ISSN 0976 – 3333

Available Online at www.ijpba.info

International Journal of Pharmaceutical & Biological Archives 2015; 6 (6): 37 – 42

RESEARCH ARTICLE

Gingival Crevicular blood an alternative site for assessment of blood glucose levels

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Received 11 May 2015; Revised 14 Nov 2015; Accepted 23 Nov 2015

ABSTRACT

Aim: Diabetes mellitus is a common chronic disease associated with increased morbidity and mortality. Periodontitis has been considered as the sixth complication of diabetes mellitus. Most of the diabetic patients present with this problem which goes undiagnosed. Patients with periodontitis will have bleeding in the gingival crevicular area which itself can be used to assess the glycemic status. Even in those who don't have bleeding minimal probing in the gingival crevicular area will give us the required sample.

Study design: To evaluate and assess the reliability of the gingival crevicular blood glucose as a diagnostic tool to assess blood glucose level. Two groups of 25 each as group A (Diabetics) and group B (Nondiabetics) accounting to a sample size of 50 were taken for the study. **Results:** Gingival crevicular blood glucose values were compared with capillary finger blood glucose and conventional venous blood glucose. The values in the group were statistically analyzed using Pearson's rank correlation. The paired samples revealed an intra class statistically significant correlation ($p < 0.001$). **Conclusion:** Considering the correlation between the gingival crevicular blood glucose and the other two standard methods, assessment of crevicular blood glucose can be used as a routine in small clinics, PHC'S, dental OPD's. The technique is safe, easy to perform and is also cost effective. Hence gingival crevicular blood glucose estimation can be used as a tool to assess the blood glucose level with accuracy.

Keywords – Gingival crevicular blood glucose, Diabetes mellitus, periodontitis

INTRODUCTION

Diabetes mellitus is one of the most common chronic diseases that affects mankind and is associated with considerable morbidity and mortality. It is a syndrome characterized by chronic hyperglycemia which is due to relative insulin deficiency, resistance or both. Diabetes mellitus (DM) affects more than 120 million people worldwide, and it is estimated that it will affect 220 million by the year 2020 [1].

The literature provides consistent evidence of greater prevalence and severity of periodontal disease in diabetics, both types 1 and 2. Periodontal diseases can have a significant impact on the metabolic state in diabetes. The presence of periodontitis increases the risk of worsening of glycemic control over time [2].

Periodontitis is considered to be one of the pathognomic oral warning signs and is designated as the sixth complication of Diabetes mellitus [3]. Emerging trends have placed oral physicians at the forefront in diagnosing Diabetes mellitus, control the illness and help those with prediabetes avoid full onset. It is undiagnosed in approximately half of the patients actually suffering from the disease. In contrast to laboratory method, results are obtained instantaneously, which helps the clinician to decide if further confirmatory tests are required to diagnose diabetes. Recently there has been an increasing evidence of research carried out to use gingival crevicular blood in monitoring blood glucose levels [4,5,6].

Since periodontal inflammation, with or without the complicating factor of diabetes mellitus, is known to produce ample extravasated blood during diagnostic procedures, and routine probing during a periodontal examination is less traumatic compared to a finger-puncture with a sharp lancet, these devices may actually allow for painless testing of blood oozing from the gingival crevices of patients with periodontal problem during routine periodontal examination and could be a simple and relatively inexpensive in-office screening device for any patient suspected to have diabetes. They can also be used to monitor blood

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glucose levels in known diabetics[7]. Development of a non-invasive method for measuring the blood glucose level is an urgent necessity, and putting such a method into practical use will enable some of the physical and mental stress that patients with diabetes have to endure to be removed. The ability to collect gingival crevicular blood for glucose measurement using readily available glucometers seems to be a good method of screening diabetic patients, since it is painless to collect blood by probing. The present study has been conducted to evaluate the use of gingival capillary blood as a marker for blood glucose estimation using glucometer against the conventional laboratory method.

