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Original Research Article

Study of salivary electrolyte in type 2 diabetes mellitus patients of North Gujarat region of India

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ABSTRACT

Background: A lack of literature on the probable relationship between diabetes and salivary electrolyte. Therefore, present study aims to study of salivary electrolyte in type 2 diabetes mellitus patients of North Gujarat region of India.
Methods: The present cross sectional study was done on 60 subjects of diabetes mellitus (T2DM) and 60 subjects' non-diabetic healthy controls at Banas medical college and our hospital. The subject's demographic and anthropometric parameters were recorded; detailed history and clinical examination were performed in the entire cases. The saliva was collected in the fasting state during resting state. Salivary pH, flow rate, biochemical variables and electrolytes were analyzed. Data which was collected was statistically analyzed.
Results: Predominance of the T2DM subjects was in the age group of 41-45 years. Mean value for age ($p<0.05$), body mass index ($p<0.01$), waist- hip ratio ($p<0.05$), salivary Potassium ($p<0.001$), glucose ($p<0.001$), Chloride ($p<0.01$), bicarbonates ($p<0.01$) and sodium levels ($p<0.001$) were significantly higher in the T2DM subjects where as salivary pH ($p<0.01$), flow rate ($p<0.01$) and calcium level ($p<0.001$) were significantly lower in the T2DM subjects.
Conclusions: In our study, we conclude that significant variations were reported in salivary pH, flow rate and electrolyte variables between diabetics and non diabetics. Therefore, we suggested that estimation of salivary variables might be a cost effective and a non invasive choice for screening, diagnosis and monitoring of diabetes instead of blood.

Keywords: Diabetes mellitus, Salivary pH, Salivary flow rate, Salivary electrolyte

INTRODUCTION

Diabetes mellitus (DM) is a cluster of metabolic syndrome or syndrome-x characterized by hyperglycemia ensuing from defects in insulin secretion from β cell of pancreas, mechanism of insulin action, or can be together. More than ninety percent of individual with DM throughout globally have type 2 diabetes mellitus.[1] India is capital of diabetes mellitus in the world. This is being reached to beneath ten crores diabetics by the year 2035.[2] Diabetes is one in the midst of the most monetarily draining chronic non-communicable disease. The expenses for treatment increasing and the encumber it bears on family or entity finances and society makes it crucial to approach this disease in a more joint entirety.[3] In India, more than 50% of patients have deprived glycemic control and have vascular complications. Thus, there is an imperative require to build up novel therapeutic agents of diabetes without the progress and progression of complications on safety.[4] In addition, it has been illustrated that the salivary glands are also pretentious directly or circuitously. Data on oral health

complications which are linked with T2DM, which are frequently came across by physicians embrace xerostomia, tooth loss, gingivitis, periodontitis, odontogenic abscesses and soft tissue lesions of the tongue and the oral mucosa.[5] Numerous physiologic features participate to compromised salivary function in inadequately controlled T2DM. It has been associated with autonomic neuropathies, microvascular changes; hormonal imbalances and its amalgamation of these are accountable for salivary under function and dehydration in diabetics patients.[6] However, lack of literature on the probable relationship between diabetes and salivary electrolyte in Indian populations. Thus, the present study is undertaken to know the salivary electrolyte in type 2 diabetes mellitus patients of North Gujarat region of India.

METHODS

The present cross sectional study was carried out in the department of dentistry, general hospitals associated with Banas medical college & research institute Palanpur and our private dental clinic, Banaskantha, Gujarat, India, over period of 6 months from July 2021 to December 2021. All type 2 diabetes mellitus patients attending the OPD of the hospital during the study period were enrolled in the present study. Total 60 type 2 diabetes mellitus patients, age ranging 35 to 50 years, were selected for present study. 60 age and sex-matched healthy volunteers selected from the patient's entourage and health care professionals were incorporated in the control group. Subjects with any acute infirmity, any acute or complex chronic complications of DM were excluded from present study. The written informed consent was obtained from all participants before starts of study.

