Pancreatic lipase and Pancreatic Amylase in Children with Type 1 Diabetes Mellitus

Munazza Saduf, , Saima Zareen,[2] Anila Asghar,[3] Jaida Manzoor,[4] Nazia Shahzadi,[5] Asma Fiqhat[6]

Abstract

Objective: To find out the serum levels of pancreatic lipase and pancreatic amylase in children with type 1 diabetes mellitus and to compare them with normal healthy children.

Methods: We conducted this cross-sectional comparative study at The Post Graduate Medical Institute, Lahore and The Children's Hospital and Institute of Child Health, Lahore from March 2018 – May 2019. We recruited 76 children ⩽ 16 years of age with type 1 diabetes mellitus and 76 age and gender matched normal self-reported healthy children were recruited as control group. Children with recent history of mumps or any other recent comorbidity were excluded from study. After written informed consent, a detailed questionnaire regarding demographic data was recorded. Levels of pancreatic lipase and pancreatic amylase were estimated and noted. Data was analyzed using SPSS version 20.

Results: Pancreatic lipase and pancreatic amylase were significantly decreased in children with type 1 diabetes mellitus as compared to normal healthy controls. Furthermore, in children with type 1 diabetes mellitus pancreatic amylase was significantly negatively correlated with duration of the disease though this correlation was statistically non-significant.

Conclusion: Pancreatic lipase and pancreatic amylase were significantly decreased in children with type 1 diabetes mellitus as compared to normal healthy controls. In children with type 1 diabetes mellitus a non-significant negative correlation was observed in levels of pancreatic lipase and amylase with duration of the diabetes mellitus giving a clue towards progressive atrophic changes of exocrine pancreas along with underlying endocrine pathology.

Keywords: pancreatic amylase, pancreatic lipase, children, type 1 diabetes mellitus.

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Introduction

Type 1 diabetes mellitus (T1DM) is one of the common chronic disorders in children all over the world. It occurs due to autoimmune or idiopathic destruction of beta cells of pancreas leading to absolute insufficiency of insulin. It is characterized by hyperglycemia and metabolic abnormalities contributed by a complicated interplay between genetic and environmental factors.[1] Incidence as well as prevalence of T1DM is persistently increasing across the world irrespective of age, gender and ethnicity of children. In the past decade, an annual increase of 1.4% has been documented in adjusted risk for development of T1DM.[2]

Various complex pathophysiologic events involving pancreatic tissue are responsible for the symptomatology of T1DM. Pancreas is a unique gland having both exocrine and endocrine components which are linked by complex intercommunications. Islets of Langerhans form less than 2% of total mass of pancreas and composed of α, β, δ and PP (pancreatic polypeptide) cells producing glucagon, insulin, somatostatin and pancreatic polypeptide respectively. Exocrine part of pancreas, made up of a fine network of acini and ducts, secretes digestive enzymes (pancreatic lipase and pancreatic amylase), ions and water. It transfers its secretions into the duodenum along with bicarbonate to maintain an optimal environment for action of its enzymes. Functions of exocrine and endocrine pancreas are interlinked and regulated by blood circulation, gap junctions and autonomic innervation.[3]

T1DM results in micro and macro vascular changes resulting in altered diffusion and heterogeneous disruption in structural integrity of pancreas as a whole.[4] Serial magnetic resonance imaging studies have shown that

1. Munazza Saduf
2. Saima Zareen
3. Anila Asghar
4. Jaida Manzoor
5. Nazia Shahzadi
6. Asma Fiqhat

1-3: Department of Biochemistry, Postgraduate Medical Institute, Lahore / Mian Ameer ud Din Medical College, Lahore.

5-6: Department of Physiology, Federal Postgraduate Medical Institute, Lahore.

4. Department of Endocrinology, The Children's Hospital and Institute of Child Health, Lahore.

Correspondence:

Munazza Saduf, *Demonstrate, Department of Biochemistry, Postgraduate Medical Institute, Lahore. Email: hiranoor104@gmail.com*

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there is a significant gradual reduction in pancreatic volume in diabetes mellitus. These progressive atrophic changes are noted to start at the beginning of the disease[4]. This pancreatic atrophy and interstitial fibrosis are suggested to be due to insulin omission as well as inflammatory cell infiltration. Due to the fact that structural and functional integrity of exocrine pancreatic acinar cells is maintained by exposure to high levels of circulating insulin released from beta cells. Insulin insufficiency or omission in T1DM is responsible for decline in exocrine pancreatic function which causes inhibition of incretin producing enteroendocrine L- cells leading to further suppression of insulin secretion and sensitivity.[5]

Serum levels of pancreatic lipase and amylase are reliable biomarkers to access pancreatic status as a whole possibly due to connections between gut, exocrine and endocrine pancreas via incretin as well as paracrine effects. They can be helpful in prediction of occurrence and progression of pancreatic damage in diabetes mellitus.[6] This study was conducted to find out levels of pancreatic lipase and pancreatic amylase to exclude lipase and amylase from non-pancreatic sources like parotid and salivary glands and thus to predict exocrine pancreatic functions in children with T1DM.

