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Salivary Uric Acid And Catalase Levels In Diabetes

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KEYWORDS
; Diabetes mellitus ; Saliva; Uric acid Catalase

Abstract

Background: Diabetes Mellitus (DM) is a common progressive metabolic disorder. Cell and organ damage in diabetes mellitus contributes to oxidative stress reactions in diabetes, which is .associated with changes in antioxidant enzyme systems and total antioxidant capacity

Objective : The aim of this study was to analyse the uric acid and catalase levels in the saliva of .patients with type 2 DM and compare them with the healthy control group

.Methods: In this study, 20 patients with diabetes and 20 healthy individuals were evaluated Salivary antioxidants markers consisted of uric acid (UA) and catalase. Sialo Chemical analysis was performed with spectrophotometric assay. Values were obtained and all the statistical analyses .were conducted using SPSS software

Results : Salivary Uric acid (3.12 vs. 1.89 mg/dL) was significantly higher ($P < 0.001$) in patients with DM than healthy controls. Mean UA was approximately 1.7 times higher in diabetic patients than in healthy controls. The antioxidant enzyme catalase showed significantly lower values in the study group than the controls ((1214 vs. 9468.9 kat, $P < 0.001$), drastic reduction in catalase activity was seen in diabetic samples. The present study demonstrates that antioxidant levels in .saliva from diabetic patients exhibit significant differences compared to control samples

Conclusion: According to the findings of the current study, patients with type 2 DM showed some alterations in their salivary levels of uric acid and catalase which suggests that there is .increase in the oxidative stress levels

-: INTRODUCTION

Diabetes mellitus (DM), a chronic endocrine metabolic illness that affects both industrialised and developing nations, has spread globally. In 2011, there were 366 million cases of DM worldwide. There were around million instances in India alone, and by 2030, it is 61.3 possible that there would be 101.2 million cases ,worldwide. The need of the hour is for a different straightforward method of detecting and regularly monitoring hyperglycemia and other relevant markers of DM. Recently, saliva has started to draw a lot of attention as a tool for studying disease processes and .illnesses

,Numerous studies have shown that oxidative stress which increases free radical generation and causes DM-,related problems such retinopathy and nephropathy among others, is a significant factor. The body's antioxidant defence mechanisms aim is to reduce this harm. Enzymatic and nonenzymatic components make up the two main classes of the human antioxidant

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,system. Catalase (CAT), superoxide dismutase (SOD) and glutathione peroxidase are important enzymatic antioxidants. Superoxide radicals (O2-), which are extremely reactive, are broken down by the enzyme oxidoreductase SOD into O2 and H2O2, which are then .safely broken down into H2O and O2 by CAT ,Numerous macromolecules like albumin ceruloplasmin, and ferritin as well as low-molecular-weight substances like ascorbic acid, reduced glutathione (GSH), uric acid (UA), and bilirubin are examples of nonenzymatic antioxidants. Each of these works in concert to preserve or restore redox equilibrium. Nonenzymatic antioxidants are measured by their total antioxidant activity (AOA). AOA of human serum or plasma has been measured using a variety of techniques because it is challenging to .measure each antioxidant component independently Evaluation of a few specific antioxidant indices and AOA in healthy persons, as well as in cases of controlled and uncontrolled DM, may aid in improving .management of the condition

The goal of this study was to compare individuals with diabetes mellitus (DM) to healthy controls in order to .determine the oxidative stress levels in saliva

-: MATERIALS AND METHODOLOGY

This study was a case control study conducted on subjects reporting to Department of Oral Medicine and Radiology at a Dental Science Institute in South India during 2022 . Sample size estimation was done by finding out the mean difference between two groups and pooled Standard Deviation and applying it to a standard formula to find out the sample size. This resulted in the .sample size of 20 in each group

Control Group (Group I): 20 healthy subjects without .any oral and systemic diseases

Study Group (Group II): 20 subjects diagnosed clinically with type 2 diabetes mellitus with laboratory investigations for confirmation and with oral manifestations. The study group included subjects who were diagnosed with type 2 diabetes mellitus for more .than 5 years

Convenient sampling technique was used to recruit individuals under the control and the study groups. For both the control and the study groups, strict inclusion criteria were followed. Healthy subjects in the age group of 30 – 60 years and without any history of oral and .systemic diseases were taken as controls

Laboratory investigations were carried out to rule out undiagnosed type 2 diabetes mellitus. Subjects included in the Group I were not on any medications and did not have adverse oral habits like smoking, tobacco chewing .and alcohol consumption