AIMS AND OBJECTIVES

The aim of the study is to assess the reliability of gingival crevicular blood glucose as a diagnostic tool to assess blood glucose.

1. To compare crevicular, capillary blood glucose measurements and venous sample in diabetic and non- diabetic individuals.

MATERIALS AND METHODS

Patients were selected for the study after obtaining informed consent. The patients were divided into 2 groups.

Group A comprised of 50 diabetic patients, 20 females and 30 males selected from a list of diabetic patients, monitored regularly.

Group B included 50 non-diabetic patients, 32 females and 18 males

The approval from the ethical committee of the institution was obtained regarding the study.

Inclusion criteria:

- Patients 20-70 years of age.
- Patients with diabetes mellitus with or without peridontitis
- Controls without diabetes mellitus with or without peridontitis

Exclusion criteria:

- Any indication for antibiotic prophylaxis
- Any bleeding disorder
- Severe systemic diseases such as cardiovascular, renal, hepatic, immunologic, or hematological disorders.
- Any medication interfering with the coagulation system.

CLINICAL AND LABORATORY ASSESSMENTS:

Data was collected by qualified examiner trained through standardized procedures for making the required measurements. The device was calibrated prior to the study. Patients with periodontitis were examined intraorally for visual signs of periodontal inflammation. Areas with marked signs of inflammation were probed by a Williams probe, inserted into the gingival sulcus, as is commonly done during a periodontal examination. When the probe was removed, the gingival crevice was observed for bleeding. Bleeding gingival sites were determined and site with profuse bleeding on probing with access for the glucose self-monitoring device were chosen for testing Gingival Crevicular Blood Glucose (GCBG). These areas were isolated with cotton rolls to prevent saliva contamination and dried with compressed air. Probing was repeated until sufficient amount of blood appears in the gingival crevice. The selected area was analyzed using the glucometer (ACCU-CHEK Active, Roche Diagnostics, USA), according to the manufacturer's instructions. The top edge of the reagent strip of glucometer is placed against the bleeding site. The blood is automatically drawn into reaction cell of the strip by capillary action, until the conformation window is full.

Fifty diabetic [Group A] and 50 non-diabetic [Group B] patients underwent routine laboratory measurement of fasting plasma glucose (FPG) levels (venous sample). These patients after a meal were subjected to periodontal examination using the same method, and only one site with bleeding on probing was selected for testing GCBG. Immediately after measuring GCBG, capillary finger stick blood glucose (CFBG) was assessed using the same glucose self-monitoring device. The fingertip of fourth finger on the left hand was wiped with surgical spirit and was allowed to evaporate. The sample was drawn on the lateral surface of the fourth digit since it will have thinner epithelium and also it is a finger of lesser use. The hand is held down and the finger tip is gently massaged (but not squeezed) to obtain a round drop of blood. The first drop of blood was wiped away and the second drop was used. This may reduce the risk of an inaccurate result, should the sample contain excess tissue fluid or alcohol used to clean the finger. The blood glucose levels of gingival crevicular blood (GCBG), finger stick blood (CFBG) and the venous blood (FPG) of all patients were documented.

OBSERVATION AND RESULTS

Between the two groups of the study, Pearson's rank correlation was used.

Diabetic patients [Group A] included 20 females and 30 males with a mean age of 50.38±10.25 years old. [Fig 1] Their mean blood level at fasting blood was 148.22±42.04, capillary finger stick blood was 221.42±66.14 and gingival crevicular blood was 207.14±69.71. A statistically significant correlation (p=0.001) was found between CFBG and FBG (r=0.798); [Fig 2.1] GCBG and FBG (r=0.736) [Fig 2.2] and GCBG and CFBG (r=0.949) [Fig 2.3].

