

Estimation of Salivary Flow Rate in Myocardial Infarct Patients and its Association with Type II Diabetes Mellitus

BHUNESHA DEVI¹, SHAZIA AKBAR², AYESHA BASIT³, UZMA TARIQ⁴, SYED FARAZ MOIN⁵, SANA MUBARAK⁶

¹Assistant Professor, Oral pathology Department, Hamdard University Dental Hospital Karachi.

²Shazia Akbar Ansari, Professor, Department of Oral Pathology, Dow University of Health Sciences, Pakistan.

³Ayesha Basit, Associate Professor, Oral and Maxillofacial Surgery, Hamdard University Dental Hospital Karachi.

⁴Uzma Tariq, Assistant Professor, Department of Oral Pathology, Isra Dental Collage, Isra University Hyderabad.

⁵Syed Faraz Moin, Assistant Professor, National Center for Proteomics, University of Karachi, Karachi.

⁶Sana Mubarak, Senior Lecturer, Department of Oral Pathology, Baqai Medical University.

Corresponding author: Bhuneshha Devi, Email: bhuneshha.devi@gmail.com

ABSTRACT

Objective: The aim of our study was to investigate the association between salivary flow rate in diabetes mellitus and the development of coronary artery disease.

Methodology: A cross-sectional study was executed in the Cardiology Department of Civil Hospital Karachi. Unstimulated saliva was collected between 9 and 11 a.m. Participants were asked to refrain from eating and drinking for 1 hour before saliva collection. They were then instructed to collect 5 ml of unstimulated saliva in a 15 ml falcon tube for 10 minutes. Finally, the patient's oral hygiene status was recorded by a dentist. Data was entered in SPSS version 21. Descriptive analysis and significance of relationship was analyzed using chi-square test.

Results: Out of 100 myocardial infarct patients between the age range of 30-70 years, 71(71%) were male and 29 (29%) were female. Overall frequency of diabetes mellitus was 55%. Significant relationships were found between occurrence of myocardial infarction in diabetes mellitus, among salivary flow rate reduction and age of the patient, and salivary flow rate reduction and gender of patient. Salivary flow reduction below 3ml/10 minute was found in 48 diabetic patients whereas 11 nondiabetic patients had this clinical finding. No significant relationship was found between occurrence of caries and periodontitis with presence of diabetes.

Conclusion: Careful monitoring of the oral symptoms related to severity of DM particularly the salivary flow rate can be helpful in early diagnosis of patients at possibility of developing cardiovascular complications.

Keywords: Myocardial infarction, unstimulated saliva, Type II DM, Salivary flow rate.

INTRODUCTION

Saliva is regarded as an important investigative tool for both local and systemic diseases as, like blood, it contains the biological information in the form of essential molecules like DNA, RNA, and proteins¹. Because of the current advancements in the field of salivaomics, saliva is recognized as a group of organic markers covering from biochemical changes, nucleic acids and proteins to Microflora. Saliva has a massive capacity as a demonstrative oral bio-fluid to check general wellbeing of patient and has an advantage over different fluids because of easy collection technique and non-intrusive method². The minor and major salivary glands work constantly during awake and sleep time, in response to mechanical excitement as well as in response to autonomic stimulation³. Usually the normal salivary flow rate in a healthy person is about 0.3-0.5 ml/minute⁴. About 70% of the saliva is secreted from submandibular and sublingual glands, about 20% from the parotid gland whereas only 10% secretion from minor salivary glands⁵. The reduction in salivary secretion is thought to be due to age-related degenerative changes in the cellular structure of the submandibular and parotid salivary glands, including a 20% to 40% reduction in cell volume and a consistent expansion in fibroglandular tissue⁶. Many researchers have analyzed salivary flow rates with regards to cell maturation, but the outcomes are clashing. A few studies have testified reduced flow of saliva as the age increases and others reported no change. Saliva performs several important functions in maintaining oral and general health. Lubricating and cleaning teeth and oral mucosa, buffering effect keeps pH value neutral, protects teeth from demineralization, has antibacterial activity, preserves taste, helps bolus formation, initiates enzymatic decomposition of starch and important for chewing, swallowing and intonation⁷. Systemic conditions responsible for reduced salivary flow include Diabetes Mellitus, head and neck radiotherapy, drugs, rheumatologic diseases (Sjögren syndrome, rheumatoid joint inflammation, and systemic lupus erythematosus), Alzheimer's disease alcoholism, smoking, viral diseases (HIV/AIDS, HCV), fibromyalgia, host versus graft disease and sarcoidosis. Xerostomia is also connected to mental conditions like distress, depression, and nervousness⁸.

