

EVALUATION OF BIOCHEMICAL MARKERS SERUM AMYLASE, LIPASE FOR THE ASSESSMENT OF EXOCRINE FUNCTIONS OF PANCREAS IN CASES OF TYPE 2 DIABETES MELLITUS IN GREATER NOIDA, WESTERN UTTAR PRADESH

**Keshav Kumar Goyal¹, Thuraya Abdulsalam.AALazazi²,
Rajesh Kumar Thakur³, Dhivya S⁴, Nirupma Gupta⁵, Bhaskar Charana Kabi⁶
and Manoj Kumar Nandkeoliar^{7*}**

¹MBBS Student, School of Medical Sciences & Research, Sharda University.

²Research Scholar, Department of Biochemistry,
School of Medical Sciences & Research, Sharda University.

³Associate Professor, Department of Biochemistry,
School of Medical Sciences & Research, Sharda University.

⁴Assistant Professor, Department of Biochemistry,
School of Medical Sciences & Research, Sharda University.

⁵Professor, Anatomy & Dean, School of Medical Sciences & Research, Sharda University.

^{6,7}Professor, Department of Biochemistry,
School of Medical Sciences & Research, Sharda University.

*Corresponding Author Email: drmanojkumar55@gmail.com

Abstract

Introduction: Diabetes Mellitus (DM) is a metabolic disorder marked by the presence of either a total lack of insulin or reduced insulin activity, resulting in the worsening of the illness. The pancreas is a very intricate organ consisting of several cellular structures. The exocrine component constitutes around 84% of the pancreas' in overall volume, whilst the endocrine component represents a meagre 2%. The structural and functional interconnection of these two regions suggests that any disruption in one region can have consequences for the other. Aim & objective: To study the correlation between exocrine and endocrine functions of Pancreas in Type 2 Diabetes Mellitus (T2DM). Material & Method: case control study, 30 cases with T2DM were selected as subject and 30 with normal fasting blood sugar (FBS) as control. Fasting Blood Sugar (FBS), Serum amylase and serum lipase were measured by using automated biochemistry analyser, Vitros 5600 in Biochemistry Department, Central Laboratory, Sharda University, Greater Noida, UP, India. Result: negative correlation between FBS and Amylase ($r=-.340^*$), and FBS and Lipase ($r=-.382^*$). Conclusion: Pancreatic amylase and lipase function is diminished in type 2 diabetics, Pancreatic enzymes may be a good indication of diabetes progression.

Keywords: DM, T2DM, FBS, SERUM AMYLASE, SERUM LIPASE, VITROS 5600

INTRODUCTION

Diabetes mellitus (DM) refers to a collection of chronic metabolic diseases. Chronic hyperglycemia is detected as a result of inadequate insulin secretion, inadequate insulin response, or a combination of both the conditions. Type 2 Diabetes Mellitus (T2DM) has become a prevalent health issue in modern society, affecting a substantial number of individuals worldwide, reaching a startling 462 million cases. Notably, a considerable subset of 77 million cases is seen presently in India (1,2).

According to data presented by the International Diabetes Federation, an anticipated global population of around 537 million individuals aged between 20 to 79 years were diagnosed with diabetes in the year 2021. The aforementioned data indicates a prevalence rate of 10.5% at a global level. Based on forecasts, it is expected that the numerical value would experience a substantial increase, reaching a cumulative count of 642 million individuals by the year 2040. It is crucial to recognize that there is a

growing prevalence of diabetes worldwide, which may be primarily ascribed to many factors such as an ageing population, urbanization, the adoption of unhealthy dietary habits, and sedentary lifestyles (3).

According to the World Health Organization (WHO), there is a global prevalence of diabetes affecting around 422 million individuals, with a significant concentration in low- and middle-income nations. Furthermore, WHO reports that diabetes is directly responsible for approximately 1.5 million fatalities annually (4).

The manufacture of insulin occurs within the cells of the pancreatic islets. Islet cells, which are found adjacent to exocrine cells within the pancreas, are responsible for the secretion of acinar cells. The exocrine portion of the pancreas accounts for around 84% of its overall volume, whereas the endocrine portion comprises only 2%. The complex interaction between the structure and function of these two global domains results in the possibility for any disturbance in one region to have an impact on the other. The existing body of evidence indicates that pancreatic endocrine hormones, particularly insulin, exert an influence on the exocrine function of the pancreas. The administration of insulin has been found to have an adverse effect on exocrine acinar cells. The exocrine acinar cells possess a range of enzymes, such as amylase and lipase. These enzymes are of utmost importance in easing the process of digesting particular dietary particles (6,9).

The occurrence of extended periods of uncontrolled hyperglycemia can result in tissue damage, which in turn can lead to the development of end organ damage due to the existence of both microvascular and macrovascular complications. Individuals with diabetes may experience notable disruptions in their exocrine function due to the intimate association between the exocrine and endocrine system. Hence, the normal functioning of the exocrine system plays a vital role in the effective digestion and absorption of nutrients within the gastrointestinal (GI) tract (9).