Fig 1. Age and gender distribution of diabetic patients

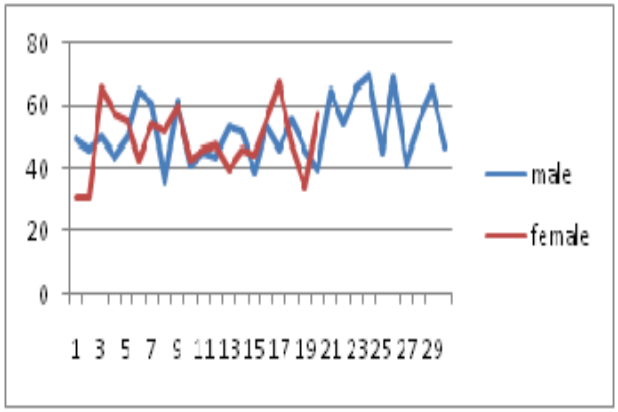

Fig 1: Age and gender distribution of diabetic patients

Fig 2: Mean plots of measurements in diabetic patients (mg/dl)

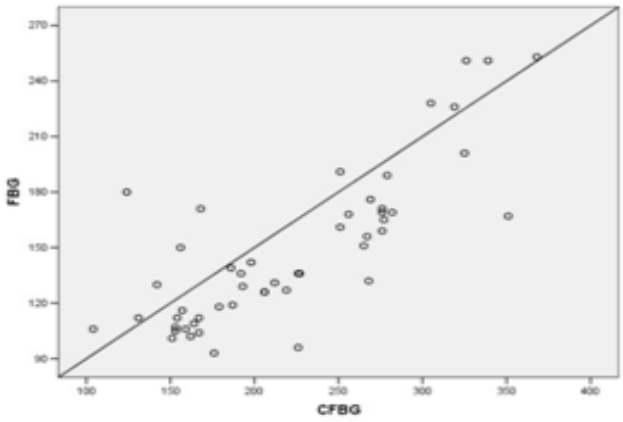

Fig 2.1 FBG and CFBG

Fig 2.2 FBG and GCBG

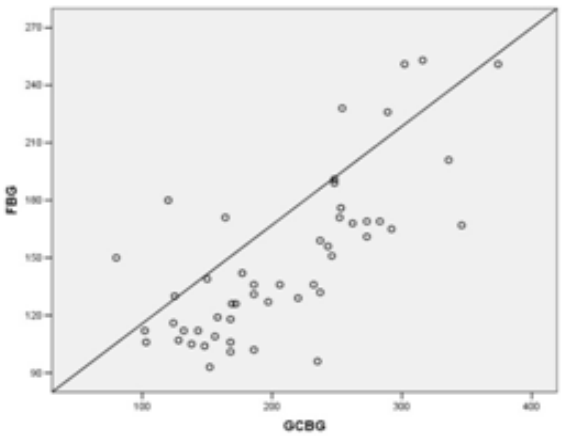

Fig 2.2 FBG and GCBG

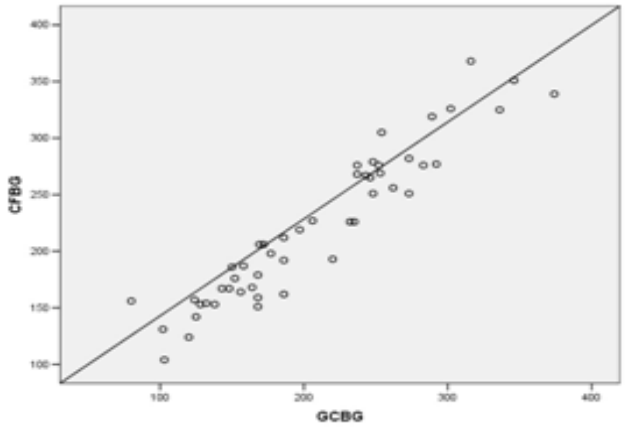

Fig 2.3: CFBG and GCBG

Non- diabetic individuals (control group) [Group B] included 32 females and 18 males with a mean age of 48.34±13.99 years old. [Fig 3] Their mean glucose level at fasting blood was 98.08±27.44, capillary finger stick blood was 135.22±49.88 and the gingival crevicular blood was 119.46±41.90. A statistically significant correlation (p=0.001) was found between CFBG and FBG (r=0.783); [Fig 4.1] GCBG and FBG (r=0.784) [Fig 4.2] and GCBG and CFBG (r=0.934) [Fig 4.3]

