RESEARCH ARTICLE   **OPEN ACCESS**

Biochemical changes in saliva and blood of diabetic patients

Kalsoom Zaigham[1], Khawar Ali Shahzad[1, 2], Abdul Razzaq1, Muhammad Moeez[1], Muhammad Zaigham Javed[1]

[1]Institute of Molecular Biology and Biotechnology, The University of Lahore, Lahore 54000, Lahore, Pakistan
[2] Department of Microbiology and Immunology, Southeast University, Nanjing 210009, China

Abstract
Owing to the contribution of serum derived components into whole saliva. It is hypothesized that the changes in serum composition caused by diabetes would be reflected in whole saliva. The present study was therefore aimed to evaluate the biochemical changes in blood and saliva of diabetic patients. For this purpose total 50 blood samples were collected (25 from diabetic patients and 25 from healthy individuals) from Jinnah Hospital Lahore, Pakistan. Total 50 samples of saliva were also collected with the same ratio. The serum from the blood samples was separated by centrifugation at 3000 rpm for 10 minutes. Serum and saliva was then analyzed for biochemical changes viz estimation of serum calcium, phosphate, total protein, alkaline phosphatase and salivary calcium, phosphate and amylase. Outcomes revealed that in diabetic parent's metabolism of minerals (calcium and phosphate) get altered significantly. In diabetic condition, phosphate decreased in blood and saliva with reduction in amylase levels while other biochemical changes were found insignificant. It was suggested that saliva tests can be used to evaluate the diabetes and oral health in diabetic patients.
Keywords: Diabetes, alkaline phosphatase, calcium, phosphate, amylase, oral health.

To cite this manuscript: Zaigham K, Shahzad KA, Razzaq A, Moeez M, Javed MZ. Biochemical changes in saliva and blood of diabetic patients. Biomed Lett 2016; 2(1):46-48.

Introduction

Diabetes is a group of metabolic disorder characterized by an inability to produce sufficient insulin resulting in alteration in metabolism. Type 1diabetes is caused by a deficiency in insulin secretion due to the loss of pancreatic β cells, and the disease requires life-long treatment with exogenous insulin. Without the body's own insulin production the body loses its ability to utilize carbohydrates as an energy source. Diabetes mellitus type 2 is a non-insulin dependent diabetes mellitus. It is a metabolic disorder that is characterized by high blood glucose level. Type 2 diabetes is far more common and results from a combination of defects in insulin secretion and insulin action [1]. The association between diabetes and mineral metabolism has been extensively investigated, despite this several mechanisms contribute to disturbed mineral metabolism [2]. Impaired insulin, sustained hyperglycemic state, IGF-1 concentrations affects bone tissue mass and mineral metabolism in diabetic condition [3]. Cohort studies revealed that diabetic patients (with both type 1 and type 2 disease) have a higher risk for bone desorption and oral problems due to altered mineral metabolism [4] although the association of trace elements with health and disease has already been established, but relationship between mineral metabolism and the complications

of diabetes mellitus is still a subject of intensive debate [5]. The present study was therefore conducted to investigate the biochemical changes in saliva and blood of diabetic patients.

Materials and Method

This prospective, descriptive and analytical study was conducted on 25 individuals of diabetes mellitus disease as samples and 25 normal healthy donors as control group. Total protein, calcium, phosphate and alkaline phosphatase were estimated in the blood of diabetic patients and healthy individuals by enzymatic kit (Randox) method. In saliva, calcium, phosphate and amylase were analyzed by same method. Mean of statistical values were calculated with standard deviation. Data obtained was be analyzed on SPSS 16 version by applying t-test.

Results

Estimation of biochemical changes in blood

The mean serum calcium level was recorded as10.92 mg/dl ± 0.63 in diabetic patients while in normal individuals the mean value of calcium level was observed as 9.03 mg/dl ± 0.605. Significantly (p < 0.05) increase levels of serum calcium were observed in diabetic patients as compare to healthy individuals. Mean serum phosphate level was measured as 4.46

mg/dl ± 1.01 in diabetic patients and in normal individuals the mean value of serum phosphate level was 4.85 mg/dl ± 0.66. Insignificant (p > 0.05) reduction of serum phosphate was observed in diabetic patients as compare to individuals of control group.

