Serum α–Amylase Level in Sudanese Patients with Long Standing Diabetes Mellitus Type 2 in Khartoum State, Central Sudan

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Abstract

Objectives: To evaluate and correlate the serum activity of α-amylase in Sudanese patients with type 2 long standing diabetes mellitus.

Methodology: This is a descriptive, cross- sectional, hospital based, case- control study was done in fifty patients (twenty male &thirty female) above forty yearswith long period diabetes mellitus type 2 referred to Jabber Abu ElizDiabetes Center and Bahri Diabetes Center in Khartoum state in central Sudan within six months. Thirty healthy volunteers with matching age and sex and socioeconomic status were included. Data was collected through, clinical evaluation form, questionnaire, and laboratory investigations. Serum concentrations of α- amylasewere measured by spectrophotometer and t test and correlation were used in statistical analysis for the comparison between test and control group for example: control group.

Results: The result showed a significant difference between the mean of serum α- amylase of the control group compared with that of the test group (Mean ±SD): (39.83±9.0) versus (32.22±13.5) U/L respectively, ($P<0.05$). Also, there wasa significant positive correlation between the levels of α- amylase and the duration of diabetes mellitus. Correlation coefficient (r) = ($r = 0.27$, $P= 0.000$) for example: 0.0000.

Conclusion: From this study it was concluded that; the diminution of the serum levels of α- amylase could be part of the exocrine pancreatic insufficiency since α- amylase activity decline correlated well with the duration of long-standing type 2 Diabetes Mellitus.

Keywords: *α-amylase, Diabetes Mellitus, Pancreas exocrine Insufficiency.*

Introduction

Diabetes mellitus is a common metabolic disease that is characterized by mis regulation of blood glucose levels leading to hyperglycemia[1][2]. The disease affects millions of people worldwide and the number of people affected by diabetes is increasing[3]. The prevalence of diabetes is high among Middle Eastern and North African countries with frequencies between 4% and 10%[4] [5]. Diabetes is associated with several complications that include renal deteriorations, retinopathy leading to vision disturbance, nerve damage and predisposition to cardiovascular diseases. Globally, the statistics are

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staggering. Diabetes is the third leading cause of death in the United States after heart disease and cancer[5].

Type 2 diabetes was previously called non–insulin dependent diabetes mellitus or adult-onset diabetes because the peak age of onset is usually later than type 1 diabetes. In adults, type 2 diabetes accounts for about 90% to 95% of all diagnosed cases of diabetes. Type 2 diabetes usually begins with insulin resistance, a disorder in which the cells primarily within the muscles, liver, and fat tissue do not use insulin properly[6].

Since the tight control of enzyme activity is essential for homeostasis, any malfunction (mutation, overproduction, underproduction or deletion) of a single critical enzyme can lead to a genetic disease. The importance of enzymes is shown by the fact that a lethal illness can be caused by the malfunction of just one enzyme out of the thousands of enzymes present in our bodies[7].

α- amylase is marked increase (five to 10 times the upper reference limit) in acute pancreatitis; severe glomerular impairment; severe diabetic ketoacidosis and moderate increase (up to five times the upper reference limit) in acute abdominal disorders as perforated peptic ulcerand salivary gland disorders, Mumps, salivary calculi and myocardial infarction (occasionally),renal failure — due to reduced excretion[7].

There is a significant reduction in pancreatic outputs of amylase, trypsin, chemotropism, and to a lesser degree, bicarbonate in patients with long standing type 2 diabetes mellitus. Clinical evidence of disease of the exocrine pancreas was missing. There was no discernible relationship between the abnormality of external pancreatic function and the duration of diabetes mellitus[6].In Type 2 diabetes mellitus, there are defects in secretion and signaling of insulin. These defects may also affect the exocrine pancreatic activity [7].

Materials and Method

Setting and participants: This study was carried out in Khartoum state in central Sudan. The subjects were selected in Khartoum city randomly. The data obtained from different sites in Khartoum city: Khartoum and Khartoum north (Bahri). The study was conducted for three months.

Fifty patients (Twenty male &Thirty female) above forty years with long standing diabetes mellitus (more than ten years), were selected after taking their consent. Each volunteer in this study was asked to come to Jabber Abu Eliz Diabetes Center in Khartoum and BahriDiabetes Center for medical assessment and sample collection. Thirty healthy subjects (Twelve males, eighteen females) were selected as a control group who were age, sex and socioeconomic status matched to the diabetic group (test group) Clinical data was obtained from the patient's history and recorded on a questionnaire sheet. Clinical assessment of the study group was done by a medical doctor and they were not suffering from acute pancreatitis orsalivary gland disorders which leaded to increaseα- amylase level.