Diabetes mellitus is a metabolic disorder that is described as elevated blood glucose level. It is thought to pose a risk of coronary artery disease. Studies have shown that the risk of developing a myocardial infarction (MI) can be more than three times higher in patients with early-onset type 2 diabetes diagnosed up to 40 years of age⁹. In 2019, an estimated 463 million people had diabetes, representing approximately 9.3% of the world's adult population (20-79 years). That number is projected to reach 578 million (10.2%) in 2030 and 700 million (10.9%) in 2045. The frequency of diabetes in 2019 is calculated to be 9.0% in women, and 9.6% in men¹⁰. Oral complications of diabetes mellitus include periodontitis, dry mouth; delayed wound healing and burning sensation in the mouth¹¹. The aim of our study was to investigate the association between salivary flow and the development of coronary artery disease in patients with diabetes mellitus.

MATERIALS AND METHODS

This cross-sectional study was performed in the Cardiology Department of Civil Hospital Karachi during the period from June 6th till 31st October 2021 after ethical approval (IRB-1958/DUHS/Approval/2021). Informed consent was acquired from patients after explaining the goals and nature of research.

Inclusion criteria included patients reporting to the ER of the cardiology department and diagnosed to have Myocardial Infarction were part of the study, participants' age range was 30-70 years, and participants with Type 2 Diabetes Mellitus.

Exclusion criteria included participants with other possible causes of hyposalivation like cerebral paralysis, Sjogren Syndrome, Rheumatoid Arthritis, Myasthenia Gravis, chemotherapy, radiotherapy, Bell's paralysis, Syphilis, Tuberculosis, stomatitis, enlarged adenoids, viral infection, and Sialolithiasis were excluded from the study. Critical patients and those on ventilation were excluded from the study.

The unstimulated saliva was collected between 9 and 11 a.m. One hour before saliva collection, participants were requested to abstain from eating and drinking. They were then instructed to collect 5 ml of unstimulated saliva in a 15 ml falcon tube for 10 minutes. Finally, the patient's oral hygiene status was recorded by a dentist.

Data was entered in SPSS version 21. Descriptive analysis and significance of relationship was analyzed using chi-square test.

RESULTS

Out of 100 myocardial infarct patients between the age range of 30-70 years, 71(71%) were male and 29 (29%) were female. Overall frequency of diabetes mellitus was 55% (n= 55).

Significant relationship was found between occurrence of myocardial infarction in diabetes mellitus.

Table 1: Relationship of myocardial infarction with diabetes mellitus.

Patient's gender		Frequency	Percent	X ²	Sig.
Male	yes	35	49.3	157.128	.001
	no	36	50.7		
	Total	71	100.0		
Female	yes	20	69.0		
	no	9	31.0		
	Total	29	100.0		

Significant relationship was found between salivary flow rate reduction and age of the patient.

Table 2: Relationship of reduced salivary flow rate with age of patient.

		Age of Patient				Total	X ²	Sig.
		30-40	41-50	51-60	61-70			
saliva rate	.00	0	0	0	3	3	157.128	.001
	0-1ml	0	0	2	10	12		
	1-2ml	1	1	7	4	13		
	2-3ml	8	8	24	3	43		
	3-4ml	9	14	3	0	26		
	>4ml	1	2	0	0	3		
Total		19	25	36	20	100		

Significant relationship was found between salivary flow rate reduction and gender of patient.

Table 3: Relationship of reduced salivary flow rate with gender.

		Saliva rate					Total	X ²	Sig.
		.00	0-1ML	1-2 ML	2-3 ML	3-4ML			
Patient's gender	Male	3	5	4	32	13	14	51.115	.005
	Female	0	7	9	11	2	0		
Total		3	12	13	43	15	14		

Frequency of unstimulated salivary flow rate in diabetic and non-diabetic patients and significance of relationship.

Table 4: Frequency of unstimulated salivary flow rate in diabetic and non-diabetic patients and their significance of relationship.

		Saliva rate ml/10min						Total	X ²	Sig.
		.00	0-1ml	1-2ml	2-3ml	3-4ml	>4ml			
Diabetes	yes	2	9	17	20	5	2	55	42.802	.036
	no	1	3	0	7	21	13	45		
Total		3	12	17	27	26	15	100		

The relationship of occurrence of caries and periodontitis with diabetes mellitus was not found significant.

