Biochemical analysis of serum amylase and lipase in patients with type 2 diabetes mellitus

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Abstract
Introduction: Diabetes mellitus is a metabolic disease characterized by abnormally high blood glucose levels. Caused by a derangement in the secretion and function of the endocrinal portion of the pancreas as there is a interrelation between the functional and the anatomical portion of the pancreas.
Objectives: To evaluate serum amylase and serum lipase in diabetic patients and its association.
Materials and Methods: 30 age and sex matched diagnosed cases of type 2 DM between 40-80yr were included in the study and 30 healthy individuals as controls. All samples were analyzed by auto analyser. Data analysis was done by means of two tailed and independent 't' test.
Results: There was a considerable decline in serum amylase ($p<0.0001$) and serum lipase ($p=0.00661$) in diabetic patients compared to controls who were age and sex matched. FBS showed moderate positive correlation with serum amylase ($r=0.1086$) and serum lipase ($r=0.0155$).
Conclusion: The current study shows an pancreatic exocrine destruction in type 2 DM. Serum pancreatic enzymes can be used as an extra explanatory parameter for the evaluation of progression of the disease and response to treatment.

Keywords: Serum amylase, Serum lipase, Type II diabetes mellitus.

Introduction
Diabetes mellitus is a metabolic disease characterized by abnormally high blood glucose levels (hyperglycemia). Either due to deficiency in insulin flow, imperfect action or both.[1] Diabetes mellitus is rapidly developing from 171 million in 2000 to 366 million in 2030 with a maximum increase in India.[2] Presently India is the center of diabetes mellitus in the world.[3]

Uncontrolled diabetes mellitus patients are unable to transport glucose into fat and muscle cells and have glucose intolerance[4]. The symptoms of diabetes are polyuria, polyphagia and polydipsia with weight loss.[5] Diabetes non-communicable diseases ranks high in the world.[6]

Pancreas, a mixed gland with both exocrine and endocrine function, the exocrine portion (84%). 4% by Ductal cells and blood vessels, 2% by exocrine and the remaining part (10%) by an extracellular matrix. The acinar is in close proximity with the islet cells and there by affects the organs.[7]

Anatomically the islets and acinar cells are supplied by islet-exocrine portal system.[8] The pancreatic exocrine function is influenced by the pancreatic endocrine hormones. Insulin has a growth like effect on the peri-insular acini. The pancreatic exocrine tissue becomes fibrosed and shows a decreased response to hormonal stimulus.[9,10]

The decreased manufacture of exocrine discharge also influences on insulin scarcity, insulin secretion is increasing the exocrine function like secretion of alpha amylase and lipase function but glucagon decreases it secretion.[11] Diabetes mellitus and exocrine pancreatic dysfunction in perk mice reveals a function for translational power in secretary cell survival.[12]

Cellular and animal studies shows association between endocrine and the exocrine pancreas, and also insulin affects amylase. Insulin binds to its receptors on acinar cells and stimulates amylase discharge.[10] The outcome concerned to serum lipase in type-2 DM are puzzling.

There are limited studies in regard to the serum amylase, serum lipase and its relationship with type 2 DM in India. So the present study was conducted to estimate serum amylase, serum lipase in type 2 DM to evaluate the function of serum amylase and serum lipase as a biochemical marker.

Materials and Methods
Source of Data: The present study was accepted and carried with the approval of ethical and the research committee at Bangalore medical college and research institute. The study comprises of 30 already diagnosed type 2 diabetes mellitus of age group 40-80years on treatment for ≥5 years of duration in Victoria Hospital, which is attached to Bangalore Medical College and Research Institute, Victoria hospital Bangalore and 30 healthy subjects from general population. Patients with pancreatic disorders and intra-abdominal disease, liver dysfunction, thyroid disease, neoplastic diseases on treatment, pregnant and lactating mothers were excluded from the study. Patients already diagnosed with Type 2 Diabetes Mellitus at least for ≥5 years of duration on regular treatment of age group ≥40

years without any complications are included in the study. Controls were Age and sex matched healthy individuals.

Under aseptic condition, about 4 ml of blood was collected by venepuncture from the median cubital vein with all necessary precautions after collection, sample was stored in plain tube and allowed to clot for 20mins and was subjected to centrifugation for 5 minutes to separate the serum. Estimation of fasting blood sugar, Serum amylase and Serum lipase. Parameters were measured in BECKMAN COULTER AU480 and COBAS INTEGRA 400 plus after proper calibration of the method.

