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Oral Hygiene and Hemoglobin in Connection with Glycosylated Haemoglobin and Comparison of Blood Sugar Levels from Capillary, Venous and Gingival Sites

Aafrin Shabbir, KH Noorul Ameen, NN Anand*

Department of General Medicine, Sree Balaji Medical College & Hospital Affiliated to Bharath Institute of Higher Education and Research, Chennai, Tamil Nadu, India

ABSTRACT

In the present study 100 type 2 diabetes mellitus patients were selected who were on regular treatment with oral hypoglycemic agents. The study population comprised of 100 patients out of which 67 were females and 33 were males. The patients selected were between 35 years to 60 years and the duration of diabetes ranged between 5 to 10 years. BMI was assessed and among the overweight and obese 74.4% are overweight and had very poor oral hygiene. 70% of patients above 40 years have poor oral hygiene. 77.27% of patients with a duration of diabetes of more than 5 years have poor oral hygiene. Poor oral hygiene can be taken as a factor for high glycated hemoglobin i.e., high blood sugar levels indicating poor glycemic control.

Key words: Anemia, Hemoglobulin, Diabetes, Uremia, Haemoglobinopathy

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Corresponding author: NN Anand

e-mail✉: anand.nn@bharathuniv.ac.in

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INTRODUCTION

Glycated haemoglobin (Hb) provides an accurate and objective measure of glycemic control over a period of 2 months. It is used to assess glycaemic control but is not sufficiently sensitive to make a diagnosis of diabetes [1,2]. The non-enzymatic covalent attachment of glucose to Hb (glycation) increases the amount in the HbAlc fraction relative to non-glycated adult Hb (HbA0). The rate of formation of HbAlc is directly proportional to the blood glucose concentration; a rise of 1% in HbAlc corresponds to an increase of 2 mmol/1 in blood glucose. HbAl c concentration reflects blood glucose over the erythrocyte lifespan (120 days) but is affected more by recent events [3].

HbAlc estimates may be erroneously diminished in anaerma and pregnancy and may be difficult to interpret uraemia and haemoglobinopathy [4]. In clinical practice, HbAlc is measured once or twice yearly to assess glycemic control and provides an index of risk for developing diabetic complications. Anemia is the most common blood disorder and a quite common finding in patients with diabetes or in patients having poor control of HBAlc [5,6]. Coagulation disorders, hematological changes may occur as a consequence of disease affecting any system, and measurement of hematological parameters is an important part of routine clinical assessment. Anemia refers to a state in which the level of hemoglobin (Hb) in the blood is below the normal range appropriate for age and sex. Other factors, including pregnancy and altitude, also affect Hb levels. The clinical features of anemia reflect diminished oxygen supply to the tissues. The symptoms of anemia will be more severe if the onset is rapid or if there is coexisting cardiorespiratory disease. According to the previous studies, about 25% of people with diabetes have some level of anemia, potentially contributing to pathogenesis of diabetic complication [7,8].

In anemia, there are fewer red blood cells than normal, resulting in less oxygen being carried to the bodies cell. People with anemia present

with tiredness and weakness and may have difficulty doing other regular activities. Other symptoms include paleness, poor appetite, dizziness, light headedness, tachycardia, pedal edema, low murmurs, tachypnea, and shortness of breath. These symptoms can also be associated with diabetes. Therefore, at times they are not recognized as anemia. Anemia may occur with poor control of glycated hemoglobin because the hormone that regulates the RBC production, erythropoietin (EPO) is produced in kidneys. Kidney damage at several level is a complication of diabetes and poor control of glycated hemoglobin. Changes in the kidney start as diabetic nephropathy and leads to chronic kidney disease. Early detection and treatment is essential to prevent or delay disease progression [9-10].

