0.001$ ) in comparison to control group. **Conclusion:** From this study, it is concluded that, exocrine derangement of pancreas may occur in type 2 diabetes mellitus.

**Key words:** Serum amylase, serum lipase, type 2 diabetes mellitus.

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**Introduction**

**D**iabetes mellitus (DM) is a metabolic disease caused by either absolute insulin deficiency or impaired sensitivity of tissues to insulin<sup>1</sup>. Diagnostic criteria of diabetes mellitus are fasting blood glucose (FBG)  $\geq 7.0$  mmol/L or 2 hour after 75 gm glucose  $\geq 11.1$  mmol/L or Random blood glucose (RBG)  $\geq 11.1$  mmol/L or glycosylated haemoglobin (HbA<sub>1c</sub>)  $\geq 6.5\%$ <sup>2</sup>. Prevalence of diabetes in Bangladesh was 5.1 million in the year 2013<sup>3</sup>.

The pancreas is a mixed gland, with the exocrine portion making up the greatest volume of 84%, while the endocrine part comprises 2% of it<sup>4</sup>. As there is a close anatomical and functional interaction prevails between these two portions

of the pancreas, disease of one portion, may affect the other one<sup>5,6</sup>. The exocrine acinar cells are exposed to high concentration of islet hormones as they receive blood flow coming through the nearby islets<sup>7</sup>. Evidence suggested that the pancreatic exocrine function is influenced by the pancreatic endocrine hormones specially insulin, which has a trophic effect on the exocrine acinar cells<sup>8</sup>.

The pancreatic exocrine acinar cells produce several types of enzymes including amylase and lipase that helps in digestion of particular food particles. Amylase is the primary enzyme responsible to cleave starch into maltose, maltotriose and  $\alpha$ -limit dextrins in the process of digestion. Lipase is primarily coming from pancreas, travels all the way down to the intestine

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and promotes breakdown of triglycerides into fatty acids and monoglycerides. Due to deficiency of pancreatic enzymes, foods are not properly digested and the consequences are mal digestion and malnutrition<sup>9</sup>. For many years, it has been thought that low serum amylase level reflects diffuse pancreatic damage due to advanced pancreatic disease. But now a days, several studies shown that this low level of serum amylase is also associated with metabolic syndrome and diabetes mellitus<sup>10</sup>.

A study investigating the effect of hyperglycemia on pancreatic exocrine functions in type 2 diabetic patients reported that serum amylase and lipase levels significantly increased with the regulation of glycemic control, but still lower as compared with control. They found a significant negative correlation of serum amylase and lipase with basal FBG and HbA<sub>1c</sub><sup>11</sup>.

In diabetic patients, insulin resistance leads to an increase in the activity of anti-insulin hormones and atrophy of exocrine acinar cells. Thus, exocrine pancreatic enzyme synthesis and secretion is decreased<sup>12</sup>. The communication between the endocrine islets and the exocrine acinar cells were also lost with the development of type 2 diabetes mellitus. The pancreatic exocrine tissue becomes fibrosed and it shows a reduced response to the hormonal stimulation<sup>13</sup>. In diabetes mellitus, hyperglycemia and/or insulin inactivity due to hypoinsulinemia or insulin resistance may induce pancreatic exocrine dysfunction and the development of pancreatic exocrine insufficiency<sup>14</sup>.

Diabetic subject with pancreatic exocrine insufficiency commonly presents with gastrointestinal symptoms such as loose bowel movement, abdominal discomfort and flatulence<sup>15</sup>. In diabetes mellitus, this exocrine insufficiency can also give rise to deficiency of macronutrients, steatorrhea and consequent malnutrition<sup>7</sup>.

In the human diabetic research of our country, very little concern has been given on exocrine pancreatic function, as less published data available regarding this topic. Majority of the studies focused the metabolic derangement due to impaired insulin action and persistent hyperglycemia. Therefore, the present study has been designed for evaluating exocrine pancreatic function by measuring serum amylase and lipase in type 2 diabetic subjects.

### Methods

This cross sectional study was done in the Department of Physiology, Dhaka Medical College, Dhaka from January 2015 to December 2015. Protocol of this study was approved by Ethical review committee of Dhaka Medical College. For this study 50 diagnosed type 2 diabetic patients of both sexes with age ranging 40-55 years were selected as study group. They were selected from Outpatient Department of Endocrinology, Dhaka Medical College Hospital, Dhaka. Diagnosis was done by FBG level  $\geq 7.0$  mmol/L or HbA<sub>1c</sub>  $\geq 6.5\%$ <sup>2</sup>. Fifty age matched healthy subjects were considered as control for comparison. After selection, the nature, purpose and benefits of the study were explained to each subject and informed written consent was taken from the participants. Before taking blood, detailed family and medical history were taken. Anthropometric measurement of the subjects was recorded and blood pressure was measured. All the information were recorded in a prefixed questionnaire. With aseptic precaution, 5 ml of venous blood was collected from ante-cubital vein by a disposable plastic syringe from each subject for biochemical tests. FBG, serum amylase and serum lipase were estimated in the Department of Laboratory Services of National Institute of ENT, Dhaka. HbA<sub>1c</sub> was estimated in the laboratory of the Department of Biochemistry of BSMMU, Dhaka. Data were expressed as Mean $\pm$ SE. For statistical analysis unpaired Student's 't' test and Pearson's correlation coefficient (r) test were done. The P

value of  $<0.05$  was accepted as level of significance. Statistical analysis was performed by using a computer based statistical program SPSS (version 22).

### Results

General characteristics are presented in Table I. There were no significant differences in any variables between study group and control.