The study group consisted of subjects in the age group of 30 – 60 years, clinically diagnosed with type 2 diabetes mellitus and confirmed with laboratory investigations. It included patients who were diagnosed with type 2 diabetes mellitus for more than 5 years and under oral hypoglycemic drugs. Subjects with oral manifestations of diabetes mellitus like burning mouth ,syndrome, candidiasis, dental caries, gingivitis ,glossodynia, lichen planus, neurosensory dysesthesias periodontitis, salivary dysfunction, taste dysfunction .and xerostomia were included in the study group

Subjects with history of any systemic diseases (other than type 2 diabetes mellitus) were excluded from the study. Pregnant and lactating women were also excluded from the study. Patients diagnosed with any malignancies were not included in the study. Subjects who were on any medications other than oral hypoglycemic drugs were excluded. Subjects with any other oral mucosal lesions other than those stated in .inclusion criteria were not considered for the study

Those patients who have adverse oral habits like smoking, tobacco chewing and alcohol consumption were omitted from the study. Each patient was thoroughly examined both intra orally and extra orally .under artificial light

Sample collection Informed consent was obtained from the patients included in the study. Ethical clearance was obtained from the institute. Detailed case history was recorded along with thorough examination of the oral .cavity

Saliva collection All salivary samples were collected .from patients 2 hours after food using spit technique Patients were asked to sit in the dental chair with head tilted forward and instructed not to speak or swallow any saliva. Then, they were instructed to spit in a sterile .graduated container every minute for 5–8 minutes Salivary sample represents whole mouth fluid (Major and minor salivary glands and gingival crevicular fluid).The collected sample was centrifuged at 3000rpm for 10 minutes, and the supernatant was collected and .stored at −20°C

-: RESULTS

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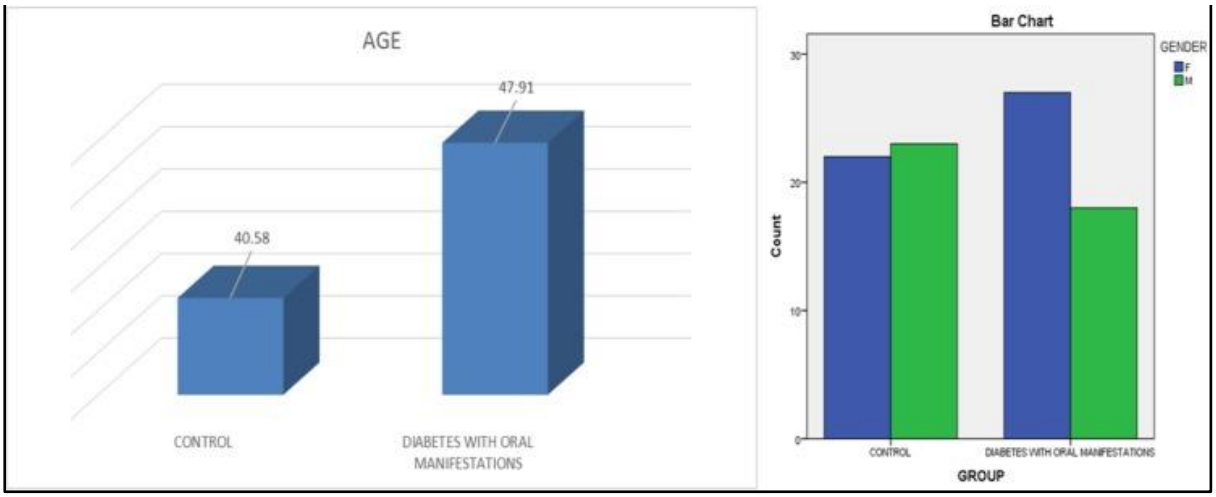

-:DISCUSSION

The present study demonstrates that uric acid and catalase levels in saliva from diabetic patients exhibit .significant differences compared to control samples

The term diabetes mellitus is derived from the Greek word for "siphon" that means "passing through ,(urine)", and the word mellitus is derived from Latin which means "honey". Diabetes mellitus means literally honey sweet urine')8(. The incidence of type 2 DM' varies substantially from one geographical region to another as a result of environmental and lifestyle risk .factors)2(

The rise in the prevalence of Type 2 diabetes mellitus (DM) is viewed as an urban phenomenon with large Indian cities showing four-fold higher rates than rural populations. In contrast, the prevalence of impaired glucose tolerance (IGT) and impaired fasting glycaemia (IFG), considered pre-diabetic, appears to be common in both urban and rural communities. The majority of people with Type 2 DM in developing countries are aged 45–64 years, in contrast to >65 years in developed countries. In a recent Indian survey, 56% of the individuals with Type 2 DM were diagnosed between and 59 years of age and 25% between 20 and 39 years 40 In our study, the mean age of the patients in the .(9) study group consisting of Type 2 diabetics with oral .manifestations was 47.91 years