HbAlc is decreased (falsely low) with conditions that shorten red blood cell lifespan such as acute or chronic blood loss, hemolysis, sickle cell anemia, thalassemia's and hereditary spherocytosis. However, HbAlc is increased with conditions that increase red blood cell lifespan such as iron deficiency anemia, vitamin B12 deficiency, folate deficiency anemia or splenectomy. Prevention of anemia in people with poor control of HBA1C IS A MUST and patient should be recognized and treated, their blood sugar levels must be kept under control. Cholesterol and triglycerides should be in normal limits and treatment must be given if needed. Iron supplementation should be started, patients should be encouraged to take food rich in iron, folic acid and vitamin B [11-15]. If erythropoietin is reduced then anemia can be treated with EPO, usually injected under the skin two to three times a week the US Food and Drug recommends that patient treated with EPO therapy achieve a haematocrit between 30 to 36%. The relationship between diabetes and oral hygiene (peridonitis) may be the strongest of all connections between the mouth and the body. Inflammation that starts in the mouth weakens the body ability to control blood sugars leading to high glycated hemoglobin [16]. The trouble is more because of decreased insulin secretion in diabetic patients.

Periodontal disease is a chronic common oral inflammatory disease characterized by destruction of soft tissue and bone. There is increased prevalence of gum disease among those with diabetes.[14] Therefore severe gum diseases can be added to the list of complications associated with diabetes such as ischemic heart disease, cardiovascular accidents, diabetic nephropathy, diabetic neuropathy, etc., Not only people with uncontrolled HBAlc are more susceptible to serious gum disease but serious gum disease may have the potential to affect blood glucose control and contribute to the progression of high HBAlc. People with diabetes have higher risk of calculus formation, gingivitis, and also periodontitis. [16,17]. This is because these individuals are more susceptible to bacterial infection and have decreased and have decreased ability to fight bacteria that invade the gum. Like all infections, serious gum disease may be factor in causing blood sugar to rise and may make diabetes harder to control.

MATERIALS AND METHODS

Study design

The design of the present study is cross sectional. This study is aimed to observe the oral hygiene in Type2 Diabetes Mellitus in connection with HbAlC and comparison with the blood samples taken from gingival, venous and capillary sites.

Study area

Diabetic outpatients attending the Department of General Medicine, Sree Balaji Medical College and Hospital (Tertiary Care), Chromepet, Chennai, India.

Study period

July 2011 to August 2012.

Study population

This study was conducted in the Department of Medicine and Department of Diabetology, Sree Balaji Medical College, Chennai, Tamil Nadu. The Type 2 Diabetes patients were included based on the selection criteria. Out of 100 patients selected, there were 33 males and 67 females whose age was ranging from 35 years and above.

Inclusion criteria

Individuals were classified as having diabetes if any of the following criteria, adapted from 1997 American Diabetes Fasting glucose level of at least 7.0 mmol/1 (126 mg/dl) Non fasting glucose level of at least 11.1 mmol/1 (200 mg/

dl) Current use of anti-diabetes medication. Type 2 diabetic patients of duration more than 5 years. On oral hypoglycemic agents. Diabetic nephropathy ruled out. Normal renal function. Age more than 35 years.

Exclusion criteria

- ✓ Patients on insulin.
- ✓ Type 2 DM less than 5 years.
- ✓ Age less than 35.
- ✓ People with good oral hygiene.
- ✓ Patients with known renal diseases.

METHODOLOGY

A cross sectional study of 100 type 2 diabetic patients was done. A structural questionnaire was prepared and their height, weight was recorded and tested for blood sugar levels at various sites like gingival, venous and capillary. The patients HBAlc was recorded at the same time. Fasting and postprandial reading were taken for four consecutive weeks for all sites mentioned. While testing the gingival blood sugar levels, the oral hygiene of the individual was also assessed. Gingivitis, missing tooth, and calculus in individual were noted and recorded. All these tests were done with the help of glucometer and the venous sample and HBAlc was tested in the laboratory.

RESULTS

Results are explained in the form tables (Table 1 and Table 2) and figures (Figure 1 to Figure 4).

Table 1: Oral hygiene.