Data collection Procedure: After informed consent, venous blood sample (5 ml) was collected from the study subjects. After blood clotting, the samples were centrifuged within 20 minutes after collection at 3000 rpm for 5 minutes and the sera were stored -20°C until analysis. The serum was allowed to reach the room temperature and α- amylase specific activity was measured spectrophotometrically in the direction of 2-chloro–4-nitrophenol formation at 405 nm wavelength using α- amylase kits from Biosystem Company Costa Brava, 30, Barcelona (Spain).

Quality control: Control serum of known α-amylase value was used to verify the performance of the measurement procedure.

Statistical analysis: The data collected in this study were analyzed by using SPSS computer program package. The mean and standard deviations of α-amylase were used to compare between the test group and the control group. The P values were obtained using the (t) test. Correlation between the serum levels of α-amylase and the duration of the disease were tested using Pearson correlation. Pvalues<0.05 were considered to be statistically significant Pvalues<0.01 were considered highly significant.

Observation and Results

Serum α- amylase: The following table shows a significant difference between the mean of serum α-amylase of the control group compared with that of the test group (Mean ±SD): (39.83 ±9.0) versus (32.22 ± 13.5) U/L, (P<0.05).

Independent sample t-test was used for comparison.

Table 1. Comparison of the means of serum α- amylase of the control group and the test group.

Variable	Control group Non-diabetic n=30	Test group Diabetic n=50	P value
Serumα- amylase (U/l) Range	39.83 ± 9.0 (20 - 98)	32.22± 13.5 (18 - 82)	< 0.05

The table shows the mean ± SD, range in brackets () and probability (P).