Fig3.Ageand gender distribution in non-diabetic individuals

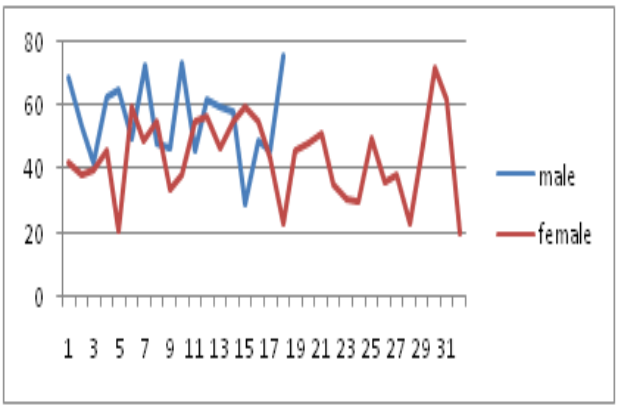

Fig3.Ageand gender distribution in non-diabetic individuals

Fig 4: Mean plots of measurements in non- diabetic patients (control group)

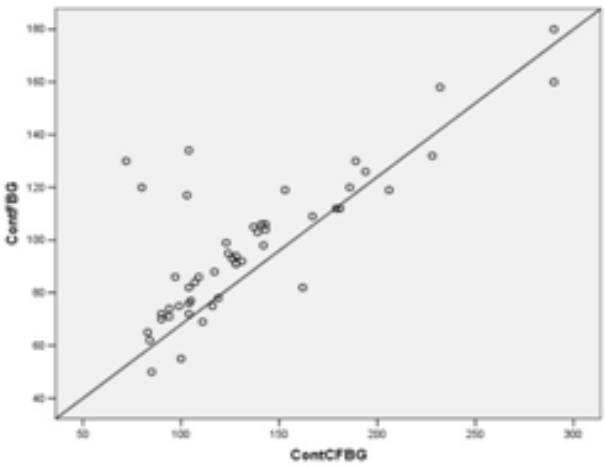

Fig 4.1: Control FBG and control CFBG

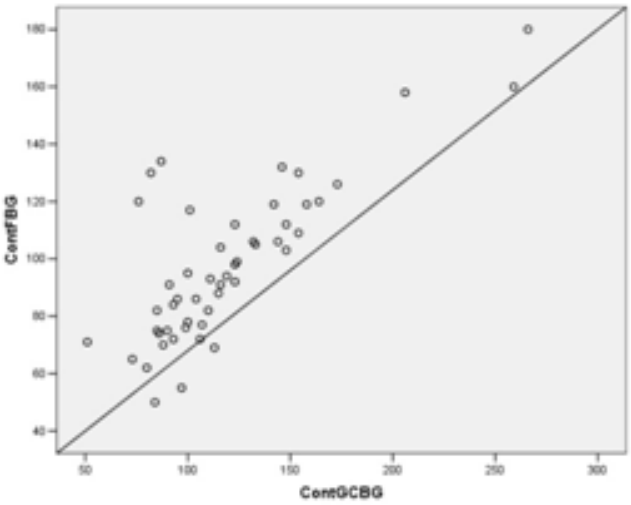

Fig 4.2: Control FBG and control GCBG

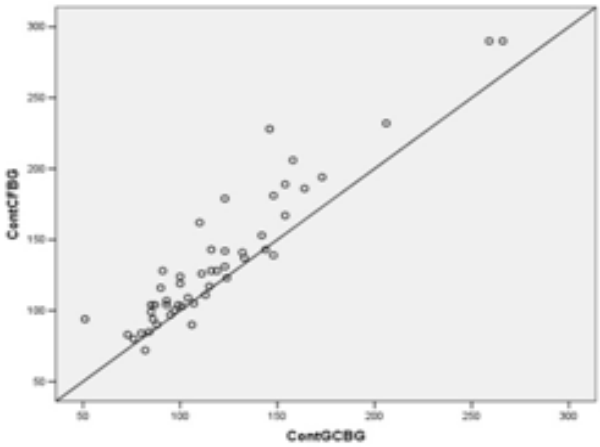

Fig 4.3 Control CFBG and control GCBG

DISCUSSION

Diabetes has emerged as a major health problem in India. According to International Diabetes Federation every fifth diabetic in world would be an Indian by year 2025. Further the Asian Indian phenotype commonly known as thrifty genotype predisposes Indian population to risk of developing diabetes.

Patients with poor glycemic levels show more prevalence of oral infections [8,9]. Over and above the glycemic status of the patient in general, local blood glucose concentration in the area is also important as it may affect the outcome of the treatment. The diabetic gingiva is unable to utilize oxygen and thus cannot oxidize glucose as readily. Gingival Crevicular blood can be used for testing blood glucose during periodontal examination, in patients with diabetes or at risk of developing diabetes. Estimation of Gingival Crevicular blood glucose level can be done as an in-office screening procedure. The advantages of this method are it is safe, reliable, and easy to perform, inexpensive, comfortable for patients, non- invasive, painless and can be done by any clinician, general physician and also the dentist.

The American Diabetes Association recommends that screening for diabetes should start at age 45 years and be repeated every 3 years in persons without risk factors, and earlier and more often in those with risk factors for diabetes. Moreover, testing at younger age or more frequently should be carried out in individuals who are (a) obese, (b) have a 1st-degree relative with diabetes, (c) are members of a high-risk ethnic population, (d) have delivered a baby weighing 4.05 kg or have been diagnosed with gestational diabetes mellitus, e) are hypertensive (>140/90), (f) have an HDL cholesterol level <35 mg/ dl and/or a triglyceride level >250 mg/ dl, (g) had on previous testing an impaired glucose tolerance or an impaired fasting glucose [10].