Category	N	%
Fair	30	30%
Poor	43	43%
Very poor	27	27%

Table 2: Correlation between HbAlc and oral hygiene.

Variable	Oral Hygiene	N	p-Value
HBAlc	Very Poor	27	0.381
	Poor	43	
	Fair	30	
	Total	100	

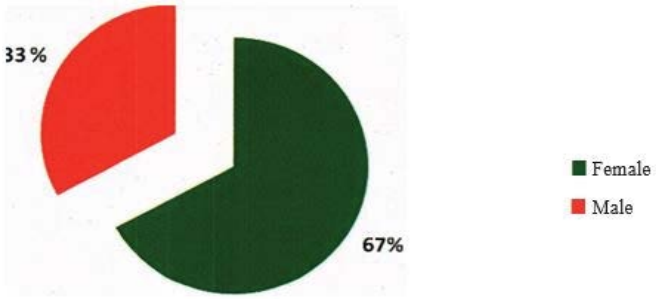

Figure 1: Age distribution.

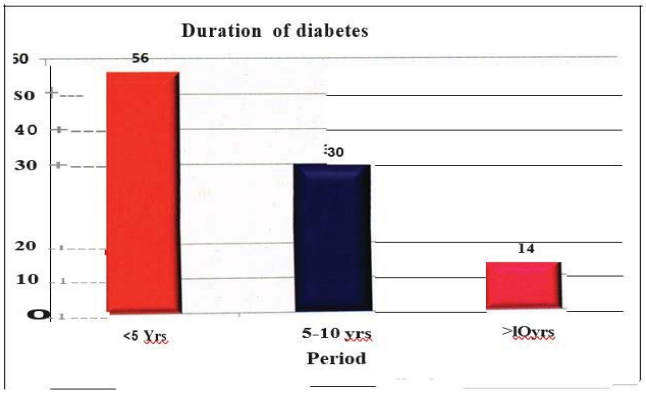

Figure 2: Illustrates duration diabetes among 100 patients.

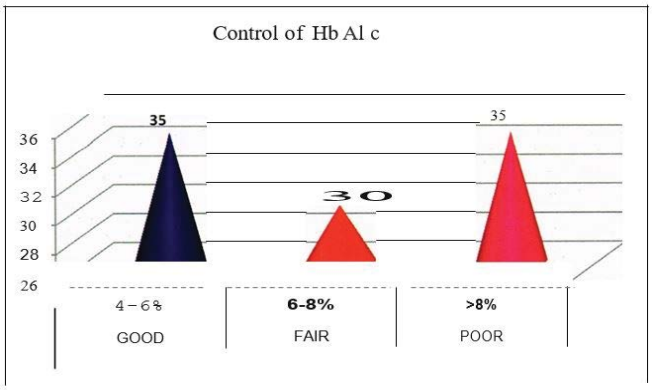

Figure 3: Shows the number of individuals and their diabetic controls.

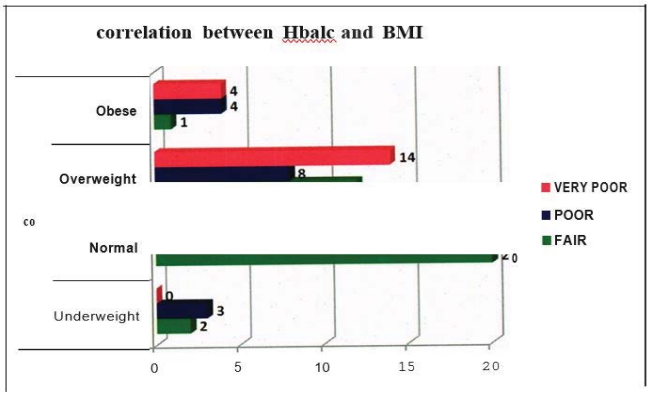

Figure 4: Correlation between HbAlc and BMI.

