AnOxident *balance*

Anti-oxidant, Glucose-barrier Technology

REVIEW OF CLINICAL PAPERS

EDITION TWO

Excess Salivary Glucose in Diabetes

1. SALIVARY FLOW RATE AND SALIVARY GLUCOSE CONCENTRATION IN PATIENTS WITH DIABETES MELLITUS INFLUENCE OF SEVERITY OF DIABETES.

Reuterving CO1, Reuterving G, Hägg E, Ericson T.

Abstract:

Eleven diabetics (eight with type I diabetes) aged 20 to 45 years underwent salivary investigations on two occasions, one to five months apart, during different metabolic control. Stimulated salivary flow rate showed a great inter-individual variation, and was not changed by improved metabolic control. Salivary glucose concentration was lower during the period of better metabolic control. In stimulated parotid saliva a positive correlation between glucose levels in saliva and blood was seen. A blood glucose threshold for glucose excretion at about 10-15 mmol/L might be present. There were no significant differences in pH, buffering capacity, total amount of protein, amylase, lysozyme, peroxidase or electrolytes (Na+, K+, Ca2+, PO42- and Mg2+) in the saliva between the two occasions of different metabolic control. In conclusion, the degree of diabetic metabolic control does not seem to be of major importance for salivary flow rate or composition in diabetics except for the salivary glucose concentration.

Source: *1987 Diabete Metab. 13(4), 457-462*

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2. SALIVARY CHANGES IN TYPE 2 DIABETIC PATIENTS.

Abd-Elraheem SE, El Saeed AM, Mansour HH 2017.

Abstract:

Objective:

This study was conducted to determine the effect of type 2 diabetes mellitus on salivary secretion of glucose, amylase and immunoglobulin A levels and also to find out if saliva could be used as a non-invasive method to monitor glycaemic control in type 2 diabbetes. This study was conducted on 40 human subjects. They were 20 males and 20 females, their ages ranged from 35 years to 64 years, and they were divided into two groups, the first group contained 20 diabetic patients. (10 males and 10 females, aged between 38 years to 64 years). the second was the control group which contained 20 healthy adults (10 males and 10 females, aged between 35 years to 60 years). They were age and sex matched. All studied group were subjected to clinical and laboratory investigation which includes post prandial blood glucose, HA1C, salivary glucose, salivary amylase, and salivary immunoglobulin A.

Results:

There was a highly significant increase in the level of post prandial blood glucose, HBA1C; Salivary glucose, Salivary amylase & Salivary immunoglobulin A in the diabetic group compared with the control group and there was a significant positive correlation between the post-prandial blood glucose and the salivary glucose in the diabetic group.

Conclusions:

These results suggest that diabetes influences the composition of saliva and that saliva can be used as a less painful, non-invasive biomarker for monitoring the blood glucose concentration in the patients with diabetes mellitus.

3. MIXED SALIVARY GLUCOSE LEVELS AND CANDIDAL CARRIAGE IN PATIENTS WITH DIABETES MELLITUS.

Darwazeh AM1, MacFarlane TW, McCuish A, Lamey PJ. 1991

Abstract:

The glucose concentration in unstimulated mixed saliva and serum was assayed and correlated with oral candidal colonization in 41 diabetics and 34 healthy control subjects. In diabetic patients, salivary glucose concentration was significantly higher than in the controls and was directly related to blood glucose concentration. Although the difference in the frequency and quantity of oral candidal isolation failed to reach significance between the two groups, diabetic patients who carried Candida intraorally had significantly higher salivary glucose concentrations than those in whom Candida could not be isolated.

Source: *J Oral Pathol Med. 20(6), 280-283.*

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4. GLUCOSE CONCENTRATIONS IN PAROTID FLUID AND VENOUS BLOOD OF PATIENTS ATTENDING A DIABETIC CLINIC.

Forbat LN, Collins RE, Maskell GK, Sönksen PH.

Abstract:

Measurements of the glucose concentration in venous blood and parotid saliva taken from 31 diabetics attending a diabetic clinic showed values ranging respectively from 3.9 to 19.1 mmol/l and 0.06 to 0.83 mmol/l (means 9.6 mmol/l and 0.32 mmol/l respectively). Linear regression of salivary glucose on blood glucose gave a simple correlation coefficient of 0.18 (NS). Since salivary glucose levels did not reflect blood glucose levels, the possibility of diabetics regulating their metabolic control by the non-invasive technique of monitoring salivary glucose concentrations is not possible.