Table 5: Caries and Periodontitis in diabetic and non-diabetic patients.

		Diabetes		Total	X ²	Sig.
		Yes	No			
Caries status	Present	18	13	31	.170	0.680
	Absent	37	32	69		
Periodontitis		55	45	100	1.131	0.568

DISCUSSION

Diabetes mellitus (DM) is a known risk factor for cardiovascular disease, with diabetics having 2-4 fold higher risk of coronary artery disease than non-diabetics^{12,13}. In our study 49%, male participants and about 69% female participants were type II diabetic. This indicates that female diabetics have higher chances of developing coronary artery disease. A study conducted in United Kingdom in 2015¹⁴ also reported that females as compared to male are at greater risk of developing CVD. They suggested that it could be due to early diagnosis and active treatment in males whereas in female's upper limit of BMI level could play a part in causing endothelial dysfunction, hypertension, dyslipidemia, and abnormalities in fibrinolysis and thrombosis that add to cardiovascular disease risk. Another study suggested that in women, increased age, type II DM and BMI, socioeconomic status and smoking may all be collectively responsible for increasing risk of MI¹⁵. and above all psychosocial stress appears to have a higher impact on females than on men¹⁶.

While some study suggests that the flow of stimulated and unstimulated parotid saliva does not alter with age, other researchers contend that the flow of both types of saliva does

diminish with ageing.⁶ Our study found a significant association (p=.001) between reduced salivary flow rate and age of the patient suffering from myocardial infarction. 20 % of the patients above the age of 60 years were having low quantity of saliva below 3ml/10. According to Rebecca et al⁶ findings, the volume of cells decreases by 20% to 40% with age as a result of degenerative changes in the salivary glands, which also result in a decrease in salivary flow.

(Table 3) Out of 29 female participants in our study, 27 exhibited salivary flow rates below 3mL/min showing a significant relationship with the gender. Other researchers have suggested that lower gland sizes¹⁷, and postmenopausal¹⁸ abnormalities (reduced oestrogen), calcium and vitamin deficiencies, and a variety of psychological concerns during the menopause years are possible causes of diminished salivary flow rates in females. As a result, in our investigation, the gender connection with lower salivary flow rate could be connected to both DM and menopause.

Saliva is a complicated fluid secreted by hundreds of minor salivary glands and 3 major salivary gland pairs.⁷ Several drugs and medical conditions including Diabetes Mellitus can impair salivary gland function resulting in dry mouth sensation (xerostomia)¹⁹. Our study showed a significant association (p=.036) between salivary flow reduction and diabetic mellitus. Salivary flow reduction below 3mL/10 minute was calculated in 48 diabetic patients whereas 11 nondiabetic patients had this clinical finding. Many studies have suggested that reduction in saliva production is frequent in diabetic patients and as age progress²⁰. Microvascular and autonomic neuropathological changes associated with diabetes are held responsible for the reduction in salivary flow in these patients²¹. The researcher discovered a substantial difference between the rate of unstimulated saliva

among type 2 DM participants and controls in one case-control study that was carried out in India²². Possible reasons being lack of hydration related to elevated blood glucose that may raise osmotic elements inside the salivary glands and therefore reducing secretion. Additionally, type 2 diabetes can cause changes in the immune, cardiovascular, ocular, and renal systems, so the salivary glands can be affected both directly and indirectly²³.

Saliva plays a vital role in defense of oral tissues which are at higher risk of damage when salivary flow rate is reduced.¹⁸ Our study showed no significant association between the incidence of caries and periodontitis and the presence of diabetes. In contrast, Malik et al suggested the influence of duration of diabetes and socioeconomic status on the development of caries in such patients²⁵. In another study Bárbara Aranha Ribeiro²⁶ suggested that reduced salivary flow and altered salivary composition in diabetic patients may promote caries development. In contrast Priscilla et al reported significant relationship²⁷ Whereas Song et al²⁸ proposed that poor oral hygiene markers along with hyperglycemia may contribute to the development of cardiovascular events.

Limitation of our study was that we did not assess Glycosylated Hemoglobin levels of the patients which could be helpful in relating severity of diabetes to occurrence of myocardial infarction and decreased salivary flow rate.

CONCLUSIONS

Careful monitoring of the oral symptoms related to severity of DM particularly the salivary flow rate can be helpful in early identification of patients at risk of developing cardiovascular complications.

Conflict of Interests: No conflict of interests exists.

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