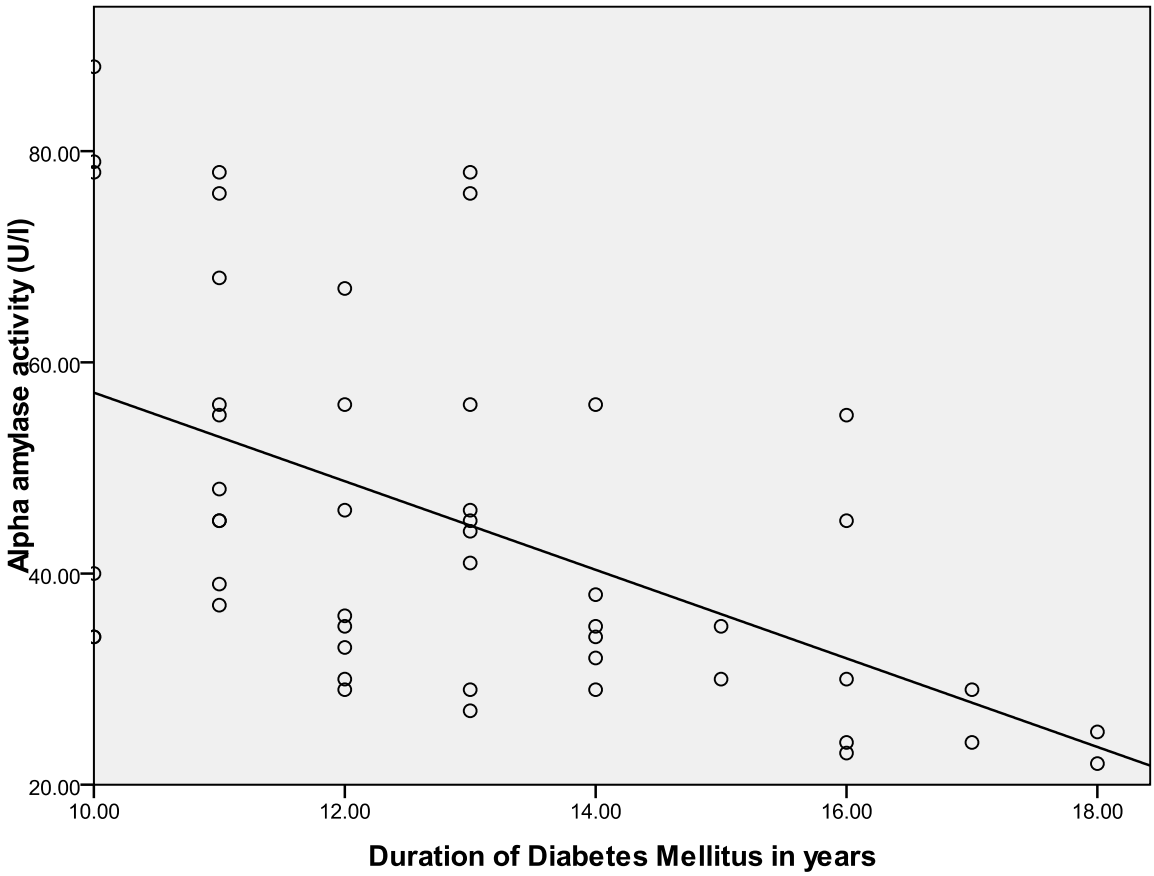

Figure 1. A scatter plot shows correlation between the serum α-amylase levels and duration of the disease (r = 0.27, P= 0.000).

Discussion

In Sudan, there were a great number of published study regarding diabetes mellitus but infrequent related published data regarding the serum levels of α- amylase enzyme in Sudanese with long standing type 2 diabetes mellitus, so this study have a tendency to compare the results with that obtained in other previous studies in none Sudanese people.

This study showed a significant difference between the mean of the serum levels of α- amylase of the test group when compared with that of the control group, the mean of the test group is significantly reduced as shown in table 1(P<0.05). This may be due to the effect of long-standing type 2 diabetes mellitus on pancreatic exocrine function. The above results agree with a study done by Matteo Piciucchi et al.[8] who were found a significant reduction in pancreatic outputs of amylase, trypsin, chemotropism, and to a lesser degree, bicarbonate in patients with long standing type 2 diabetes mellitus. Clinical evidence of disease of the exocrine pancreas was missing.

Also, there was a significant positive correlation between the serum levels of α- amylase and the duration of the disease (in years). (Figure 1) and this may be by reason of enzyme utilization in carbohydrates digestion

and to the pancreatic exocrine insufficiency. In a study done by Vishwanath, et al. [9]on patients with long standing diabetes mellitus, they found that the reduction in serum amylase in type 2 diabetes was more in patients with longer duration of illness (59%) and in patients with low serum insulin values (79%). 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.

Conclusion

This study concluded that the serum activity of α- amylase is reduced in patients with long standing diabetes mellitus type 2 with a considerable constructive correlation with the duration of the Diabetes Mellitus. The repercussion that; analysis of serum pancreatic enzymes could be supplementary informative parameter for the reflection of chronic and progression of the disease.

Conflict of Interest: The author(s) declared no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

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Ethical Clearance: Researchers had care of ethics required in research as this study was completed in accordance with the Helsinki Declaration. Written informed consent was obtained from all subjects before the data collection of the study.

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References

1. Galindo RJ, Fayfman M, Umpierrez GE. Perioperative management of hyperglycemia and diabetes in cardiac surgery patients. Endocrinol Metab Clin North Am. 2018;47(1):203.
2. Umpierrez GE, Bailey TS, Carcia D, Shaefer C, Shubrook JH, Skolnik N. Improving postprandial hyperglycemia in patients with type 2 diabetes already on basal insulin therapy: R eview of current strategies. J Diabetes. 2018;10(2):94–111.
3. Han K, Yao J, Yin X, Zhao M, Sun Q. Review on the prevalence of diabetes and risk factors and situation of disease management in floating population in China. Glob Heal Res policy. 2017;2(1):33.
4. Alotaibi A, Perry L, Gholizadeh L, Al-Ganmi A. Incidence and prevalence rates of diabetes mellitus in Saudi Arabia: An overview. J Epidemiol Glob Health. 2017;7(4):211–218.
5. Sherif S, Sumpio BE. Economic development and diabetes prevalence in MENA countries: Egypt and Saudi Arabia comparison. World J Diabetes. 2015;6(2):304.
6. Ma RCW. Epidemiology of diabetes and diabetic complications in China. Diabetologia. 2018;61(6):1249–1260.
7. Chathurika W, Vidanarachchi JK. MICROBIOLOGICAL CHANGES DURING PROCESSING AND SHELF LIFE IN ULTRA HIGH TEMPERATURE MILK. In: 7 th YSF SYMPOSIUM. 2018: 34.
8. Piciucchi M, Capurso G, Archibugi L, Delle Fave MM, Capasso M, Delle Fave G. Exocrine pancreatic insufficiency in diabetic patients: prevalence, mechanisms, and treatment. Int J Endocrinol. 2015;2015.
9. N S, L. Vishwanath H, C L. Biochemical analysis of serum amylase and lipase in patients with type 2 diabetes mellitus. Int J Clin Biochem Res. 2019;6(1):121–125.