Mean serum total protein level was measured as 7.23 g/dl ± 0.71 in diabetic patients. In normal individuals the mean values of serum total protein level were 6.83 g/dl± 0.68. Insignificant (p > 0.05) increase levels of serum total protein were observed in diabetic patients as compare to healthy individuals. The mean serum alkaline phosphatase level was recorded as 124.63 (U/L) ± 32.70 in diabetic patients while in normal individuals the mean value of serum alkaline phosphatase level was 108.45 U/L ± 22.31. Insignificant (p > 0.05) rise in serum alkaline phosphates level was observed in diabetic patients as compare to healthy individuals (**Table 1**).

Table 1: Estimation of biochemical changes in blood

Parameters	Group 1		Group 2		P-Value
	Healthy Individuals		**Diabetic Individuals**		
	Mean ± SD	**S.E**	**Mean ± SD**	**S.E**	
Calcium (mg/dl)	9.03 ± 0.605	0.18	10.92 ± .63	0.19	0.00
Phosphate (mg/dl)	4.85 ± 0.66	0.2	4.46 ± 1.01	0.30	0.92
ALP (U/L)	108.5 ± 22.3	6.7	124.6 ± 32.7	9.86	0.19
Total Protein (g/dl)	6.83 ± 0.68	0.20	7.23 ± 0.71	0.21	0.19

Estimation of biochemical changes in saliva

Mean salivary calcium level was found 8.33 mg/dl ± 1.33 in diabetic patients while in healthy individuals the mean value of salivary calcium level was 7.99 mg/dl ± 0.78. Insignificant (p > 0.05) increase in salivary calcium was observed as compare to normal healthy individuals. Mean salivary phosphate level was found to be 5.48 mg/dl ± 1.84 in diabetic patients while in healthy individuals the mean value of salivary phosphate level was 14.08 mg/dl ± 1.14. Significantly (p < 0.05) decrease level of salivary phosphate was observed in diabetic patients as compare to control group.

Mean salivary alpha amylase level was found 682.72 U/L ± 42.20 in diabetic patients while in normal individuals the mean value of salivary alpha amylase level was 853.90 U/L ± 51.25. Significant (p < 0.05) decrease level of salivary alpha amylase was observed in diabetic patients as compare to the healthy individuals (**Table 2**).

Table 2: Estimation of biochemical changes in Saliva

Parameters	Group 1		Group 2		P-Value
	Healthy Individuals		**Diabetic Individuals**		
	Mean ± SD	**S.E**	**Mean ± SD**	**S.E**	
Calcium (mg/dl)	7.99 ± 0.78	0.23	8.33 ± 1.67	0.5	0.546
Phosphate (mg/dl)	14.08 ± 1.1	0.34	5.84 ± 1.84	0.55	0.00
Amylase	853.9 ± 51.3	15.5	682.7 ± 42.2	12.7	0.00

Discussion

In present study, the biochemical changes in saliva and serum of diabetic patients were analyzed to evaluate the oral health of diabetic patients. In diabetic patients the insulin levels become high or low in serum and many other changes were also occur in minerals [6]. In present study the serum calcium, phosphate, total protein and alkaline phosphatase levels were analyzed. Salivary calcium, phosphate and salivary alpha amylase were also analyzed to measure the stage and condition of diabetes.

Overall, calcium levels in saliva and serum of both groups were studied and significantly (p< 0.05) high serum calcium levels were observed in diabetic. Outcomes were in line with the work of Lobna et al., (2008) [7] where they observed decrease serum calcium levels in diabetic patients. . Salivary calcium levels were raise in the present study but there was insignificant (p > 0.05) increase in salivary calcium levels in diabetic patients as compare to normal individuals. The outcomes were correlated with the study of Belazi et al., (1998) [8] where they observed increase calcium levels in saliva affecting the oral health of diabetic patients. The dental health of these patients was also affected due to disturbed mineral bone metabolism and the calcium level in saliva of diabetic patients was high. Insignificant (p > 0.05) reduction in serum phosphate levels were observed in diabetic patients. The outcomes were correlated with the work of Gayoum et al. (2008) [9]. Significant (p < 0.05) reduction in the level of salivary phosphate was observed in diabetic patients and the results were in line with the study of Jawed et al. (2010) [10]. .

