

**Evaluation of glycated hemoglobin levels in systemically healthy patients with various stages of periodontitis**

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**Abstract**

**Introduction:** Research and various studies have already established the fact that Diabetes Mellitus and periodontal disease have a two way relationship. Glycated hemoglobin is the most reliable indicator for evaluating long-term glycemic control. Of late, studies have noticed elevated glycated hemoglobin levels in patients suffering from chronic inflammatory conditions including chronic periodontitis. Hence, this paper aimed

to evaluates the levels of glycated hemoglobin in systemically healthy patients who are suffering from various stages of severity of chronic periodontitis.

**Method:** 05 subjects, above the age of 25 years, fulfilling the inclusion and exclusion criteria were divided into the following groups: Group A : Non – diabetic patients with chronic periodontitis: Sub-group I : Stage 1, Sub-group II : Stage 2, Sub-group III:Stage 3 and Sub-group IV: Stage 4; Group B : Type 2 Diabetics

patients with chronic periodontitis; Group C : type 2 Diabetics patients without chronic periodontitis and Group D : Heathy Individuals. A detailed case history along with clinical parameters was recorded. Blood samples of the patient was taken and send to the pathology lab for HbA1c level estimation. Evaluation and comparison of data was done by appropriate statistical analysis.

**Results:** Among the subgroup in group A Hb1Ac was high in subgroup IV.

**Conclusion:** Glycated hemoglobin levels increased with increasing severity of periodontitis

**Keywords:** periodontitis, glycated hemoglobin, two-way relationship, diabetes mellitus, glycemic control.

### **Introduction**

The oral cavity is said to be the open window of the body. Systemic diseases weaken the host's barriers and immune defense against periodontal pathogens leading to the opportunity for progression of periodontal diseases. Diabetes mellitus is a metabolic disorder caused due to dysfunctional insulin regulation {1}. It is classified as type I (insulin-dependent diabetes mellitus" (IDDM) or "juvenile diabetes") and type II non-insulin-dependent diabetes mellitus" (NIDDM) or "adult-onset diabetes"{2}.

Various cross-sectional and longitudinal studies in the 1990s investigating PIMA Indian population established the importance of diabetes as a major risk factor for periodontitis{3}. In the early 1990s periodontitis was proposed to be the 'sixth complication of diabetes' {4} establishing its two-way relationship{6}. Periodontitis also has an undesirable effect on glycemic control. Chronic gram-negative periodontal infections have been observed to in increased insulin resistance and poor glycemic control {20}. In periodontitis, the core immuno- inflammatory dysregulation shows diminishing

glycemic control due to the increase in cytokine level.{28}.

Glycated hemoglobin is a glycated protein that results from an irreversible, non-enzymatic, insulin-independent binding of glucose to hemoglobin in red blood cells{27} and is tested to monitor the long-term control of diabetes mellitus. Glycated hemoglobin causes an increase of highly reactive free radicals inside blood cells. Radicals alter blood cell membrane properties. This leads to blood cell aggregation and increased blood viscosity, which results in impaired blood flow {8}. Of late, studies have noticed elevated glycated hemoglobin levels in patients suffering from chronic inflammatory conditions, including chronic periodontitis {29}.{30}, {31}. Hence, this study aims to evaluate glycated hemoglobin levels in systemically healthy patients with various stages of periodontitis; and compare them with diabetic patients who are or aren't concomitantly suffering from chronic periodontitis; as well as healthy individuals.

### **Aim**

To evaluate the levels of glycated hemoglobin in systemically healthy patients with various stages of periodontitis

### **Materials and method**

From the OPD of a dental college in Maharashtra, 105 patients above the age of 25 years fulfilling the inclusive and exclusive criteria were selected. The study was conducted on patients visiting the out-patient department of Periodontology and Oral Implantology, abiding by all human ethical principles as per the WMA-Declaration of Helsinki of 1975, as revised in 2000. The patients were divided into 4 groups:

Group A: Non –diabetic patients with periodontitis {According to 2017 classification by American Academy of Periodontology (AAP) and the European Federation of Periodontology (EFP)}

