



Study of Serum Pancreatic Amylase and Lipase Enzyme in Patients with Type 2 Diabetes

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Introduction: Diabetes mellitus (DM) is a metabolic disorder that is greatly exacerbated by a complete lack of insulin or insulin resistance. The pancreas is a multicellular organ, the exocrine half accounting for 84% of its volume and the endocrine half accounting for only 2%. Since these two parts of the world have a close relationship with structure and function, the disruption of one can affect the other. Hemoglobin A1C (HbA1c) represents the glycemic status of the patient over the previous three months. Evidence suggests that pancreatic endocrine hormones, especially insulin, affect pancreatic exocrine function. Insulin has a detrimental effect on exocrine acinar cells. Exocrine acinar cells attached to it contain a variety of enzymes, including amylase and lipase, which help digest certain food particles.

Aim: Study of serum pancreatic amylase and lipase enzyme in patients with type 2 diabetes.
Materials and Methods: This cross sectional study was done in the Department of Biochemistry, dept. of medicine and Diabetic OPD, Datta Meghe Medical College and Shalinitai Meghe Hospital and Research Centre, Nagpur. For this study 40 diagnosed type 2 diabetic patients of both sexes with age ranging 35-60 years were selected as study group.
Results: FBS, HbA1C, serum pancreatic amylase, and lipase mean effects between control and patients showed statistically significant differences in type 2 diabetes mellitus (P <0.0001).
Conclusion: We concluded that pancreatic amylase and lipase function are impaired in type 2 patients with diabetes, and this observation is particularly important in type 2 diabetes. It has been suggested that the analysis of pancreatic enzymes in diabetic patients may be a useful parameter in determining the progression of the disease.

Keywords: T2DM; amylase; lipase; HbA1c and NIDDM.

1. INTRODUCTION

Diabetes is on the rise, and the number of depressions worldwide will double from 171 million in 2000 to 366 million by 2030, with India leading the way. By 2030, it is estimated that DM will affect up to 79.4 million people in India. At present, India is the world's leading DM epidemic [1]. Reduced or absent insulin secretion and insulin tolerance are the causes of type 1 and type 2 diabetes, respectively [2]. Insulin resistance is seen as a decrease in the response of an target organ to the effects of chemical insulin. Insulin is produced by cells in pancreatic islets. In clusters of endocrine islet cells are scattered among the exocrinal acinar cells, secreted by both the endocrine and exocrine glands [3,4].

Exocrine cells make up 84% of the pancreas structure, endocrine cells make up 2%, extracellular matrix make up 10%, and ductal cells and blood vessels make up 4%. Islet cells and acinar cells are very close. Disability of Islet cells detected in diabetes can cause pancreatic acinar cells to become irritated [5]. Hyperglycaemia is caused by a deficiency in insulin secretion and activity, which can interfere with enzyme production and excretion from the exocrine pancreas. Amylase, lipase, and protease enzymes are produced in the pancreas [6].

Diabetes mellitus (DM) is a metabolic disorder that is greatly exacerbated by a complete lack of insulin or insulin resistance. The pancreas is a multicellular organ, the exocrine half accounting for 84% of its volume and the endocrine half accounting for only 2%. Since these two parts of the world have a close relationship with structure and function, the disruption of one can affect the other [7].

When blood donations are collected from nearby islands, exocrine acinar cells are exposed to high concentrations of endocrine hormones. Evidence suggests that pancreatic endocrine hormones, especially insulin, affect pancreatic exocrine function. Insulin has a detrimental effect on exocrine acinar cells. Exocrine acinar cells attached to it contain a variety of enzymes, including amylase and lipase, which help digest certain food particles [8]. Amylase is the main enzyme that breaks down starch into maltose, maltotriose, and eliminates dextrans during digestion. Lipase is a digestive enzyme from the pancreas and spreads to the intestines, where it helps to break down triglycerides into acids and monoglycerides. The diet is poorly prepared due to a lack of pancreatic enzymes, which leads to poor digestion and starvation [9].

Low serum amylase levels have long been considered to represent the proliferation of pancreatic damage caused by advanced pancreatic disease. However, recent studies have shown that reduced serum amylase levels are associated with metabolic syndrome and diabetes. Hemoglobin A1C (HbA1c) represents the glycemic status of the patient over the previous three months [10].