Statistical Analysis

Outcomes are shown as Mean ± SD and in order to find whether there is significance between study parameters, a two tailed and independent 't' test was used. To determine the correlation among the parameters, Pearson's correlation test was used.

Significant values

+ Suggestive significant (p value: $0.05<p<0.10$)

* Moderately significant (p value: $0.01<p\leq 0.05$)

**Strongly significant (p value: $p\leq 0.01$)

Results

Among 30 cases, the age range of 40-50Y had 5 (comprising of 16.66% of total), 14 in the age group of 51-60Y (comprising of 46.66%), 8 in the age group of 61-70Y (compromising of 26.66%) and 3 in the age group of 71-80Y (remaining 10%). Among 30 controls, 4 were in the age range of 40-50Y with 13.33%, 17 in the age group of 51-60Y with 56.66% and 7 were in the age group of 61-70Y with 23.33% and remaining in the age range between 71-80Y compromising 6.66%. As per the table I the mean age range of the cases is 55yrs with a standard deviation of 8.6 years and in controls is 56.1 with an SD of 8.3.

Table 1: Age distribution among cases and controls

Age	Cases		Controls	
(in years)	No	%	No	%
41-50	5	16.66	4	13.33
51-60	14	46.66	17	56.66
61-70	8	26.66	7	23.33
71-80	3	10	2	6.66
Total	30	100	30	100
Mean ± SD	55± 8.6		56.1±8.3	

From table 1 the mean age range of the cases is 55yrs with a standard deviation of 8.6 years and in controls is 56.1 with an SD of 8.3.

Table 2: Sex distribution between cases and controls

Gender	Cases		Controls	
	No	percentage	No	percentage
Males	19	63.33	21	70
Females	11	36.66	09	30
Total	30	100	30	100

Table 3: Comparision of fasting blood sugar among cases and the controls

Subjects	Total number	Fasting blood sugar (mg/dl)		*p*-value
		Range	Mean± SD	
Cases	30	127-273	164.1 ± 38	<0.0001
Controls	30	68-106	88.56 ± 9.2	

Table 4: Comparision of serum amylase and lipase among cases and controls

Subjects	Total number	Mean ± SD	
		Serum Amylase IU/L	Serum Lipase IU/L
Cases	30	66.133 ± 40.50	70.7 ± 56.53
Controls	30	98.66 ± 0.93	104.76 ± 46.19
t-value		6.5194	2.5558
p-value		<0.0001	0.0066

Table 5: Correlation between serum amylase and FBS among cases

Parameter		FBS
Serum Amylase IU/L	r score	0.1086
	P value	<0.0001

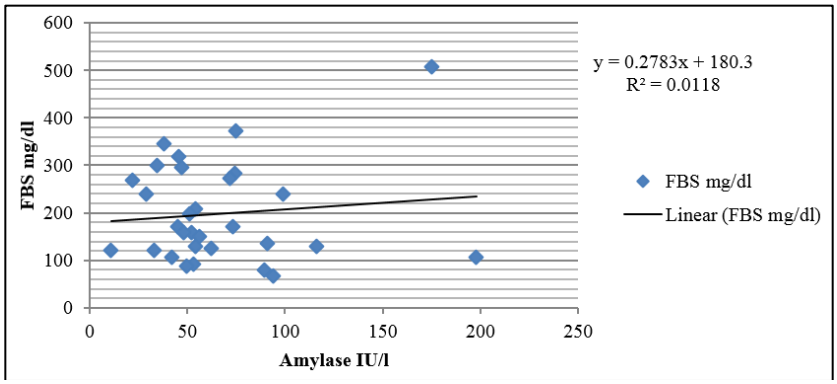

Fig. 1: Correlation between serum amylase and FBS among cases

Table 6: Correlation between serum lipase and FBS among cases

Parameter		FBS
Serum Lipase IU/L	r score	0.0155
	P value	<0.0001

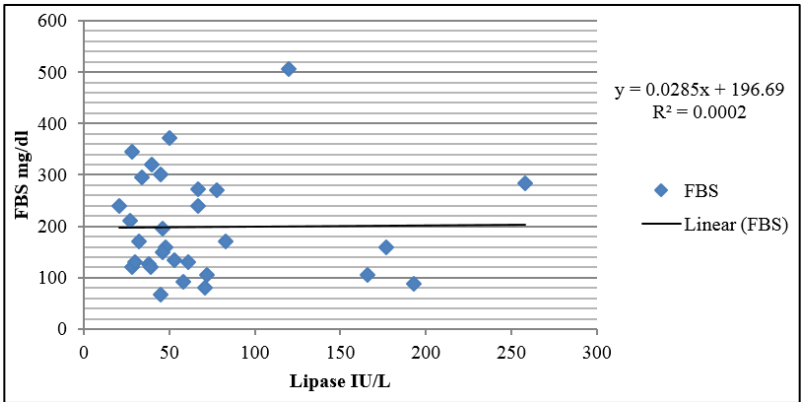

Fig. 2: Correlation between serum lipase and FBS among cases

Study has revealed a positive association with the amylase activity and lipase activity with the duration of Diabetes mellitus and the correlation coefficient was 0.1086 and 0.0155 respectively which is represented in figure number III and IV.