- Sub-group I: Stage I periodontitis
- Sub-group II: Stage II periodontitis
- Sub-group III: Stage III periodontitis
- Sub-group IV: Stage IV periodontitis
- Group B: Type II Diabetes patients with periodontitis
- Group C: Type II Diabetes patients without periodontitis
- Group D: Healthy Individuals

#### Inclusion criteria

1. Non-diabetic patients with varying stages of periodontitis.
2. Type II Diabetes patients with varying stages of periodontitis.
3. Type II Diabetes patients without periodontitis.
4. Healthy individuals.
5. Patients willing to participate in the study

#### Exclusion criteria

1. Patients who have undergone any periodontal therapy in the past 6 months.
2. Patients with history of antibiotics and anti-inflammatory therapy in the past 6 months
3. Patients with history of use of oral antiseptics or mouthwashes in the past 6 months.
4. Patients with history of tobacco use in smoked or smokeless form.
5. Patients with history of alcohol or substance abuse.
6. Patients with any systemic condition confounding or precluding to the study.

The patients were informed about the study and their written consent was taken. A detailed case history was recorded. Clinical parameters such as Plaque index (PI) (Silness and Loe 1964), Gingival index (GI) (Loe and Silness 1963), Probing Depth (PD) and Russell Periodontal Index (RPI) (1956) were recorded. Blood sample of the patient was collected and sent to the pathology lab for HbA1c test. American Diabetes Association's (ADA) diagnostic criteria was used for the

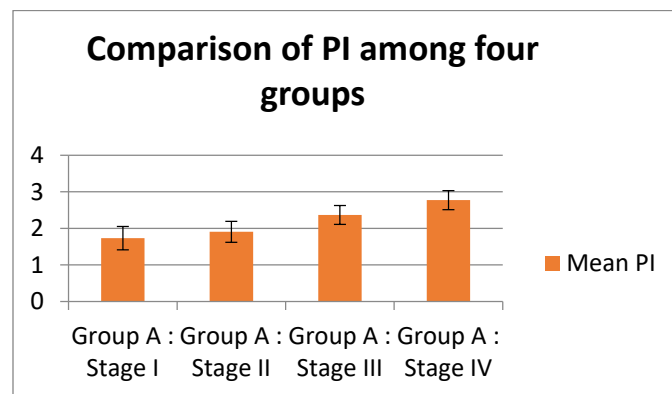
diagnosis of type 2 diabetes based on HbA1c values<sup>33</sup>. The values were estimated by turbid metric inhibition immunoassay (TINIA).

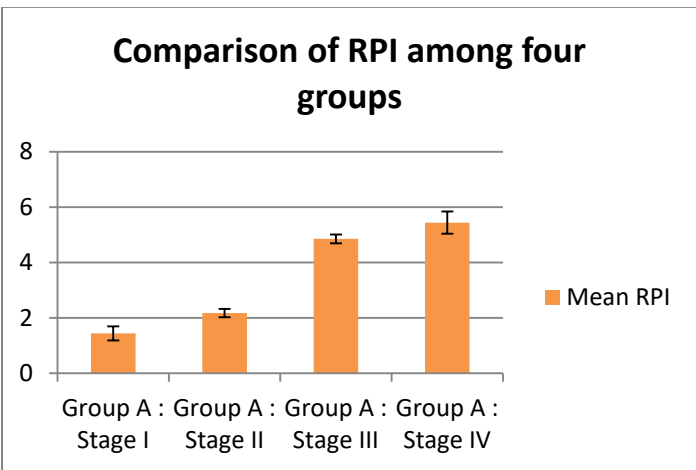
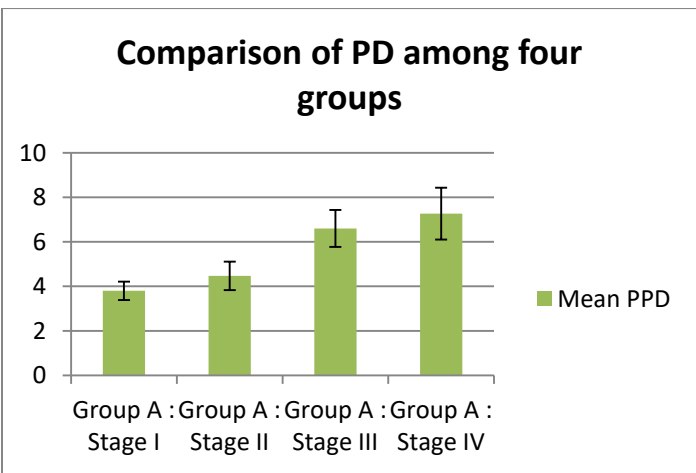
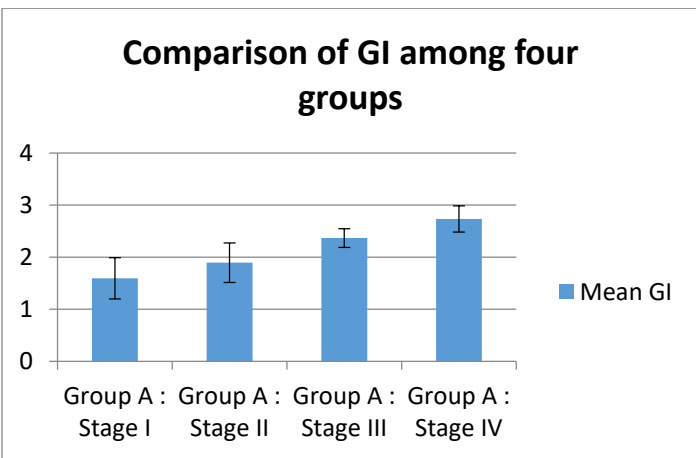
#### Statistical analysis:

All the data was entered into Microsoft Excel 2010. Descriptive statistics for all five parameters was expressed as mean  $\pm$  standard deviation (SD) for each group. All the Four groups were compared for the five parameters by Analysis of variance (ANOVA) followed by Tukey's Post hoc Test for pairwise comparison. Descriptive statistics for all five parameters was expressed as mean  $\pm$  standard deviation (SD) for each group. The Seven groups (Group A I/II/III/IV; Group B; Group C and Group D) were compared for five parameters by Analysis of variance (ANOVA) followed by Tukey's Post hoc Test for pairwise comparison. Simple /Multiple bar charts were used for graphical representation. In all the above test, 'p' value was considered statistically significant when it was  $<0.05$ . The software used was SPSS (Statistical Package for Social Sciences) version 19.

#### Results

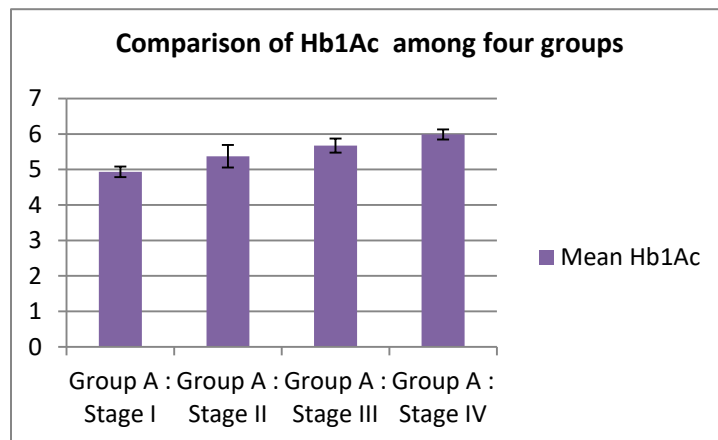
Comparison of PI, GI, PD and RPI among four subgroups in Group A.





There was a difference in all the Subgroups of Group A for Plaque Index. The difference between subgroup I & III; I & IV was statistically significant. On comparing the difference between subgroup II & III; II & IV; III & IV, the difference was statistically significant whereas the difference between subgroup I & II was statistically