Demographic information was collected from all subjects by semi structured questionnaire. A detailed clinical history was taken such as age and sex, symptomatic, past history of hypertension and other endocrine disorders, any family history of diabetes, hypertension, dyslipidemia, liver disease, history of smoking, and history of alcohol consumption. Clinical examination was also performed, anthropometric measurement including height, weight, BMI, waist circumference, hip circumference, and waist to hip ratio were also measured. The waist circumference was measured at the mid-point between the lower border of the rib cage and the iliac crest, whereas the hip circumference was recorded at the widest point between the hip and buttock.

The saliva was collected from all subjects in the morning between 6 am to 8:00 am in the fasting state. Un-stimulated entire saliva was collected in vial by standardized spitting method, for 4-5 minutes. Salivary flow rate was measured and it was showed as milliliters per minute. All salivary samples were transported within half an hour and the salivary pH was instantly estimated by using glass electrodes of pH meter. All salivary samples were centrifuged at 4000 rpm for 4-5 minutes and the supernatants were collected and they were stored at -40 to 80 ˚C until further investigation. Biochemical parameters like salivary glucose and salivary electrolyte such as sodium, calcium, chloride, bicarbonates and potassium were analyzed using commercial available diagnostic kit by using a semi auto analyzer. The study protocol was approved by institutional ethics committee human (IEC-H).

Statistical analysis

Data was analyzed using Statistical Package for Social Sciences, version 20 (SPSS Inc., Chicago, IL). Results for continuous variables are presented as mean ± standard deviation, and unpaired student's' test was used for significant difference between two variables. Chi-square test and Fischer's exact chi Square test were used for the comparison of categorical variables and presented as percentage. The level $p<0.05$ was considered as significance.

RESULTS

Demographic characteristics are presented in (Table 1-2). The total of 120 subjects was included in this study. Total 60 subjects with diabetes mellitus 2 type (20 female, 40 male, mean age 41.63±4.30) included in study group and control group included 60 subjects (25 female and 35 male, mean age 39.98±2.32).

Table 1: Age wise distribution of subjects in both groups (n=102).

Age group (years)	Diabetic subjects N (%)	Non-diabetic subjects N (%)	Level of significance
35-40	10 (16.66)	20 (33.33)	p<0.05 As per Chi-square test
41-45	30 (50)	30 (50)	
46-50	20 (33.33)	10 (16.66)	
Total	60 (100)	60 (100)	

Table 2: Distribution of subjects according to gender.

Gender	Diabetic subjects N (%)	Non-diabetic subjects N (%)	Total N (%)	Level of significance
Male	40 (66.66)	35 (58.33)	75 (62.5)	p<0.05 As per Chi-square test
Female	20 (33.33)	25 (41.66)	45 (37.5)	
Total	60 (100)	60 (100)	120 (100)	

Total male subjects are 75 (62.5%) and female subjects are 45 (37.5%) in both groups. In our study, preponderance of the T2DM subjects was in the age

group of 41-45 years. Out of 60 subjects, 10 subjects are 35-40 years (16.66%), 30 subjects are 41-45 years (50%), 20 subjects are 46-50 years (33.33%).

Table 3: Anthropometric and salivary glands variables in the study participants.

Variables Studied	Non-diabetic subjects (Mean±SD)	Diabetic subjects (Mean±SD)	Level of significance
Age (years)	39.98±2.32	41.63±4.30	p>0.05
BMI (kg/m^2)	22.67±1.76	28.43±2.31	p<0.01
Waist-hip ratio	0.89± 0.01	0.97±0.03	p<0.05
Glucose (mg/dl)	5.10±0.52	19.43± 3.89	p<0.001
Salivary pH	7.10±0.05	6.89 ±0.32	p<0.01
Salivary Flow rate ml/min	0.76±0.4	0.42±0.04	p<0.01
Calcium(mEq/l)	7.12±0.4	5.12 ±0.11	p<0.01
Potassium(mEq/l)	18.95±0.61	29.55±1.73	p<0.001
Sodium(mEq/l)	5.21±0.21	18.43±1.72	p<0.001
Chloride (mmol/l)	16.21±2.32	21.68±2.69	p<0.01
Bicarbonates (mmol/l)	6.28±2.95	9.14±2.55	p<0.01