**Table I:** General characteristics of the subjects in both groups (n=100)

Variables	Control (n=50)	Diabetics (n=50)
Age (years)	45.64±0.59	47.06±0.65
Male no.(%)	24 (48.0%)	22 (44.0%)
Female no.(%)	26 (52.0%)	28 (56.0%)
BMI (kg/m <sup>2</sup> )	25.77±0.50	25.77±0.58
Systolic BP (mmHg)	116.20±1.41	122.70±1.75
Diastolic BP (mmHg)	76.40±1.08	78.70±1.07

Sex distribution has been shown in number and percentage. All other results are expressed as mean±SE. Unpaired Student's 't' test was performed for comparison between groups. n=number of subjects.

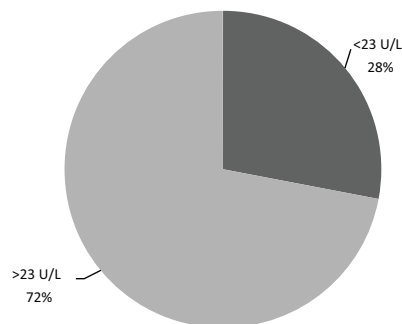
Mean serum amylase and lipase were significantly ( $p<0.001$ ) lower in type 2 diabetic patients (study group) compared to those of control (Table II).

**Table II:** Serum amylase and serum lipase levels of the subjects in both groups (n=100)

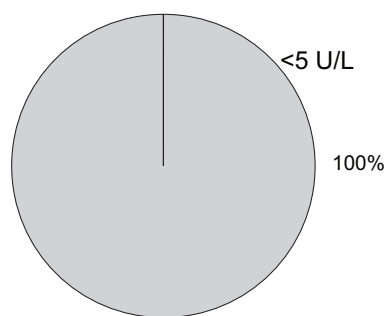
Variables	Control (n=50)	Diabetics (n=50)
Serum amylase (U/L)	56.37±1.84	33.37±2.36***
Serum lipase (U/L)	29.34±0.43	21.58±1.69***

Data were expressed as mean±SE. Unpaired Students 't' test was performed for comparison between groups. \*\*\*  $p<0.001$ .

This study showed that 28% subjects with type 2 DM had serum amylase level  $<23$  U/L (Figure 1) and 100% of subjects had serum lipase level  $<5$  U/L (Figure 2).

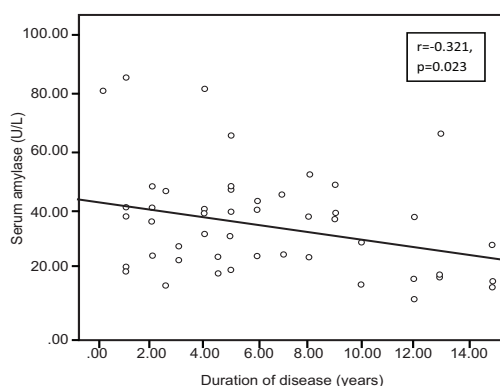


**Figure 1:** Frequency distribution of serum amylase level in study group (n=50)

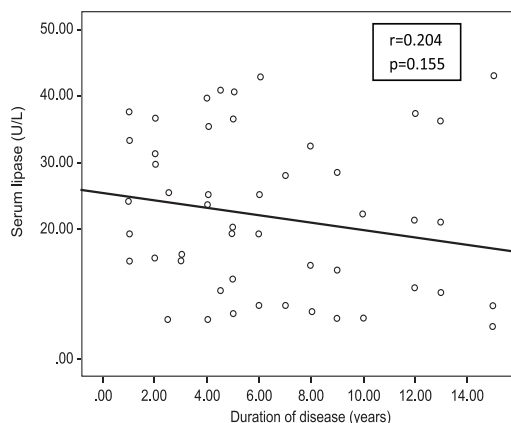


**Figure 2:** Frequency distribution of serum lipase level in study group (n=50)

Correlation analysis showed significant negative correlation between serum amylase level and duration of disease in study group (Figure 3). This study also showed negative correlation between serum lipase level and duration of disease in study group (Figure 4).



**Figure 3:** Correlation of serum amylase level with duration of disease in study group (n=50). Correlation was done by Pearson's correlation coefficient test.



**Figure 4:** Correlation of serum lipase level with duration of disease in study group (n=50). Correlation was done by Pearson's correlation coefficient test.

### Discussion

In this study, the mean serum amylase level was significantly lower in type 2 diabetic patients than that of adult healthy subjects. This finding was in agreement with results of some workers<sup>6,11,16,17,20-22</sup>. On the contrary, some researchers found serum amylase level was significantly higher in type 2 diabetic subjects<sup>23,24</sup>.

In the present study, mean serum lipase level was significantly lower in type 2 diabetic subjects than that of adult healthy subjects. Similar type of observations was found by some researchers<sup>11,21,22</sup>. But some investigators found higher serum lipase level in type 2 diabetic subjects<sup>23</sup>.

In this study, serum amylase and lipase levels showed negative correlation with duration of disease in study group. The relationship between serum amylase and duration of disease was statistically significant. Similar finding was also made by other research workers<sup>20</sup>. Amylase in type 2 diabetic subjects became more severely affected in long-standing cases of diabetes mellitus<sup>16</sup>.

Literature review suggested that in diabetes mellitus, hyperglycemia may cause cellular

damage of the exocrine pancreas and leads to impaired synthesis of pancreatic digestive enzymes<sup>11</sup>. Some authors suggested that, hyperglycemia can cause disturbance in cellular signaling that controls both transcription and protein metabolism in the pancreas leading to pancreatic exocrine insufficiency in DM<sup>25</sup>.

### Conclusion

From the results of the study, it may be concluded that, lower serum amylase and lipase levels in T2DM may be associated with the derangement of exocrine-endocrine axis leading to impaired exocrine pancreatic function.

**Conflict of Interest:** None

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