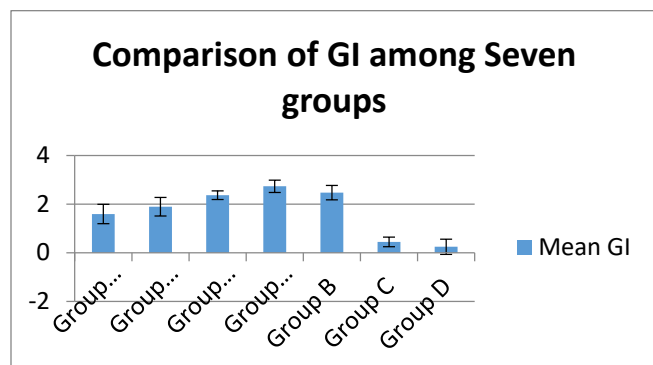
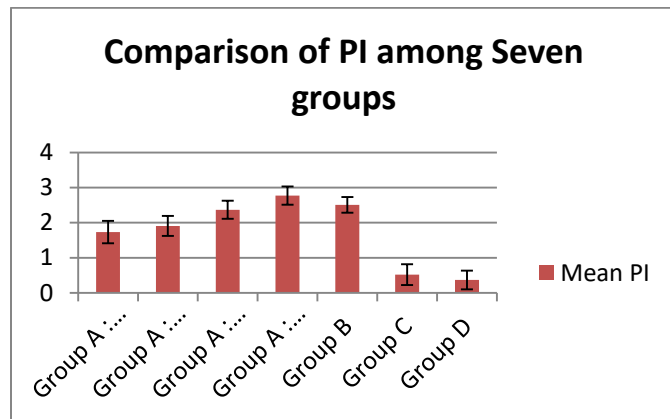
insignificant. Similar results was observed with GI, PD and RPI.

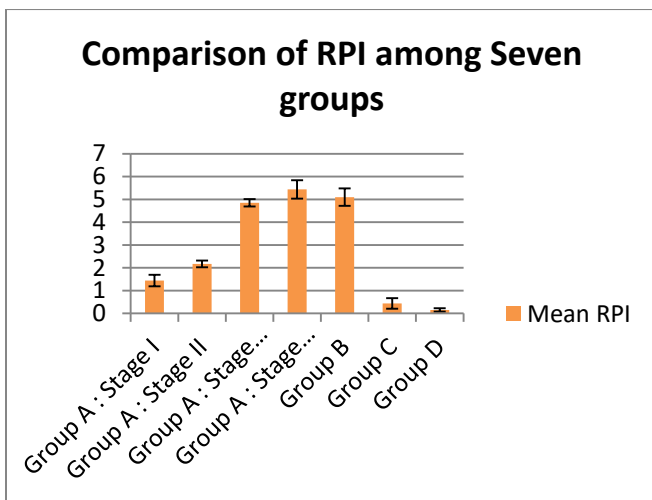
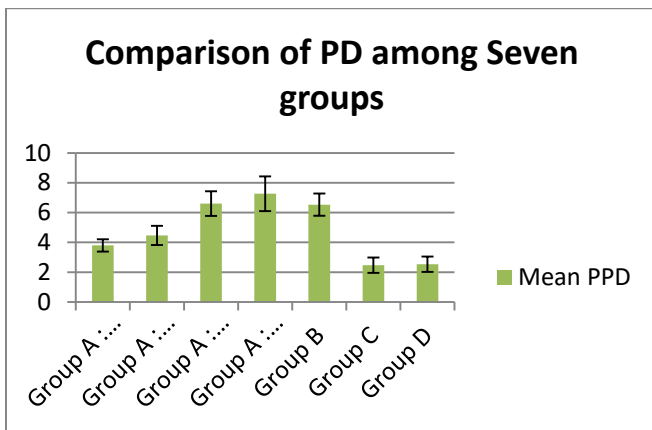


#### Comparison of Hb1Ac four subgroups in Group A.

There was a difference in all the Subgroups of Group A for HB1Ac. The difference between subgroup I & II; I & III; I & IV was statistically significant. On comparing the difference between subgroup II & III; II & IV; III & IV, the difference was statistically significant.

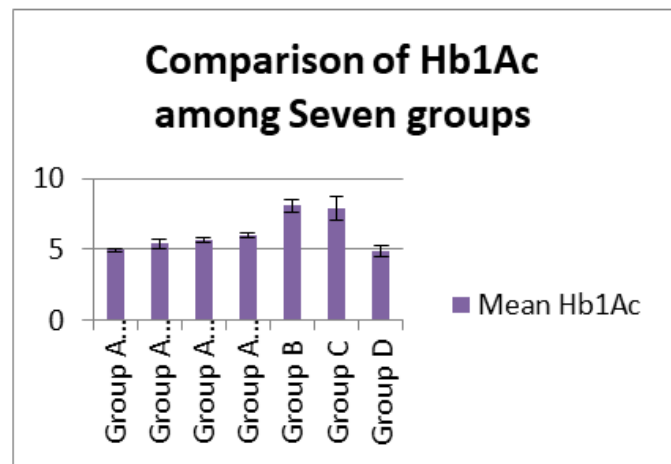
Comparison of PI GI, PD and RPI among all 7 groups.