Abnormally high levels of lipid peroxidation and the simultaneous decline of antioxidant defense mechanisms can lead to damage of cellular organelles and lead to oxidative stress. The antioxidant status of patients may determine whether they develop microvascular or macrovascular complications. Many medical researchers have found that the depletion of body chemicals called antioxidants may increase the .risk of complication from diabetes mellitus)10(

An antioxidant can be defined as "any substance that when present in low concentration compared to that of an oxidizable substrate significantly delays or inhibits the oxidation of that substance". Radicals have the capacity to react in an indiscriminate manner leading to damage in almost any cellular component. An extensive range of antioxidant defenses, both endogenous and exogenous, are present to protect cellular components from free radical induced damage (11). Superoxide dismutase (SOD) is widely distributed in oxygen-metabolizing cells and has been supposed to protect such cells against the deleterious action of superoxide .radical)12(

In this study, the mean serum Superoxide dismutase .level in healthy controls was 4.315 U/mg of Hb However, in subjects with Type 2 diabetes mellitus with oral manifestations, it was reduced to 2.833 U/mg of Hb which was significantly lower than the controls. This was in consistent with the studies conducted by Sundaram RK et al (13) and Rahbani-Nobar ME et al where they stated that in diabetic patients, the (14) autoxidation of glucose results in the formation of ,hydrogen peroxide which inactivates SOD. Therefore the accumulation of hydrogen peroxide may be one of the explanations for decreased activity of SOD in these patients. The primary catalytic cellular defense that protects cells and tissues against potentially destructive reactions of superoxide radicals and their derivatives is the Cu/Zn-SOD. It has been observed that SOD can be rapidly induced in some conditions when cells or organisms are exposed to oxidative stress. The low activity of SOD in diabetes mellitus may suggest that with longer disease duration, SOD induction and

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consequently its activity progressively decreases. In addition the nonenzymatic glycation which is the other cause for hydrogen peroxide production leads to further .inhibition of Cu/Zn SOD

Further, this study is consistent with studies conducted by Taheri E et al (16) and Sayed et al (17) in which the decrease of SOD activity was noticed. This could be :attributed to the following reasons

Hyperglycemia activates various biochemical .1 pathways such as glucose autoxidation, nonenzymatic .glycation of proteins and activation of protein kinase C ,This, in turn, overproduces oxidants like superoxide .hydroxyl radicals and hydrogen peroxide

The increase of glycosylated SOD that leads to the .2 ,inactivation of this enzyme. (3) Loss of its two factors .+Zn2+ and Cu2

Todate, salivary studies which have been documented in literature are very few. This study showed a significant reduction in SOD in Type 2 Diabetics with oral manifestations when compared to controls. The results are in accordance with the study conducted by Trivedi S et al (4). This study stated that the decreased SOD in the saliva of Diabetics might be a consequence of antioxidant depletion. The depletion of the antioxidant is attributable to ongoing free radical activity and breakdown of protective antioxidant species. The reduction in the activitis of SOD may be attributable to excessive oxygen radical production from autooxidation of glucose, glycated proteins and glycation of antioxidative enzymes, which limit their capacity to detoxify oxygen radicals. In the case of Diabetes Mellitus, there is ROS production, but the body is not adapted for the required antioxidant formation. Thus, the level of SOD decreases because of .enzymatic use

In this study, the correlations of Serum Superoxide dismutase with Salivary Superoxide dismutase in the two groups were analyzed. The Pearsons correlation analysis revealed good positive correlation between serum and salivary Superoxide dismutase in healthy subjects (r = 0.412), and very good positive correlation was observed between serum and salivary Superoxide dismutase in subjects with Type 2 Diabetes Mellitus with oral manifestations (r = 0.767). Thus, antioxidant parameter assessed in saliva of diabetic patients may be of great importance in evaluating the activity and severity of the disease. The findings of this study suggest the potential role of saliva as an adjunctive tool to monitor prognosis of diabetes mellitus. This study highlights that Type 2 diabetic patients undergo decline of antioxidant defence systems that leads to the .development of complications

In conclusion, saliva could be used as a reliable, non-invasive tool in the assessment of antioxidant levels which may give a substantial insight into the pathogenesis and evolution of diabetes mellitus. Saliva may be a valuable tool in evaluating the progression and .severity of diabetes mellitus

Further extensive studies are required to be conducted with larger samples along with antioxidant therapy. This will help in establishing the reliability of Superoxide dismutase in saliva as a potential biomarker of oxidative stress in diabetes mellitus. Further, it may also help in establishing the role of oxidative stress in the .pathogenesis of diabetes mellitus and its complications

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