The anthropometric and salivary glands variables in the study population are shown in (Table 3). Differences between anthropometric and salivary glands variables between diabetic subjects (T2DM) and non-diabetic subjects were tested by Student independent *t*-test. Mean value for age (p<0.05), body mass index (p<0.01), waist-hip ratio (p< 0.05), salivary Potassium levels (p<0.001), glucose (p<0.001), chloride (p<0.01), bicarbonates (p<0.01) and sodium levels (p<0.001) were significantly higher in the T2DM subjects as compared to non-diabetic subjects where as salivary pH (p<0.01), flow rate (p<0.01) and calcium level (p<0.001) were significantly lower in the T2DM subjects when compared to non-diabetic Subjects. Salivary pH was observed to be significantly lower in diabetics as compared to that to non diabetics. Flow rate was significantly diminished in diabetics. The study results showed significantly increased levels of salivary glucose, sodium and potassium and decreased levels of calcium in diabetics

DISCUSSION

Several salivary variables are changed by metabolic, nutritional and neurological abnormalities, the hydration condition of an individual and by drugs such as anti-cholinergics, diuretics, anti-histaminics, anti hypertensives, etc.[7] Diabetes is connected with microvascular impediments and therefore, autonomic neuropathy, together of which might influence the salivary secretions.[8] Numerous studies which were finished on resting salivary pH expected a range of 5.5-7.9 in normal persons.[9] The pH of saliva is maintained by carbonic acid and bicarbonate system, phosphate system and protein system of buffers.[10] In our study showed a significant decrease in pH in diabetics in comparison with that in non diabetic subjects. Acidic pH was also reported in diabetic persons by M E Lopez et al., in their research and this was attributed to either the microbial activity or a decrease in bicarbonate, which had occurred along with the flow rate.[11]

Resting state of saliva is the combination of secretions which come in the mouth in the absence of exogenous stimuli. Normal resting entire saliva flow rates range from 0.3 to 0.5 ml/min, while hypo-salivation with symptoms of dry mouth appear in the range of 0.10 to 0.01 ml/min. Citric acid stimulated entire saliva flow rates are usually measured at 1.0 to 3.0 ml/min.[12] In this study salivary flow rate was significantly decreased in diabetics as compared to that in non-diabetics. The fact that the salivary flow rate was diminished in diabetics was in agreement with the results of numerous other studies also.[11,13] It can be clarified that the thirst and dry mouth traits of diabetics was associated to the deprived glycaemic control in diabetics, which in twist, was connected with augmented diuresis and fluid loss. This result was also evaluated by Cherry‐Peppers et al in his report on salivary flow rates, in subjects without diabetes and in subjects with well-controlled type II diabetes.[14]

In our study, outcome demonstrated that sodium and potassium were significantly increased in diabetics but that calcium was significantly decreased. Significantly elevated potassium concentrations were also observed by Ben Aryeh et al., in their studies on whole saliva of both T2DM and IDDM (insulin dependent diabetes mellitus) patients, in comparison to those in healthy controls.[15] The elevated potassium concentrations which were found in the diabetic patients may be due to either hyper aldosteronism or an impaired Na+-K+-ATPase activity, which lead to a changed transport of potassium in the salivary glands. However an accord was observed with regards to the potassium levels, conflicting consequences were observed for the calcium levels by Harrison et al.[16]

Entire saliva can be collected non-invasively and by persons with inadequate training. No particular equipment is required for its compilation. Diagnosis of a disease by doing the analysis of saliva is potentially valuable for children and older adults, since collection of the fluid is related with fewer conformity evils in

comparison to the collection of blood. Furthermore, the analysis of saliva seems to be a cost-effective move toward in the screening of huge populations.

Limitations

The present study has some limitations such as little sample size which vetoed to present study from arriving at conclusions on the changed in salivary variables in diabetic subjects. A bigger sample size would have facilitated to our study in establishing the association between fasting plasma glucose levels and a variety of salivary variables. In addition, HbA1c was not estimated in this study thus it would have been a value addition if the status of the glycaemic controls of the subjects it had been analyzed.

CONCLUSION

In our study, we conclude that significant variations in anthropometric, salivary pH, flow rate and electrolyte variables of saliva in T2DM subject, thus accentuating the reality that the salivary composition was not immediately a indication of the oral health condition of a subject, but also of one's systemic condition. Prospect studies can be performed on a bigger sample size, taking into description the several limitations. This would assist us in overwhelmingly establishing the role of saliva in the screening and diagnosis of diabetes, as substitute to blood.

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