2. AIM

Study of Serum Pancreatic Amylase and Lipase Enzyme in Patients with Type 2 Diabetes Mellitus.

3. MATERIALS AND METHODS

Present Study was carried out in the Dept. of Biochemistry at Datta Meghe Medical College in collaboration with Dept. of General medicine. For this study 40 diagnosed type 2 diabetic patients of both sexes with age ranging 35-60 years were selected as study group.

3.1 Sample Collection

7ml of blood samples are collected from each patient and are clearly distributed, sodium fluoride and EDTA as 3ml, 2ml and 2ml respectively. A serum sample from a plain vial was used to measure Amylase and Lipase while EDTA samples were used to measure HbA1c, sodium fluoride samples were used to measure FBS.

3.2 Biochemical Analysis

Amylase, Lipase, HbA1C, FBS were estimated on AU480 Analyser.

4. RESULTS

Table 1 shows the comparison of laboratory data between the control group and the study group. FBS was significantly elevated (215.0 ± 73.8) in type 2 patients compared with healthy subjects (93.2 ± 14.1). HbA1C was significantly elevated (7.60 ± 1.42) in type 2 patients compared with healthy subjects (4.7 ± 0.90).

According to Table 1, Amylase significantly reduced (38.6 ± 16.0) in type 2 patients compared with healthy subjects (66.7 ± 18.1) and Lipase significantly decreased (21.0 ± 2.8) in type 2 patients compared with healthy (26.2 ± 4.1) subjects.

FBS, HbA1C, serum pancreatic amylase, and lipase mean effects between control and patients showed statistically significant differences in type 2 diabetes mellitus ($P < 0.0001$).

5. DISCUSSION

Skrha J et al found that patients with insulin-dependent diabetes mellitus have low serum lipase levels and amylase levels. These findings can be explained by the decrease in acinar cell activity near the depleted insulin islands. Other

studies have shown a decrease in other pancreatic enzymes such as elastase, trypsin, and chymotrypsin. In diabetic patients with uncontrolled hyperglycaemia, analysis of pure pancreatic secretions embedded in the pancreatic cavity revealed a significant decrease in amylase levels with a slight increase in the concentration of bicarbonate and lipase. Diabetes is one of the most common chronic diseases, endangering the lives of millions of people worldwide [11]. It is characterized by hyperglycaemia and decreased serum insulin content, and is divided into two types: type 1 (IDDM) and type 2 (NIDDM) depending on the early years and the requirement for insulin treatment. Dyslipidaemia is a very important risk factor for diabetes complications, and is widely studied [12,13].

Lorini et al, Yajnik et al, and Kim et al all related weight loss recorded in pancreatic amylase, lipase, trypsin, and elastase. In diabetic patients with uncontrolled hyperglycaemia, analysis of pure pancreatic juice directly into the pancreatic cavity revealed a significant decrease in amylase production with no difference in lipase and bicarbonate concentrations. The activity of pancreatic juice amylase is increased while glycaemic regulation is stable [14].

Hatt f BF et al, on the other hand, observed a significant increase in serum amylase levels in people with diabetes (175.35 ± 21.74) in relation to the control group (40.19 ± 10.50) diabetics with ketoacidosis. Decreased amylase secretion in diabetic pancreas may be due to cytosolic free calcium concentration (Ca^{2+}) and amylase expression, rather than cholecystokinin (CCK) receptor gene expression in pancreatic acinar cells. according to Patel R et al. Exocrine dysfunction is common in diabetics, according to a recent study from a number of diabetic centers using fecal elastase 1 concentration as a diagnostic tool for exocrine pancreatic function [15-21].

Table 1. Comparison healthy individuals with type 2 DM subjects

Parameters	Control (n=20)	Type 2 DM (n=20)	P-value
FBS (mg/dl)	93.2±14.1	215.0±73.8	P < 0.0001
HbA1c (%)	4.7±0.90	7.60±1.42	P < 0.0001
Amylase (u/L)	66.7±18.1	38.6±16.0	P < 0.0001
Lipase (u/L)	26.2±4.1	21.0±2.8	P < 0.0001

6. CONCLUSION

We concluded that pancreatic amylase and lipase function are impaired in type 2 patients with diabetes, and this observation is particularly important in type 2 diabetes. It has been suggested that the analysis of pancreatic enzymes in diabetic patients may be a useful parameter in determining the progression of the disease.