Source: *1981 J R Soc Med. 74(10), 725-728.*

5. EFFECT OF SLEEP AND SALIVARY GLUCOSE ON GINGIVITIS IN CHILDREN.

Alqaderi H, Tavares M1, Hartman M, Goodson JM

Abstract:

It has been shown that inadequate sleep has deleterious effects on health by suppressing immunity and promoting inflammation. The aim of this study was to investigate the effect of sleep and salivary glucose levels on the development of gingivitis in a prospective longitudinal study of Kuwaiti children. Data were collected from 10-yr-old children (N = 6,316) in 2012 and again in 2014. Children were approximately equally distributed from 138 elementary schools representing the 6 governorates of Kuwait. Calibrated examiners conducted oral examination, self-reported sleep evaluation interviews, anthropomorphic measurements, and unstimulated whole saliva sample collection. Salivary glucose levels were measured by a florescent glucose oxidase method; values of salivary glucose ≥1.13 mg/dL were defined as high glucose levels. A multilevel random intercept and slope analysis was conducted to determine the relationship between sleep duration and gingivitis on 3 levels: within schools, among children, and over time. The outcome was the progression of the extent of gingival inflammation in children over time. The main independent variables were the number of daily sleep hours and salivary glucose levels. Other explanatory variables and confounders assessed were governorate, dental caries and restorations, and obesity by waist circumference (adjusted for snacking and gender). Gingivitis increased over time in children who had shorter sleep duration ($P < 0.05$). Salivary glucose levels >1.13 mg/dL predicted gingivitis ($P < 0.05$). Children who had more decayed or filled teeth had more gingivitis ($P < 0.05$). No significant association was found between gingivitis and obesity. The level of gingivitis was different among the 6 governorates of Kuwait. Additionally, there was a strong clustering effect of the observations within schools and among children across time. Longitudinal analysis of 6,316 Kuwaiti children revealed that shorter sleep duration and higher salivary glucose levels were both associated with increased gingival inflammation.

Source: *2016. J Dent Res. 95(12), 1387-1393*

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6. GLUCOSE ESTIMATION IN THE SALIVARY SECRETION OF DIABETES MELLITUS PATIENTS.

Abikshyeet P, Ramesh V, Oza N.

Abstract:

Aim:

Saliva is one of the most abundant secretions in the human body and its collection is easy and noninvasive. The aim of this study was to find a medium that can be used to diagnose and monitor diabetes. In this, saliva could play a major role. To substantiate the role of saliva as a diagnostic tool, we compared saliva samples with blood glucose and glycated hemoglobin (HbA(1c)) in healthy and diabetic subjects.

Materials & Methods:

Included in the study were 106 patients, newly diagnosed with type 2 diabetes mellitus and 15 healthy control subjects. The patients and control subjects were asked to come to the clinic in the morning, after an 8-hour fast. At that time, 5 mL of venous blood was collected, 2 mL of which was collected in an ethylenediaminetetraacetic acid (EDTA)-containing blood collection tube and sent for HbA(1c) estimation. Unstimulated saliva was collected from both groups as well. The saliva and sera from the blood samples were subjected to glucose estimation.

Results:

The correlation coefficient between serum glucose and salivary glucose in the control group was calculated and the r value was found to be 0.5216, which was statistically significant ($P < 0.05$). The correlation coefficient between serum glucose and salivary glucose in the patient group was also calculated and the r value was found to be 0.7686, which was highly significant ($P < 0.01$). Finally, the correlation coefficient between HbA(1c) level and salivary glucose in the patient group was calculated and the r value was found to be 0.5662, which was also highly significant ($P < 0.01$).

Source: *2012 Diabetes Metab Syndr Obes.;5, 149-154*

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7. SALIVARY GLUCOSE CONCENTRATION AND EXCRETION IN NORMAL AND DIABETIC SUBJECTS.

Jurysta C, Bulur N, Oguzhan B, Satman I, Yilmaz TM, Malaisse WJ, Sener A.

Abstract:

The present report aims mainly at a reevaluation of salivary glucose concentration and excretion in unstimulated and mechanically stimulated saliva in both normal and diabetic subjects. In normal subjects, a decrease in saliva glucose concentration, an increase in salivary flow, but an unchanged glucose excretion rate was recorded when comparing stimulated saliva to unstimulated saliva. In diabetic patients, an increase in salivary flow with unchanged salivary glucose concentration and glucose excretion rate were observed under the same experimental conditions. Salivary glucose concentration and excretion were much higher in diabetic patients than in control subjects, whether in unstimulated or stimulated saliva. No significant correlation between glycemia and either glucose concentration or glucose excretion rate was found in the diabetic patients, whether in unstimulated or stimulated saliva. In the latter patients, as compared to control subjects, the relative magnitude of the increase in saliva glucose concentration was comparable, however, to that of blood glucose concentration. The relationship between these two variables was also documented in normal subjects and diabetic patients undergoing an oral glucose tolerance test.