The exposure of exocrine acinar cells to heightened quantities of endocrine hormones takes place when blood donations are obtained from adjacent islands. The existing body of evidence indicates that pancreatic endocrine hormones, particularly insulin, exert an influence on the exocrine function of the pancreas. The injection of insulin has a negative effect on exocrine acinar cells. The exocrine acinar cells, which are encapsulated, possess a diverse array of enzymes, including amylase and lipase, that aid in the enzymatic hydrolysis of certain food particles throughout the process of digestion. (10)

The reduction in blood amylase levels has been regarded as a dependable indicator of the progression of pancreatic injury associated with advanced pancreatic illness. Recent research has yielded findings suggesting a potential association between diminished blood amylase levels and the prevalence of metabolic syndrome and diabetes mellitus (11,13)

Despite the considerable investigation into the interaction between exocrine and endocrine functions in the pancreas through animal and cellular studies, there has been a noticeable dearth of attention given to the role of pancreatic exocrine function in research pertaining to diabetes in human. The main focus of the research lies in investigating metabolic disturbances that arise from prolonged period of heightened blood glucose levels caused by reduced insulin secretion. Numerous investigations have been undertaken to examine the association between heightened levels of blood amylase and lipase in cases of acute pancreatitis (6,10).

Nevertheless, there is a paucity of studies investigating the importance of reduced levels of serum amylase and lipase in clinical scenarios, such as diabetes mellitus.

MATERIAL & METHOD

A case-control study was done by the Department of Biochemistry at the School of Medical Sciences and Research, in collaboration with the Department of Medicine at Sharda Hospital, Sharda University in Greater Noida, Uttar Pradesh, subsequent to approval from the Institutional Ethics Committee. The study population consisted of subjects who sought medical care at both the outpatient department (OPD) and inpatient department (IPD) of Sharda Hospital, as well as persons residing in Greater Noida and nearby area of Western Uttar Pradesh. Informed written consent were obtained from the subjects.

Following the completion of the medical history a thorough physical examination was conducted. The procedure of collecting samples for the purpose of analysis was conducted. 5ml venous blood sample was collected from each of the cases and control. The serum derived from whole blood was subjected to analysis, namely to determine blood glucose, amylase, and lipase levels. The analysis was conducted utilizing the dry chemistry autoanalyzer, Vitros 5600 system.

Statistical analysis:

The analysis of the data was performed with SPSS software version 22.0. The present study performed a statistical analysis that encompassed the use of both descriptive and inferential statistics. The data was used for determining the mean \pm standard deviation (SD) or standard error of the mean (SEM). The correlation between variables were measured by using Pearson correlation coefficient. In statistical analysis, a p-value that is less than or equal to 0.05 is accepted as being statistically significant.

RESULT

Mean \pm SD of FBS, serum amylase, and serum lipase in cases and control is shown in table 1. Correlation between FBS, serum amylase and serum lipase by using Pearson correlation coefficient are shown in table no 2.

Table no.1:

Group Statistics	class	Mean	Std. Deviation	Std. Error Mean
FBS	case	205.7	96.86078	17.68428
	control	83.5455	13.01049	3.92281
AMYLASE	case	40.6667	10.13813	1.85096
	control	71.6364	24.07186	7.25794
LIPASE	case	43.2	29.37909	5.36386
	control	159.8182	133.92298	40.3793

Table no.2:

Correlations		FBS	AMYLASE	LIPASE
FBS	Pearson Correlation	1	-.340*	-.382*
	Sig. (2-tailed)		0.03	0.014
	N	41	41	41
AMYLASE	Pearson Correlation	-.340*	1	.358*
	Sig. (2-tailed)	0.03		0.021
	N	41	41	41
LIPASE	Pearson Correlation	-.382*	.358*	1
	Sig. (2-tailed)	0.014	0.021	
	N	41	41	41

* Correlation is significant at the 0.05 level or less (2-tailed).

DISCUSSION

Disorders that specifically target the human pancreas have a direct impact on the exocrine secretions of the organ. The reduced concentrations of serum amylase reported in persons diagnosed with diabetes may suggest impaired exocrine-endocrine interactions inside the pancreas. Nevertheless, there have been only a restricted number of clinical trials that have explored this complex interplay (7-9).

The purpose of this investigation was to establish a correlation between islet cells, which are classified as endocrine glands, and acinar cells, which are categorised as exocrine glands, within the pancreas. To examine the association, we performed tests of Fasting blood glucose (FBS), serum amylase, and serum lipase levels in both the cases and control groups. This investigation revealed a significant correlation between levels of serum amylase, serum lipase, and fasting blood sugar (FBS). It has been shown that people with Type 2 Diabetes Mellitus (T2DM) exhibited significantly reduced levels of blood lipase and serum amylase in comparison to the control group. The researchers also observed that their results were in line with prior studies that have shown elevated levels of blood amylase and serum lipase in individuals who have been diagnosed with early-stage type 2 diabetes mellitus (T2DM) (8,9).