There was a difference among seven groups for **Plaque Index** which was statistically significant. As stated above the difference between subgroup I & II of in group A was insignificant statistically. But comparing Group and I & II and rest all six groups the difference was statistically significant. Apart from subgroups III & IV of group A, there was a difference when comparing group B to the other groups which was statistically significant. Both group C & D when compared to other groups had difference which was significant statistically, no difference was observed when compared with each other statistically. Similar results were observed with GI, PD and RPI.

Comparison of Hb1Ac among the 7 groups



There was a difference among seven groups for **Hb1Ac**. On comparing subgroup I of group A, apart from subgroup II and group D, with the other group there was a difference which was statistically significant. Similarly when comparing subgroup II with the other groups, apart from subgroup III, there was a difference observed which was statistically different. Subgroup III when compared with the other group had a difference which was significant statistically except when compared to group IV. Group C when compared to the other group, baring group B, a difference was seen, which was statistically significant. Similar results were seen when comparing all groups with group D apart from comparing subgroup I.

### Discussion

In the recent years, great attentions of the world researches have focused on association between oral health and systemic diseases. Diabetes Mellitus is one such systemic disease with a strong association with periodontitis. Periodontitis is a possible early sign of diabetes mellitus. Periodontitis and diabetes are complex chronic diseases, linked by an established bidirectional relationship [21]. Periodontitis is characterized by chronic inflammation, and inflammation can promote insulin resistance and deregulate glycaemia. Although the biologic mechanisms linking periodontitis to

impaired glucose metabolism have not been fully researched upon, the theory that inflammatory mediators (particularly IL-6 and TNF- $\alpha$ ) generated within the inflamed periodontal tissues or in response to oral bacteria that translocate into the systemic circulation interfere with the actions of insulin receptors, thereby decreasing insulin sensitivity is wide accepted{23}.

It is a known fact that in patients with diabetes, there is an increase in the glycated hemoglobin levels and glycated hemoglobin is used to assess the long-term control of diabetes {10}, {11}. Glycated hemoglobin levels also increase in chronic inflammatory conditions; like chronic periodontitis, even when the individual is not suffering from diabetes. So, this study aimed at evaluating the levels of glycated hemoglobin in systemically healthy patients with various stages of periodontitis.

Turbid metric Inhibition Immunoassay is a reliable method with very high precision and good accuracy, and hence was used for evaluation of glycated hemoglobin in this study {32}.

In the present study, we found that among the diabetic patients, the individuals with periodontitis had slightly elevated levels of glycated hemoglobin when compared to diabetics without periodontitis. This could be due to the resistance of insulin conferred by periodontitis. Among the non-diabetics, it was seen that with the increase in the severity of periodontitis, the levels of glycated hemoglobin also increased. And, in the patients with Stage III & Stage IV periodontitis, HbA1c levels were in the range of pre-diabetic levels as proposed by American Diabetes Association (5.7%-6.4%)

This increases in the level of glycated hemoglobin in patient with periodontitis concur with earlier studies carried out by Wolff et al {12}, Niabali{13} et al , Bethesda{14}and Katanz{24} et al and could be due to

the loss of glycemic control which is triggered by periopathogens. Hence glycated hemoglobin can be a risk indicator for future development of periodontitis. Hence further studies with larger study sample size need to be conducted to establish a relation of glycated hemoglobin with periodontitis; as well as the effect of treatment of Periodontist on the glycated hemoglobin level.

### Conclusion

It was observed in the current study that glycated hemoglobin levels in non-diabetic patients with Stage III and Stage IV periodontitis were in the range of pre-diabetic individuals. Glycated hemoglobin levels increased with increasing severity of periodontitis. More studies need to be conducted to assess if HbA1c can be considered as a risk indicator for not only diabetes, but for periodontitis as well.

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