DISCUSSION

In the present study 100 type 2 diabetes mellitus patients were selected who were on regular treatment with oral hypoglycemic agents. The study population comprised of 100 patients out of which 67 were females and 33 were males. The patients selected were between 35 years to 60 years and the duration of diabetes ranged between 5 to 10 years. BMI was assessed and among the overweight and obese 74.4% are overweight and had extremely poor oral hygiene. 70% of patients above 40 years have poor oral hygiene [18]. 77.27% of patients with a duration of diabetes of more than 5 years have poor oral hygiene. 34.3% were overweight and were under fair control of HBAlc. 26.7% were overweight and were under poor control of HBAlc. 40% were overweight and under extremely poor control of HBAlc. The present study shows that overweight individual has a bad control of blood sugar levels as well as have poor oral hygiene [19]. It also shows that oral hygiene worsens with the duration of diabetes mellitus. According to the study it has also been clear that mild to moderate degree of anaemia exist among people who have poor control of HBAlc. 70% of patients with bad control of HBAlc had mild anaemia. And 25% of patients with bad control of HBAlc had moderate anaemia. Therefore, it is proved that Hb values were significantly higher when compared to persons with poor control of HbAlc. Therefore, poor control of diabetes was associated with anemia and HbA1c was increased with patients with anemia [20-23].

Moreover, it has also been noted in the study that majority of type 2 dm patients the mean capillary blood sugar is the highest in comparison to the mean values of venous and gingival blood sugar levels both at fasting and at postprandial testing. hence one can conclude with the above study that the capillary blood sugar measurement is a reliable method for emergency treatment as well as for the treatment of diabetes mellitus [24,25].

Thus, the present study has not only proved the correlation of anaemia with increased glycated haemoglobin but also proved that overweight and obese individual are at an increased risk of poor oral hygiene and their relationship with increased glycated hemoglobin [26]. Further study must be done in same patients

to know whether anemia directly contributes to the acceleration of complications in diabetic nephropathy or to the progression of diabetic renal disease. Further study also needs to be done to see whether good oral hygiene is associated with better control of diabetes [27]. Further studies need to be done to find whether anemia is associated with poor control of diabetes.

CONCLUSION

Poor oral hygiene can be taken as a factor for high glycated hemoglobin i.e., high blood sugar levels indicating poor glycemic control. Patients with decreased hemoglobin (mild to moderate anaemia) have high glycated hemoglobin. Therefore, anemia is a common accompaniment to diabetes. Samples taken from three different sites viz. venous blood, finger prick (capilliary) and gingiva showed mean glucose concentration in the following order. Call taken at the same point of time. Therefore, at the same point of time, the glucose concentration varies at different sites with highest being capillary blood glucose.

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ETHICAL APPROVAL

The study was approved by the Institutional Ethics Committee.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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REFERENCES