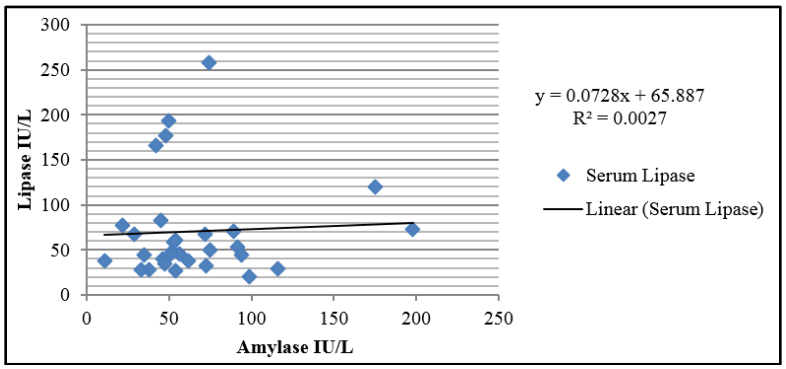

Fig. 3: Correlation between serum amylase and serum lipase among cases

The above figure shows a negative association between serum amylase and serum lipase with a r-value of -0.104

Discussion

The study done was to know the difference in the serum amylase and serum lipase activity between type 2 diabetes patients and healthy controls and also to correlate the association between islet and acinar cells. We found notably decreased amylase and lipase levels in cases when compared to healthy subjects. Similar results were found by Aughsteen A et al., that is the decrease in values of serum amylase 35.3±17.8 IU/L and serum Lipase 26.5±7.8 IU/L in type 2 diabetes mellitus.[13] Kel Nakajima,[14] Swislocki A[15] et al., Snehankar K et al[16] et al., also found reduction in the serum amylase levels in type 2 DM. serum amylase and lipase levels reverted to normal after in vivo insulin administration.[17] Study done by Skrha J et al., established a low serum lipase and isoamylase levels. This results may be due to reduced acinar cell function.[18] Similar decrease in the other pancreatic enzymes like chymotrypsin, trypsin and elastase was found in few studies.[19,20]

Insulin insufficiency and glucagon overload in diabetes affect the internal environment of the pancreas. This leads to total volume and size reduction, and reduced secretion.[7,21] Study done by Patel R et al., showed reduced secretion of the serum amylase from the diabetic pancreatic tissue due to fall in the cytoplasmic free calcium concentration and gene expression for amylase and not due to cholecystokinin gene expression.[22]

There is a dysfunctional insulino-acinar-ductal-incretin gut hormonal axis in type II DM.[23] Many defects in the signaling pathways in type 2 DM have shown a influence of insulin on exocrine pancrease.[24] The secretion of the pancreatic juice is controlled by the autonomic nervous system and gut hormones, cholecystokinin and secretin. Due to autonomic neuropathy and microvascular diseases, the release of pancreatic juice is disturbed in diabetes mellitus.[25]

An association between reduced level of serum amylase and reduced levels of lipase was found in type 2 DM was due to decrease of exocrine acinar cells. Pancreatic fibrosis is the predominate outcome and others are fatty infilteration, atrophy, loss of exocrine cells.

Limitations of the Study

It is a cross sectional study with small sample size and HbA1c levels where not done for the patients so the control for sugars for past 3 months was not considered. Serum insulin levels and insulin resistance was not measured to comment on insulin acinar axis.

Conclusion

From the present study it shows that the levels of amylase and lipase were decreased in type 2 DM. This biochemical parameter is suggested to consider as a consistent biochemical marker of pancreatic exocrine function and its deficiency in clinical illness should be approved by widespread, large scale experimental studies and research.

The implication that investigation of serum pancreatic enzymes could be an further informative parameter for the consideration of chronic and progression of the disease as well as the response to therapy, but has to be further investigated in detail.

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Conflict of Interest: None.

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