Source: *2009 J Biomed Biotechnol. 2009, 1 – 6*

8. SALIVA: A TOOL IN ASSESSING GLUCOSE LEVELS IN DIABETES MELLITUS.

Satish BN, Srikala P, Maharudrappa B, Awanti SM, Kumar P, Hugar D. 2014

Abstract:

Background:

Diabetes mellitus is a metabolic disorder affecting people worldwide, which require constant monitoring of their glucose levels. Commonly employed procedures include collection of blood or urine samples causing discomfort to the patients. Hence the need for an alternative non-invasive technique is required to monitor glucose levels. Saliva present in the oral cavity not only maintains the health of the oral cavity but plays an important role in diagnosis of cancers of the oral cavity, periodontal diseases, HIV, heart diseases etc. The aim of the present study was undertaken to correlate the glucose levels in saliva and blood of diabetic and healthy non-diabetic individuals and to determine the efficacy of saliva as a diagnostic tool.

Materials & Methods:

A total of 30 individuals of which 20 patients were diabetic patients and on medication and 10 patients were healthy non-diabetic individuals were included in the study. Blood and saliva were collected under resting conditions and were subjected to glucose estimation.

Results:

Salivary and blood glucose concentrations were determined in non-diabetic healthy individuals (n=10) and Type II Diabetes mellitus patients (n=20). Glycosylated haemoglobin A1c was also determined in both Type II diabetic patients and Control group and a significant correlation (r=0.73) and (r=0.46) was found between HbA1c and serum glucose concentrations in diabetic and control group respectively. A significant correlation (r=0.54) and (r=0.45) was found between fasting blood glucose and fasting salivary glucose for diabetic group and control group respectively. A positive correlation (r=0.39) and (r=0.38) was found between fasting salivary glucose and HbA1c for diabetic and control group respectively.

Conclusion:

These findings suggest that the saliva can be used in the assessment of the blood glucose concentration in diabetes mellitus patients.

Source: *J Int Oral Health. 6(2) :114-117.*

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9. A TENTATIVE MODEL FOR (D)-GLUCOSE TURNOVER IN HUMAN SALIVA.

Cetik S, Zhang Y, Hupkens E, Jurysta C, Malaisse WJ, Sener A. 2013

Abstract:

Objective:

The aim of the present study is to propose a tentative model for d-glucose turnover in human saliva. The whole saliva and the saliva from parotid and submandibular/sublingual glands were collected by use of the Salivette™.

Results:

The saliva glucose concentration was measured by the hexokinase method, saliva bacteria glycolysis by use of d-[5-(3)H] glucose, and the saliva ATP content by the luciferase method. The concentration of glucose amounted to 43.9±6.3 (n=29), 197.5±17.3 (n=29), 104.0±12.4 (n=27) μM in whole saliva, parotid saliva and submandibular/sublingual saliva, respectively. The rate of d-glucose utilization by oral bacteria at a physiological concentration of d-glucose in saliva (50μM) was estimated at 0.047±0.003 (n=11) nmol/min per 10(6) bacteria. Unstimulated salivary d-glucose turnover rate, as calculated from the amount of glucose secreted in saliva which comes from parotid and submandibular and sublingual glands represented 214.6±19.1%/min. In order for salivary d-glucose production to match bacterial utilization of the hexose, the total number of oral bacteria was estimated at about 2.0×10(9) bacteria, in fair agreement with previously published data.

Conclusion:

This study thus provides support for a tentative model for d-glucose turnover in human saliva.

Source: *Arch Oral Biol.;58(10), 1265-1270.*

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10. DECREASED SALIVARY GLUCOSE SECRETORY RATE: USEFULNESS FOR DETECTION OF DIABETIC PATIENTS WITH AUTONOMIC NEUROPATHY.

Marchetti P, Tognarelli M, Giannarelli R, Grossi C, Picaro L, di Carlo A, Benzi L, Ciccarone A, Navalesi R 1989

Abstract:

In this study we investigated whether the presence of diabetic autonomic neuropathy (DAN) leads to an altered composition of saliva. DAN was evaluated in 33 normal subjects and 31 diabetic patients by means of the Valsalva manoeuvre, R-R variation during deep breathing, heart rate response to standing and lying down and blood pressure response to standing. Salivary flow (ml/h), salivary glucose levels (mumol/l) and salivary glucose secretory rate (mumol/h) were measured in each subject. Twelve diabetic patients were positive for DAN. Salivary flow (13 +/- 2 ml/h) and glucose concentration (330 +/- 50 mumol/l) were not significantly lower in patients with DAN than in normal subjects (18 +/- 2 ml/h, 500 +/- 50 mumol/l) and diabetic patients without DAN (16 +/- 1.9 ml/h, 500 +/- 40 mumol/l). The salivary glucose secretion rate was significantly lower (P less than 0.02) in diabetic patients with DAN (4.2 +/- 1.0 mumol/h) than in normal subjects and diabetic patients without DAN (9.0 +/- 1.0 mumol/h and 8.0 +/- 0.9 mumol/h respectively). The test had a good sensitivity and specificity, and appeared to be particularly indicated in discriminating patients without DAN. It is suggested that the measurement of salivary glucose may represent a simple, quick and inexpensive method for the screening of diabetic autonomic neuropathy.

Source: *Diabetes Res Clin Pract. 7(3), 181-186.*

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