Rubbing or direct wiping of intra-oral blood on to the test strip will not produce a uniformly timed reaction and may damage the strip's chemical indicator surface [11]. Also, significant contamination may occur from saliva and oral debris present at the wiped gingival area or from plaque and crevicular fluid on the dental curette from its entry into the gingival sulcus. American Diabetes Association in their consensus statement on blood glucose monitoring (1987) [12] said that manual timing of the test strip reaction and the wiping of the test strip are significant sources of error when using glucose self monitors.

To over-come these errors, Parker *et al* used a glucometer, which is self- timing and requires no wiping. The use of plastic pipette is claimed to reduce contamination of the sample with saliva, plaque, and debris.

Beikler *et al,* [13] suggested direct use of test strip of glucometer to collect blood sample from gingiva. In contrast to Parker's study, the sampling procedure used in this study was much easier to perform and less time consuming and required no additional tools to collect gingival crevicular blood.

In this study, ACCU-CHEK Active, Roche Diagnostics, USA is the glucometer used to measure the glucose levels in the blood which oozes out during routine probing. Measuring blood glucose with a glucometer is very sensitive since it can provide results with 2-3µl of blood within 10 seconds. It is a less time consuming

procedure and does not require any additional tools like sharp lancet for puncture. Even in case of very low gingival bleeding, glucose measurement is possible with a glucometer, due to low volume of blood (3µl) required to perform the analysis.

In this study, significant correlation (r= 0.93, p<0.001) was found between gingival crevicular blood glucose levels and capillary finger stick blood glucose levels in diabetics and non-diabetics [Group A & B] Fasting blood glucose is always considered the gold standard. Considerable correlation (r=0.75, p<0.001) was found between levels of gingival crevicular blood glucose and fasting blood glucose both in diabetic patients and the normal population. [Group A & B] The results of our study are consistent with Beikler et al., and Parker et al. and Tsutsui *et al* [14].