CONSENT AND ETHICAL APPROVAL

Ethical clearance taken from institutional ethics committee & patient's written consent has been collected and preserved by the author(s).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. 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 ;10(11):BC01-BC04.
2. 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
4. Singh J, Yago MD, Adeghate E. The role of insulin, glucagon, somatostatin, cholecystokinin, acetylcholine and nerve stimulation in the interactions between the endocrine and exocrine pancreas in normal and diabetic conditions in rats. *Int J Diabetes.* 1999;7(1):114–19.
5. Ambad R, et al. Relationship between uric acid and creatinine in pre-diabetic and diabetic patients: Vidarbha region of Maharashtra. *Int. J. Res. Pharm. Sci.* 2020;11(3):3412-3417.
6. Daniel V, Daniel K. Perception of nurses' work in psychiatric clinic. *Clinical Medicine Insights.* 2020;1(1):27-33. Available:https://doi.org/10.52845/CMI/2020v1i1a5
7. Kamble A. To study the effect of oral vitamin D supplements on wound healing in patient with diabetic foot ulcer and its effect on lipid metabolism. *Int. J. Res. Pharm. Sci.* 2020;11(2):2701-2706.
8. Barrett KE, Barman SM, Boitano S, Brooks HL. Ganong's review of medical physiology. 24th ed. New Delhi: Tata McGraw-Hill. Chapter 26, Digestion, Absorption and Nutritional Principles. 2012 ;477-495.
9. Ambad R, et al. Association of leptin in diabetes mellitus and obesity. *Research J. Pharm. and Tech.* 2020;13(12):6295-6299.
10. Daniel V, Daniel K. Diabetic neuropathy: New perspectives on early diagnosis and treatments. *Journal of Current Diabetes Reports.* 2020;1(1):12–14. Available:https://doi.org/10.52845/JCDR/2020v1i1a3
11. Nakajima K, Nemoto T, Muneyuki T, Kakei M, Fuchigami H, Munakata H. Low serum amylase in association with metabolic syndrome and diabetes: A community-based study. *Cardiovasc Diabetol.* 2011 ;10:34.
12. Bhadarge G, et al. Study of Hba1c in iron deficiency Anaemia. *European Journal of Molecular and Clinical Medicine.* 2021 ;8(1):314-319.
13. Lorini R, et al. Exocrine pancreatic function in children and adolescents with insulin-dependent diabetes mellitus. *Diabetes Res Clin Pract.* 1990;8:263-267.
14. Hadke S, Gawali R. Analysis of acute neurologic problems in young non diabetic patients with hypertension. *JARHAS.* 2021 ;2(1):1-4.
15. Ordu JI, Chukwu A. Kinetics and stability studies of formulated micro/nano suspension of metronidazole. *International Journal of Scientific Research and Education.* 2018;06(03):7882-97.
16. Daniel V, Daniel K. Exercises training program: It's effect on muscle strength and activity of daily living among elderly people. *Nursing and Midwifery.* 2020 ;1(01):19-23. Available:https://doi.org/10.52845/NM/2020v1i1a5
17. Kim K, et al. Evaluation of pancreatic exocrine function using purepancreatic juice in non insulin-dependent diabetes mellitus. *J Clin Gastroenterol.* 2000;31:51-54.

18. Ambad R. Polyherbal antidiabetic drug: An approach to cure diabetes. *Int. J. Res. Pharm. Sci.* 2020;11(2):2679-2683.
19. Yadav D, Nair S, Norkus EP, et al. Nonspecific hyperamylasemia and hyperlipasemia in diabetic ketoacidosis: incidence and correlation with biochemical abnormalities. *J Gastroenterol.* 2000 ;95(11):3123-8.
20. Seshan S, Nagrale N, et al. Therapeutic potential of yoga practices in management of diabetes. *European Journal of Molecular & Clinical Medicine.* 2021;8(1):174-182.
21. Nunes AC, Pontes JM, Rosa A, Gomez L, Carvalheiro M, Freitas D. Screening for pancreatic exocrine insufficiency in patients with diabetes mellitus. *Am J Gastroenterol.* 2003 ;98:2672-2675.

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