1. Diabetes Research in Children Network (DirecNet) Study Group. Comparison of fingerstick hemoglobin A1c levels assayed by DCA 2000 with the DCCT/EDIC central laboratory assay: Results of a Diabetes Research in Children Network (DirecNet) Study. Pediatr Diabetes 2005; 6:13-6.
2. Monnier L, Colette C. Contributions of fasting and postprandial glucose to hemoglobin A1c. Endocrine Practice 2006; 12:42-46.
3. Chetty VT, Almulla A, Odueyungbo A, et al. The effect of continuous subcutaneous glucose monitoring (CGMS) versus intermittent whole blood finger-stick glucose monitoring (SBGM) on hemoglobin A1c (HBA1c) levels in Type I diabetic patients: A systematic review. Diabetes Res Clin Practice 2008; 81:79-87.
4. Sinha N, Mishra TK, Singh T, et al. Effect of iron deficiency anemia on hemoglobin A1c levels. Annals Laboratory Med 2012; 32:17.
5. Foss-Freitas MC, de Andrade RC, Figueiredo RC, et al. Comparison of venous plasma glycemia and capillary glycemia for the screening of type 2 diabetes mellitus in the Japanese-Brazilian community of Mombuca (Guatapará-SP). Diabetol Metabolic Syndrome 2010; 2:1-5.
6. Priya M, Mohan Anjana R, Pradeepa R, et al. Comparison of capillary whole blood versus venous plasma glucose estimations in screening for diabetes mellitus in epidemiological studies in developing countries. Diabetes Technol Therapeut 2011; 13:586-91.
7. Colagiuri S, Sandbaek A, Carstensen B, et al. Comparability of venous and capillary glucose measurements in blood. Diabetic Med 2003; 20:953-6.
8. American Diabetes Association. Standards of medical care in diabetes. Diabetes Care 2006; 29:S4-S42.
9. Burtis CA, Ashwood ER. Tietz Textbook of clinical chemistry, 2nd Edn, W.B. Saunders Company, 1994; 959.
10. Brand-Miller JC. Postprandial glycemia, glycemic index, and the prevention of type 2 diabetes. Am J Clin Nutrition 2004; 80:243-244.
11. Brand-Miller J, Liu V, Petocxz P, et al. The glycemic index of foods influences postprandial insulin like growth factor binding protein responses in lean young subjects. Am J Clin Nutrition 2005; 82: 350-354.
12. https://www.who.int/nutrition/publications/nutrientrequirements/9251041148/en/
13. Jenkins DJA, Wolever TMS, Taylor RH, et al. Glycemic index of foods: A physiological basis for carbohydrate exchange. Am J Clin Nutrition 1981; 34:362-367.
14. Kelly S, Frost G, Whittaker V, et al. Low glycaemic index diets for coronary heart disease. Cochrane Database Syst Rev 2004; D004467.
15. Philip L. Medscape education: Constructing optimum treatment regimens for type 2 diabetes. 2007.
16. Rasaiah B. Self-monitoring of the blood glucose level: Potential sources of inaccuracy, Can Med Assoc J 1985; 132:1357-1361.
17. Muller HP, Behbehani E. Non-invasive monitoring of gingival crevicular for estimation of blood glucose level. J Med Biol Eng Computing 2004; 42:322-327.
18. Hara H, Egusa G, Yamakido M, et al. The high prevalence of diabetes mellitus and hyperinsulinemia among the Japanese Americans living in Hawaii and Los Angeles. Diabetes Res Clin Pract 1994; 24:S37-S42.

19. Gimeno SG, Ferreira SR, Franco LJ, et al. Increase in mortality associated with the presence of diabetes mellitus in Japanese-Brazilians. Public Health Magazine 1998; 32:118-24.

20. Gimeno SGA, Ferreira SRG, Franco LJ, et al. Prevalence and 7-year incidence of Type II diabetes mellitus in a Japanese-Brazilian population: An alarming public health problem. Diabetologia 2002; 45:1635-1638.

21. UK Prospective Diabetes Study (UKPDS) Group: Intensive blood glucose control with sulphonylureas or insulin compared with conventional treatment and risk of complications in patients with type 2 diabetes (UKPDS 33). Lancet 1998; 352:837-853.

22. Georg AE, Duncan BB, Toscano CM, et al. Economic analysis of a screening program for diabetes mellitus in Brazil. Rev Saude Publica 2005; 39:452- 460.

23. American Diabetes Association: Standards of Medical Care Diabetes. Diabetes Care 2008; 31:S5-Sll.

24. Oliveira JEP, Milech A. Diabetes Mellitus- Clfnica, Diagn6stico e Tratamento Multidisciplinar. Sao Paulo: Editora Atheneu; 2004.

25. Harris MI, Eastman RC: Early detection of undiagnosed diabetes mellitus: a US perspective. Diabetes Metab Res Rev 2000; 16:230-236.

26. Kuwa K, Nakayama T, Hoshino T, et al. Relationships of glucose concentrations in capillary whole blood, venous whole blood and venous plasma. Clin Chimica Acta 2001; 307:187-192.