Material and Methods:

The study included 76 children ≤ 16 years of age with type 1 diabetes mellitus (group A) and 76 age and gender matched normal healthy children as controls (group B) from the outpatient department of The Children's Hospital and Institute of Child Health, Lahore from March 2018 – May 2019. Study was approved by ethical committee of The Post Graduate Medical Institute, Lahore as well as internal review board of The Children's Hospital and Institute of Child Health.

After informed consent, about 1ml blood was drawn from each subject for estimation of levels of pancreatic lipase and pancreatic amylase. A detailed questionnaire regarding demographic data was recorded. Levels of pancreatic lipase and pancreatic amylase were measured by ELISA.

The data was analyzed using IBM SPSS (Statistical Package for Social Sciences) version 20. Data were checked for normality of distribution by using Shapiro Wilk's test and considered to be normally distributed if p value is ≥ 0.05 and vice versa. The mean ± standard deviation was given for the normally distributed quantitative variables. Independent sample t test was applied to compare biochemical parameters between two groups. Pearson's correlation was applied to observe correlation between variables.

Results

Group A comprised of 76 children out of which 40 were males and 36 were females. Mean age of participants was 9.17 ± 3.96 years. Group B comprised of age and gender matched self-reported healthy children. Levels of pancreatic lipase and pancreatic amylase were compared and found to be significantly lower in children with type 1 diabetes mellitus as compared to controls (Table 1). Pearson's correlation showed a negative correlation, between levels of pancreatic lipase, amylase and duration of diabetes though not statistically significant (Table 2).

Table 1: *Comparison of pancreatic lipase and amylase in diabetic and control groups*

Characteristics	Groups	Mean ± SD	*p* – value
Pancreatic lipase	Diabetics (Group A)	10.697 ± 3.98	0.00**
	Non diabetics (Group B)	29.631 ± 9.48	
Pancreatic amylase	Diabetics (Group A)	530.50 ± 156.48	0.00**
	Non diabetics (Group B)	1473.67 ± 320.11	

**Significant difference between group A and group B at the 0.01level (2 tailed)

Table 2: *Correlation of pancreatic lipase and amylase with duration of disease in children with type 1 diabetes mellites.*

		Duration since onset of diabetes	Pancreatic amylase	Pancreatic lipase
Duration since onset of diabetes	r/rho	1		
	p- value			
Pancreatic amylase	r/rho	-0.066	1	
	p- value	0.59		
Pancreatic lipase	r/rho	- 0.150	0.066	1
	p- value	0.197	0.569	

Correlation coefficient (r) and p -values are generated by Pearson Correlation coefficient. p -value ⩽ 0.05 is considered statistically significant.

Discussion

The study was conducted due to increasing incidence and prevalence of T1DM in Pakistan.[7] Many studies have been conducted in attempt to understand biochemical role and underlying mechanism to link exocrine and endocrine function of pancreas in diabetes mellitus. Studies have shown that levels of serum total lipase and serum total amylase are altered in diabetic individuals in the absence of any other significant comorbidity.[8,9] Lipase and amylase are secreted by pancreatic as well as extra pancreatic tissues and elevation of serum lipase and amylase may reflect elevation due to non-pancreatic sources.[10] We have measured pancreatic lipase and pancreatic amylase in diabetic children in

an attempt to get more accurate results regarding the pathologic involvement of exocrine pancreatic tissue in diabetes mellitus. To our knowledge a little documented data about the levels of pancreatic lipase and amylase in children with T1DM is available. The findings of this study showed that levels of pancreatic lipase and pancreatic amylase are reduced in children with T1DM as compared to healthy controls.

In our study we found pancreatic lipase and pancreatic amylase in diabetic children were significantly decreased as compared to healthy controls ($p=0.001$), leading us to the conclusion that exocrine pancreatic function is compromised in children with type 1 diabetes mellitus. These results are in line with the work of Madole et al., 2016[11], they used serum total lipase and amylase as biomarkers to access exocrine pancreatic function and found that they were statistically significantly lower ($p<0.01$) and contributed it to atrophic changes in pancreas due to deficiency of insulin and glucagon resulting in decreased pancreatic volume and secretion of pancreatic lipase and pancreatic amylase. We however, could not find any significant documented data regarding levels of pancreatic lipase and amylase in children with type 1 diabetes mellitus.

We also found in this study that levels of pancreatic amylase were negatively correlated with duration of diabetes mellitus as shown by Pearson's correlation though it was not significant statistically. This finding is similar to the work of Subedi et al, 2020.[12] They documented ($r = -0.313$, p-value <0.001) showing negative correlation between serum total amylase levels and duration of diabetes and concluded it to be a result of pancreatic atrophy in diabetes. The difference in results may be due to estimation of only pancreas specific enzymes in our study as well small sample size. Studies on pancreatic enzymes with larger sample size may give a better insight in to exocrine pancreatic pathology occurring concomitantly in type 1 diabetes mellitus.

Conclusion

Significant reduction in pancreatic lipase and pancreatic amylase in children with T1DM may be due to progressive atrophic changes of exocrine pancreas as a result of T1DM. Analysis of pancreatic enzymes could be an additional informative parameter for the assessment of chronicity of diabetes and understanding of pathophysiologic events.

Conflict of interest:

None

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Authors Contribution

SM, AA, MJ: Conceptualization of Project

SM, SN: Data Collection

SM, ZS, FA: Statistical Analysis

SM, ZS: Writing of Manuscript