In the study conducted by Ratel et al. it was determined that the reduced synthesis of amylase in the pancreas of individuals with diabetes can be attributed to a decline in the concentration of cytosolic free calcium (Ca²⁺) and the suppression of gene expression associated with amylase. This phenomenon is not caused by changes in the gene expression of cholecystokinin (CCK) receptors in pancreatic acinar cells (13).

According to Bhadarge. G.L., et.al., the study proposes that the assessment of blood amylase and lipase levels in newly diagnosed individuals with type 2 diabetes mellitus may be beneficial in the early diagnosis of diabetes mellitus and its associated problems (5). More studies with larger samples size is required to establish the correlation between endocrine and exocrine function of pancreas in T2DM.

CONCLUSION

It is concluded that individuals with type 2 diabetes exhibit reduced functionality of pancreatic amylase and lipase, which holds particular significance within the context of type 2 diabetes. There has been a suggestion that the evaluation of pancreatic

enzymes in individuals with diabetes could serve as a valuable indicator for assessing the advancement of the condition.

References

- 1) Kakkar S, Nandkeoliar MK, Thakur RK, Punia VPS, Kabi BC. Association Of sCD 36 And Insulin Resistance in Type2 Diabetes Mellitus. 2022;13(9):5430–5.
- 2) <https://www.who.int/india/health-topics/mobile-technology-for-preventing-ncds>
- 3) IDF. Over 74 million adults are living with diabetes in India-second highest number in the world. 2021;1–2. Available from: www.diabetesatlas.org.
- 4) https://www.who.int/health-topics/diabetes#tab=tab_1
- 5) Bhadarge G, Dawande P, Bankar N, Kotecha R. Study of Serum Pancreatic Amylase and Lipase Enzyme in Patients with Type 2 Diabetes. *J Pharm Res Int*. 2021;(August):197–201.
- 6) Madole MB, Iyer CM, Madivalar MT, Wadde SK, Howale DS. Evaluation of Biochemical Markers Serum Amylase and Serum Lipase for the Assessment of Pancreatic Exocrine Function in Diabetes Mellitus. *J Clin Diagn Res*. 2016 Nov;10(11): BC01-BC04. doi: 10.7860/JCDR/2016/23787.8900. Epub 2016 Nov 1. PMID: 28050357; PMCID: PMC5198310.
- 7) Ambad R, et al. Polyherbal antidiabetic drug: An approach to cure diabetes. *Int. J. Res. Pharm. Sci*. 2020;11(2):2679-2683. 3. Buran T, Sanem Gökçe Merve Kılınc, Elmas Kasap. Prevalence of extraintestinal manifestations of ulcerative colitis patients in Turkey: Community-based monocentric observational study. *Clinical Medicine and Medical Research*. 2020;1(2):39-46. Available: <https://doi.org/10.52845/CMMR/2020v1i2a8>
- 8) Ambad R, et al. Polyherbal antidiabetic drug: An approach to cure diabetes. *Int. J. Res. Pharm. Sci*. 2020;11(2):2679-2683
- 9) Prasanna Kumar HR, Gowdappa HB, Hosmani T, Urs T. Exocrine dysfunction correlates with endocrinal impairment of pancreas in Type 2 diabetes mellitus. *Indian J Endocrinol Metab*. 2018;22(1):121–5.
- 10) Ambad R, Jha RK, Chandi DH, Hadke S. Association of leptin in diabetes mellitus and obesity. *Res J Pharm Technol*. 2020;13(12):6295–9
- 11) Article R. Diabetic neuropathy: new perspectives on early diagnosis and treatments. *J Curr Diabetes Reports*. 2020;1(June):15–7.
- 12) Riceman MD, Bound M, Grivell J, Hatzinikolas S, Piotto S, Nguyen NQ, et al. The prevalence and impact of low faecal elastase-1 in community-based patients with type 2 diabetes. *Diabetes Res Clin Pract* [Internet]. 2019; 156:107822. Available from: <https://doi.org/10.1016/j.diabres.2019.107822>
- 13) Patel R, Shervington A, Pariente JA, Martinez-Burgos MA, Salido GM, Adeghate E, et al. Mechanism of exocrine pancreatic insufficiency in streptozotocin-induced type 1 diabetes mellitus. *Ann N Y Acad Sci*. 2006; 1084:71–88. [PubMed] [Google Scholar]
- 14) Xu H, Huang X, Arnlov J, Cederholm T, Stenvinkel P, Lindholm B, et al. Clinical correlates of insulin sensitivity and its association with mortality among men with CKD stage 3 and 4. *Clin J Am Soc Nephrol*. 2014; 9:1–8. [PMC free article] [PubMed] [Google Scholar]