Chemical Pathology

Alfa Amylase Activity and Lipid Profile in Sudanese Patients with Type2 Diabetes Mellitus

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Abstract: Diabetes mellitus (DM), is a global metabolic disorder characterized by hyperglycemia, associated with insulin deficiency or resistance, due to endocrinal pancreatic insufficient. The exocrine portion of the pancreas secreted different enzyme involved in nutrients metabolism such as amylase. Endocrinal disturbance observed in diabetes may interfere with the exocrine function of the pancreas. Forty six type 2 Diabetes patients under treatment matched with forty six healthy individuals as control were included in this study. Fasting venous blood samples were collected from each participant and they were analyzed with semi-automated analyzer for fasting blood glucose (FBG), α-amylase (α-AMY) and the lipid profile [triglycerides (TG), total cholesterol (T. CHOL), high density lipoprotein (HDL) and low density lipoprotein (LDL)]. The data were analyzed statistically using SPSS version 16. Significantly low amylase levels were found in the diabetic patients as compared to those in the healthy controls (p value 0.00). Fasting total cholesterol, triglycerides and the LDL were significantly higher in the patients as compared to those in the controls (P = 0.000, 0.011 and 0.000 respectively). The HDL level was found to be lower in the diabetic patients (P 0.000). It was concluded that in Sudanese with type 2 diabetes mellitus, the serum amylase activity was found to be significantly lower than in the healthy controls and negatively correlated with blood glucose level, duration of the disease and lipid profile. This finding reflected an affected endocrine-exocrine axis of the pancreas.
Keywords: Diabetes mellitus, amylase, lipid profile.

INTRODUCTION

Diabetes mellitus is a chronic metabolic disorder characterized by hyperglycemia that occurs either when insulin is deficient (type 1), or in case of insulin resistance (type 2) [1].

Diabetes is an important public health problem. (An estimated 422 million adults were living with diabetes in 2014) [1]. The Prevalence of diabetes in Sudan is rising from 9.3% in 2010 to 10.6 % in four states in 2013 [2]. Recent estimates place the diabetes population at around one million – around 95% of whom have type -2 diabetes [3].

The pancreas is composed of endocrine and exocrine parts. The endocrine part (2% of pancreatic mass) consist of different types of islet of Langerhans (alfa, beta, delta, gamma and epsilon) and secrete different hormones involved in blood glucose regulation [4, 5]. The exocrine glands (84% of gland), consist of acinar cells which secrete pancreatic juice containing digestive enzymes that assist in the digestion and absorption of nutrients in the small intestine. The reminder mass (14%) is a complex of ductal cells, blood vessel and extra cellular matrix [6- 8].

Insulin has a trophic effect on the exocrine pancreas, especially on the peri - insular acini. Insulin bind to receptors of acinar cells and stimulates amylase secretion through a number of ways [9]. Deficiency in insulin secretion can lead to a damage of pancreatic acinar cells, So that the exocrine tissue in a diabetic patient becomes fibrosed and shows a reduced response to the hormonal stimulation [8].

In type 2 Diabetes, loss of interstitial matrix connection between the endocrine and exocrine pancreas lead to dysfunctional insulino-acinar-ductal-incretin gut hormonal axis [10]. Also defects in the insulin secretion and the signalling lead to defect in the enzyme synthesis and release in the exocrine pancreas [11, 12]. Diabetes mellitus by time and loss of control can lead to serious complication including pancreatic damage [13].

Amylase is one of pancreatic juice enzyme cleaves starch into smaller polysaccharides. The main sources of amylase in humans are the pancreas and salivary glands [14]. Low serum amylase may be associated with metabolic syndrome, obesity and diabetes [15].

MATERIALS AND METHODS

This is a case control study conducted in Sudan, including forty six type 2 diabetic patients, attending Zinam specialist hospital for follow up and without any other diseases that cause lipid and amylase abnormalities. Forty six healthy individuals were included as controls. All the participants were fully informed about the study and their consents were taken.

Fasting venous blood was collected from each participant, centrifuged and the plasma was separated for analysis on the same day for the blood glucose, lipid profile [triglycerides (TG), total cholesterol (T CHOL), high density lipoprotein (HDL) and low density lipoprotein (LDL)] and the α- amylase (α-AMY) activity. Analysis was carried out with semi-automated analyzer using different reagent kits.

- Fasting blood glucose was estimated using glucose oxidase method.
- Triglycerides were measured by the enzymatic (GPO– PAP) method.
- For total cholesterol, an enzymatic (CHOD–PAP) method was used.
- Indirect measurements for LDL and direct measurement of HDL were done using enzymatic methods.
- The amylase activity was measured by a photometric enzymatic method.

Statistics

Data were analyzed using SPSS 16. Comparisons between groups were performed with the two-tailed analysis of variance. The results were considered significant at $P < 0.05$. All results are expressed as mean $\pm$ SD

RESULTS

The mean fasting blood glucose for the patients and control groups were 194 mg/dl $\pm$ 55 and 91 mg/dl $\pm$ 11 respectively.

The mean α-AMY activity for the patients and control groups were 29 U/L $\pm$5 and 59 U/L $\pm$ 10 respectively.

The mean CHOL levels for the patients and control groups were 190 mg/dL $\pm$ 41 and 161 mg/dl $\pm$12 respectively.

