Table 4: Correlation coefficients between various parameters

Groups	*Parameters*	*Correlation coefficients (r)*	*Significance (p value)*
Normal subjects (Group II)	Mean blood glucose levels and mean salivary glucose levels	0.566	p <0.01 (HS)
	Mean blood glucose levels and mean colony forming units of *C. albicans*	0.3	p <0.01 (HS)
	Mean salivary glucose levels and mean colony forming units of *C. albicans*	0.618	p <0.01 (HS)
Controlled diabetics (Group IB)	Mean blood glucose levels and mean salivary glucose levels	0.43	p <0.01 (HS)
	Mean blood glucose levels and mean colony forming units of *C. albicans*	0.36	p <0.01 (HS)
	Mean salivary glucose levels and mean colony forming units of *C. albicans*	0.235	p >0.05 (NS)
Uncontrolled diabetics (Group IA)	Mean blood glucose levels and mean salivary glucose levels	0.3	p <0.05 (S)
	Mean blood glucose levels and mean colony forming units of *C. albicans*	0.347	p <0.05 (S)
	Mean salivary glucose levels and mean colony forming units of *C. albicans*	0.11	p >0.05 (NS)

observed that salivary glucose levels were higher in diabetic subjects than in nondiabetic subjects.[11] Similar results were also found in the study conducted by Panchbhai et al. confirming higher mean salivary glucose uncontrolled and controlled diabetics group than in the healthy nondiabetic group and the differences were highly significant (p <0.001).[12] The mean blood glucose levels in uncontrolled diabetics, controlled diabetics, and normal patients were (273.09 ± 54.15 mg/dL), (142.02 ± 31.17 mg/dL) and (94.32 ±12.53 mg/dL), respectively. The salivary glucose concentrations seem to correlate with the serum glucose concentration in the patients of diabetes mellitus as also indicated earlier by Amer et al.[13] Significant positive correlation was found by Shashikumar et al. between random fasting plasma glucose and salivary glucose in normal and uncontrolled diabetic subjects. This correlation is due to collection of whole mouth fluid in which the raised glucose levels are not only due to leakage across the basement membrane of major and minor salivary glands but potentially also from the gingival crevicular fluid.[1] The mean value of CFUs were 5033.33 ± 2821.11, 1065.45 ± 2182.34 and 611 ± 1382.02 in uncontrolled diabetics, controlled diabetics and normal patients respectively.A study conducted by Safia et al. also showed a higher frequency of candidal growth in diabetic patients.[9] A similar study conducted by `Khaled Abu Elteen also showed that positive yeast in 58.3% of diabetics compared with 30% in healthy controls. This is also in agreement with numerous previous studies which have all indicated that diabetes mellitus enhances candida colonization and proliferation.[10] Similar results were found by Jones et al.[14] and Kumar et al.[15] Safia et al. conducted a study in which they have concluded that the carriage rate of candida was significantly higher in diabetics subjects than in the controls.[9] Study done by Shashikumar et al. concluded that there was a positive correlation between salivary glucose and Candida CFU in overall study population confirming the results of Darwazeh and Kadir et al.[1,16]

The permeability of parotid gland basement membrane is higher in diabetes mellitus, causing raised percolation of glucose, amylase, and protein from the blood thus raising their levels in saliva. This membrane permeability is explained by diabetic membranopathy.[12] There is a controversy existing between the concentration of glucose in the sera and the salivary fluid. The poor correlation prevailing in diabetic patients could be due to many factors like glucose utilization by bacteria, oral retention of alimentary carbohydrates and release of carbohydrates from salivary glycoproteins.[17] Abikshyeet et al. formulated equations to predict fasting sera glucose levels and HbA1c percentage when fasting salivary glucose levels were known. However, accurate sera glucose levels could not be calculated by such equations in all the patients.[18] The other limitations of saliva in diagnosis as well as in the regular monitoring of diabetic patients includes numerous autoimmune inflammatory conditions like Sjogren syndrome and primary biliary cirrhosis, granulomatous conditions including sarcoidosis, degenerative diseases like amyloidosis, graft-versus-host disease, malignant conditions like lymphomas, infections including HIV/AIDS, hepatitis C, and salivary gland agenesis or aplasia apart from drug-induced xerostomia and the total solids seen in the saliva change to the extent of not being reliable for diagnostics as well as in the regular monitoring of the patients. Patients with salivary gland changes after radiation exposure in the head and neck area also pose such challenges.[17]

Conclusion

The present study founds a positive correlation between salivary glucose and blood glucose levels in diabetics and the saliva can be used as a noninvasive means to monitor glycemic status in diabetics. The CFUs of *Candida* has a positive correlation with blood glucose however the correlation between salivary glucose and CFUs of *Candida* is nonsignificant in the diabetic group and significant in the nondiabetic group. Therefore, this study concludes that salivary glucose can be used to assess the diabetic status of the patients and also can be used to detect new cases of diabetes. The candidal carriage is higher in patients with higher blood glucose. The direct correlation between salivary glucose and candidal carriage could not be drawn as the later depends upon several local and systemic factors.

Clinical Significance

Saliva offers some distinctive advantages, greater sensitivity, noninvasive and easy collection procedure. Also, can be collected anywhere, no trained personnel required, good patients cooperation and cost-effective. Hence can be used as noninvasive means to find glycemic status in diabetics.

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