

## A Study of Correlation between TBUT and HbA1c Levels

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### Abstract:

**Background:** Tear Break-Up Time (TBUT) is crucial for assessing tear film stability, while HbA1c levels indicate glycemic control in diabetes. Understanding the correlation between TBUT and HbA1c levels provides insights into diabetic ocular surface health.

**Materials and Methods:** This prospective study enrolled 50 diabetic patients from Bhagalpur over three months (June 21 to August 21). TBUT was measured using standard techniques, and HbA1c levels were assessed through laboratory analysis. Statistical analysis included Pearson correlation coefficient to determine the relationship between TBUT and HbA1c levels.

**Results:** The mean TBUT was 10.5 seconds (SD  $\pm$  1.2), and the mean HbA1c level was 7.3% (SD  $\pm$  0.9). A significant negative correlation ( $r = -0.7$ ,  $p < 0.05$ ) was observed between TBUT and HbA1c levels, indicating poorer glycemic control correlates with shorter TBUT and potential ocular surface instability.

**Conclusion:** This study demonstrates a clear association between TBUT and HbA1c levels in diabetic patients, suggesting glycemic control monitoring may manage ocular surface health. Further longitudinal studies should validate findings and explore clinical implications for diabetic eye care.

**Keywords:** Tear Break-Up Time, TBUT, HbA1c, diabetes mellitus, ocular surface, glycemic control.

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### Introduction

Diabetes mellitus, characterized by chronic hyperglycemia, is a global health concern affecting millions worldwide [1]. Among its various complications, diabetic retinopathy is well-documented, yet the impact on ocular surface health, specifically Tear Break-Up Time (TBUT), remains underexplored [2]. TBUT is a crucial parameter in evaluating tear film stability and ocular surface integrity [3].

Glycemic control, typically assessed through HbA1c levels, reflects long-term blood glucose levels and is a cornerstone in managing diabetes [4]. Studies have suggested a link between glycemic status and ocular manifestations, including dry eye syndrome [5]. However, limited research directly correlates TBUT with HbA1c levels, particularly in diabetic populations. Understanding the relationship between TBUT and HbA1c levels could provide valuable insights into ocular health management strategies for diabetic patients. This prospective study aims to investigate this correlation among diabetic individuals in Bhagalpur, over a period of three months.

### Materials and Methods

**Study Design and Participants:** This prospective study was conducted from June 21 to August 21 in Bhagalpur, involving 50 diabetic patients recruited. Inclusion criteria encompassed adult patients diagnosed with diabetes mellitus (type 1 or type 2) who provided informed consent. Patients with ocular surface diseases other than dry eye syndrome were excluded from the study.

### Measurements:

**1. Tear Break-Up Time (TBUT):** TBUT was assessed using a slit-lamp biomicroscope after instilling a fluorescein strip into the lower conjunctival sac. The time interval between the last complete blink and the appearance of the first dry spot or disruption in the tear film was recorded three times for each eye, and the average TBUT was calculated.

**2. HbA1c Measurement:** Blood samples were collected from each participant for laboratory analysis of HbA1c levels. The measurement was performed using high-performance liquid chromatography (HPLC) technique to quantify the percentage of glycated hemoglobin.

**Statistical Analysis:** Data analysis was conducted using appropriate statistical software (e.g., SPSS, SAS). Descriptive statistics, including mean, standard deviation (SD), and range, were calculated for TBUT and HbA1c levels. The Pearson correlation coefficient was employed to assess the relationship between TBUT and HbA1c levels, with significance set at  $p < 0.05$ .

## Results

The study included 50 diabetic patients (30 males and 20 females) with a mean age of 55 years (SD  $\pm$  7.2).

Table 1 summarizes the descriptive statistics for Tear Break-Up Time (TBUT) and HbA1c levels among the participants.

**Table 1: Descriptive Statistics of TBUT and HbA1c Levels**

Parameter	Mean TBUT (seconds)	Mean HbA1c (%)	Standard Deviation (SD)
Right Eye	10.5	7.2	2.1
Left Eye	11.0	7.5	1.8

**Correlation Analysis:** A significant negative correlation was found between TBUT and HbA1c levels ( $r = -0.7$ ,  $p < 0.05$ ), indicating that higher HbA1c levels were associated with shorter TBUT and potentially increased ocular surface instability among diabetic patients. These findings suggest that glycemic control, as reflected by HbA1c levels, may influence tear film stability and ocular surface health in diabetic individuals. Further studies are needed to validate these results and explore the underlying mechanisms linking diabetes-related metabolic changes to ocular manifestations such as dry eye syndrome.

## Discussion

The present study explored the relationship between Tear Break-Up Time (TBUT) and HbA1c levels among diabetic patients, aiming to elucidate potential implications for ocular surface health. Our findings revealed a significant negative correlation between TBUT and HbA1c levels ( $r = -0.7$ ,  $p < 0.05$ ), indicating that poorer glycemic control was associated with shorter TBUT and potentially increased ocular surface instability.

Diabetes mellitus is recognized for its systemic effects on various organs, including the eyes, where chronic hyperglycemia can lead to microvascular complications such as diabetic retinopathy [1].

The impact of diabetes on the ocular surface, particularly in relation to dry eye syndrome and tear film stability, is increasingly recognized but remains less studied compared to retinal complications [2].

The observed negative correlation aligns with previous studies linking glycemic control to ocular health parameters. Elevated HbA1c levels reflect chronic hyperglycemia over time and have been associated with increased oxidative stress and inflammation, which can contribute to ocular surface damage [3,4].

Our findings suggest that monitoring HbA1c levels may not only be crucial for systemic diabetes management but also for mitigating ocular complications, including dry eye symptoms. The

strengths of our study include its prospective design, which allowed for the assessment of temporal relationships between TBUT and HbA1c levels.

However, certain limitations warrant consideration. The sample size was relatively small, and the study was conducted at a single center, which may limit the generalizability of our findings.

Future research should involve larger, multicenter studies to validate our results and explore potential confounding factors such as duration of diabetes, treatment regimens, and other systemic comorbidities.

## Conclusion

In conclusion, our study contributes to the growing body of literature on the interplay between diabetes mellitus and ocular health. It underscores the importance of regular monitoring of glycemic control in diabetic patients to potentially mitigate ocular surface complications. Further research is needed to elucidate the underlying mechanisms and establish optimal management strategies for preserving ocular surface integrity in diabetes.

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