The mean TG levels for the patients and control groups were 130 mg/dL $\pm$ 37 and 114 mg/dL $\pm$ 21 respectively.

The mean LDL level for the patients and control groups were 123mg/ dL $\pm$ 34 and 73 mg/ dL $\pm$10 respectively.

The mean HDL level for the patients and control groups were 51 mg/ dL $\pm$ 13 and 70 mg/ dL $\pm$5 respectively.

T CHOL, TG and LDL were significantly higher in the patients as compared to the controls (P = 0.00, 0.01 and 0.00 respectively).

α-AMY activity and HDL were found to be significantly lower in the patients as compared to the controls (P = 0.00).

Table-1: the parameters means, SD and significances of the differences between means of the patients (P) and control (C)

Parameters	Group	Mean	SD	Sig
FBG in mg/dl	P	194	55	0.000
	C	91	11	
CHOL in mg/dl	P	190	41	0.000
	C	161	12	
TG in mg/dl	P	130	37	0.011
	C	114	21	
HDL_C in mg/dl	P	51	13	0.000
	C	70	5	
LDL_C in mg/dl	P	123	34	0.000
	C	73	10	
AMY in U/L	P	29	5	0.000
	C	59	10	

There was a large negative correlation between duration of diabetes and amylase activity in the patients of this study. (r =- 0.533, P= 0.008).

There were small positive correlation between duration of diabetes with CHOL (r = 0.256, P = 0.086), TG (r = 0.275, P = 0.06), LDL (r = 0.278, P =0.062) and HDL(r = 0.228, P = 0.127) (Table-2), (Figure-1).

Table-2: correlation of diabetic duration and amylase activity with biochemical parameters

	Duration		AMY	
	r	P-value	r	P-value
FBG	0.385**	0.008	-.608**	0.000
CHOL	0.256	0.086	-0.258	0.083
T.G	0.275	0.06	-0.226	0.131
LDL	0.278	0.062	-0.313*	0.034
HDL	0.228	0.127	-0.011	0.940

*. Correlation is significant at the 0.05 level
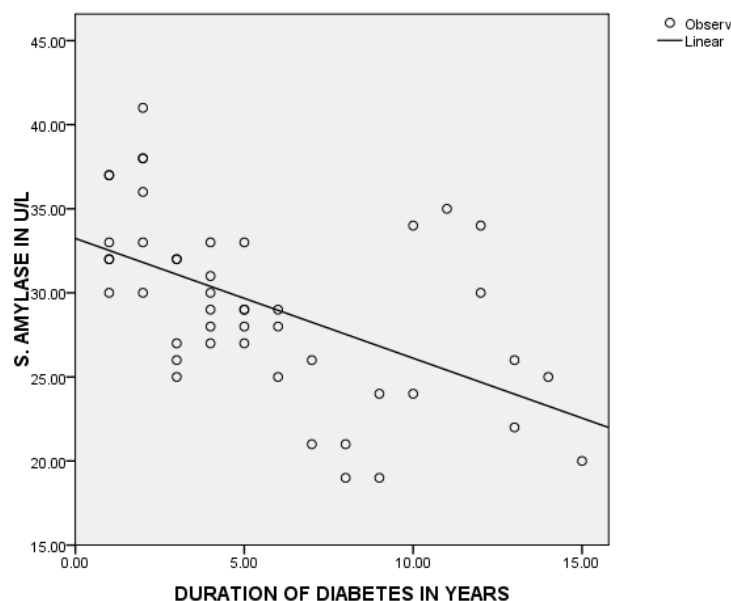**. Correlation is significant at the 0.01 level

Fig-1: Correlation of AMY activity with duration of diabetes (r = -.533, P = 0.008)

The correlation of the amylase activity with FBG reflected large negative correlation (r= - 0.608, P=0.00), but the triglycerides, total cholesterol and the HDL in the diabetic group was insignificantly correlated [(r=- 0.226, P=0.131), (r=-0.258, P=0.083) and (r=-0.011, P=0.940) respectively]. On the other hand, the LDL levels have significantly small negative correlation (r=-0.313, p = 0.034) Table-2.

DISCUSSION

There were many studies conducted to link the exocrine endocrine pancreatic function in diabetic patients. At this study we evaluated amylase activity and lipid profile to reflect this relationship.

The low amylase activity in diabetic patient as compared to healthy control (P = 0.000) may reflect an affected endocrine-exocrine axis of the pancreas. This is in agreement with [7, 4, 6] who observed a decrease of amylase activity in similar research.

In our study we also found large negative correlation between amylase activity and diabetic duration (r=-0.533, P=). This finding was in agreement with [6].

Previous studies showed pictures of dyslipidemia in diabetic patients. In our study we found significant elevation in total cholesterol, triglyceride and LDL and a significant reduction in HDL in diabetic patent compared to control. These findings may be due to impairment in lipoprotein lipase activity, and reduction in HDL (act as substrate to hepatic lipase similar result were found by [4, 16].

CONCLUSIONS

It was concluded that in Sudanese with type 2 diabetes mellitus, the serum amylase activity was found to be significantly lower than in the healthy controls and negatively correlated with blood glucose level, duration of the disease and lipid profile. This finding reflected an affected endocrine-exocrine axis of the pancreas.

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