Though high correlation between gingival and finger stick samples were reported in these studies, the contamination of the blood sample from crevicular fluid was possible and inevitable. Moreover, it has been reported that the free glucose concentration in gingival fluid was influenced by local environmental factors such as the micro flora and the liberation and activation of hydrolyzing enzymes. Thus, gingival crevicular blood after probing may not represent true capillary blood glucose measurement.

In our study, sample was collected from the capillaries on the outer surface of the gingiva, thus eliminating the possibility of contamination with crevicular fluid. None of the subjects under study reported pain / discomfort and no complications have been reported after sampling by this method. This method cannot be applied in cases where purulent exudates are found in pockets. This results in dilution of the blood sample and alteration of glucose levels.

CONCLUSION

Considering the correlation between gingival crevicular blood glucose and the other two standard methods for glucose estimation in diabetic and normal individuals, it is evident that the blood obtained during routine periodontal probing can be used for estimation of blood glucose levels. Hence, gingival crevicular blood is an efficient diagnostic tool for estimation of blood glucose levels in patients with or without diabetes mellitus. The technique described is safe, easy to perform, repeatable, comfortable for the patient, cost effective, and might therefore help to increase the frequency of diabetes screening at peripheral small clinics, remote health centers and also dental clinics.

REFERENCES

1. Kumar P, Clark M. Clinical medicine fifth edition, Mc Graw Hill 2002; p: 1077.
2. Gensini GF, Modesti PA, Lopponi A, Collella A, Costagli G, Monini M. Diabetic disease and periodontal disease. diabetes and periodontopathy. Minerva Stomatol 1992; 41(9):391-9.
3. Loe H. The sixth complication of diabetes mellitus. Diabetes Care 1993;16(1):329-334.
4. Muller HP, Behbehani E, Non-invasive monitoring of gingival crevicular for estimation of blood glucose level. J:Medical and Biological Engineering Computing. Volume 42, Number 3/May,2004.Pages 322-327.
5. Stein GM, Nebbia AA. A chairside method of diabetic screening with gingival blood. Oral Surg Oral Med Oral Pathol 1969; 27:607-12.
6. K.Suneetha and T.Rambabu. Gingival crevicular blood glucose assessment as a chairside test for diabetic patients with chronic periodontitis: A clinical study. Indian J Endocrinol Metab. 2012 Jul-Aug; 16(4): 665–666.
7. Kost J, Mitragotri S, Gabbay RA, Pishko M, Langer R. Trans-dermal monitoring of glucose and other analytes using ultra-sound. *Nat Med* 2000; 6:347-50.
8. Mealey BL. 1996 World Workshop in Clinical Periodontics. Periodontal implications: medically compromised patients. Ann Periodontol 1996:1: 256-321.
9. Ervasti T, Knuuttila M, Pohjamo L, Haukipuro K. Relation between control of diabetes and gingival bleeding. J periodontol 1985: 56: 154- 157.
10. Collin H L, Uusitupa M, Niskanen L, Kontturi-Narhi V, Markanken H, Koivisto AM and Meurman JH: Periodontal findings in elderly patients with non-insulin dependent diabetes mellitus. J. Periodontol 1998; 69: 962–966.
11. Parker RC, Rapley JW, Isley W, Spencer P, Killoy W. Gingival crevicular blood for

assessment of blood glucose in diabetic patients. J Periodontol 1993;64:666-72p

12. American Diabetes Association: Consensus statement on self monitoring of blood glucose. Diabetes Care1987;10:95-9.
13. Beikler T *et al*, In-dental-office screening for diabetes mellitus using gingival crevicular blood, Journal of clinical preriodontology2002, 29,216-218.
14. Tsutsui P, Rich SK, Schonfeld SE. Reliability of intraoral blood for diabetic screening. J Oral Med 1985; 40:62-6.