Significant (p < 0.05) increase levels of serum total protein were observed in diabetic patients The outcomes were in line with the findings of Coronel et al. (2008) [11]. They studied the hypo- proteinemia in diabetic patients. Peritoneal protein loss was seen in diabetic patients and it was related to high membrane transport in these patients. The condition of high transport in diabetic patients could be a result of diabetic micro vascular lesions that cause permeability in the peritoneal and glomerular membrane. Increasing the protein content of the diet with a corresponding decrease in the carbohydrate content potentially was a patient empowering way of reducing the hyperglycemia present with type 2 diabetes mellitus [12]. There was a net increase in protein breakdown during insulin deprivation resulting in a net release of amino acids. Insulin exerted anti catabolic effect in insulin dependent

diabetes through the inhibition of muscle protein breakdown

Significant ($p < 0.05$) increase levels of serum alkaline phosphatase were observed in diabetic patients which was in line with the work of Zehra et al. (2007) [13]. Overall decrease levels of alpha amylase were observed in diabetic patients significantly ($p<0.05$). The outcomes were correlated with the work of Zine and Rabah, (2003) [14]. They observed low salivary alpha amylase levels in diabetic patients.

In present study, calcium and phosphate levels were comparatively analyzed in saliva and serum, with serum alkaline phosphatase and total protein in diabetic patients to evaluate the saliva analysis as an important indicator of progression of beta cells dysfunction which may serve as diagnostic criteria for diabetes and oral health of diabetic patients.

Conclusion

It was concluded from the outcomes of the present study that manifestation of diabetes significantly alters the mineral metabolism particularly of calcium and phosphate affecting the oral health of diabetic patient.

Acknowledgements

References

[1] Alberti G, Zimmet Z. For the WHO Consultation. Definition, diagnosis and classification of diabetes mellitus and its complications. Provisional report of a WHO Consultation. Diab Med 1998; 15:539–553.

[2] Carnevale V, Romagnoli E, D'Erasmo E. Skeletal involvement in patients with diabetes mellitus. Diabet/Metab Res Reviews 2004; 20 (3):196–204.

[3] McCarthy AD, Etcheverry SB Cortizo AM. Effect of advanced glycation end products on the secretion of insulin-like growth factor-I and its binding proteins: role in osteoblast development. Acta Diabetol 2001; 38:113–122.

[4] Yasuda S, Wada S. Bone metabolic markers and osteoporosis associated with diabetes mellitus. Clin Calcium 2001; 11(7): 879–883.

[5] Ugwuja E. I., Ugwu N. C., Aloke C., Idenyi J.N., Nwibo A.N., Ibiam U.A., Ezenkwa U.S. effects of glycaemic status on plasma levels of calcium, chromium, copper, iron, magnesium, selenium and zinc in diabetic rats. Int J Diabt Res 2012; 1(5):92-95.

[6] Vestergaard P. Discrepancies in bone mineral density and fracture risk in patients with type 1 and type 2 diabetes a Meta-analysis. Osteoporosis Int 2007; 18:427-444.

[7] Lobna M, Entessar S, Inas T. Altered bone metabolic markers in type 2 diabetes mellitus. J Tabiha Uni Medi Sci 2008; (2):104-116.

[8] Belazi M, Galli T, Drakoulakos D, Fleva A. Salivary alterations in insulin-dependent diabetes mellitus. J Paediatr Dent 1998; 8:29-33.

[9] Gayoum A, Abdel-Gayoum, Abdulla S, Musa. The affect glycemic control on serum lipid and calcium phosphate profiles in patient with type 2 diabetes mellitus. Egyptian J Biochem Mol Biol 2008; 27:89-92.

[10] Jawad M, Shahid SM, Shah AQ, Azhar A. Dental caries in diabetes mellitus: role of salivary flow rate and minerals. J Diab Its complications 2011; 25(3): 6-18.

[11] Coronel F, Cigarrán S, Herrero JA, Delgado J, Ramos F, Gomis A. Peritoneal protein losses in diabetic patients starting peritoneal dialysis: is there a relationship with diabetic vascular lesions? Adv Perit Dial 2008; 25(3):183-186.

[12] Gannon C, Nuttall FQ. Effect of a high-protein, low-carbohydrate diet on blood glucose control in people with type 2 diabetes. Diabet 2004; 53:2375-2382.

[13] Zehra B., Alptekin G., Nilufer B., Ayes C.Y., Neslihan B.T. and Nilgun G.D. Roziglitazone decreases serum bone specific alkalie phosphatase activity in postmenopausal diabetic women. J Clin Endocrine Metab 2007; 3(2):104-116.

[14] Zine K, Rabah K. Determination of Alkaline phosphatase activity in patients with different zinc metabolic disorders. Turk J Med Sci 2003; 33:387-391.