

ANALYSIS OF GLUCOMETER BLOOD GLUCOSE LEVEL IN COMPARISON WITH LABORATORY CHEMISTRY ANALYZER

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Background: Diabetes Mellitus is the most common metabolic disorders in India. Blood glucose estimation is the most important tool for diagnosis, monitoring and management of diabetes mellitus. **Aim:** To compare the blood glucose levels from capillary blood using glucometer and venous blood using auto analyzer and to find out variations in the results. **Materials and Methods:** 50 subjects of age group 25 to 60 years were selected and blood glucose levels was measured by both the methods. **Results and Conclusion:** It was found that although the values of blood glucose levels differ in the capillary and venous blood and also with the type of method being used to measure the levels. The results were statistically not significant and thus concludes that estimation of blood glucose levels by glucometer can be used as an alternative simple easy method to measure the glycemic status provided the blood glucose levels are not too high.

INTRODUCTION

Diabetes mellitus is one of the most common metabolic disorders worldwide and has emerged as a major public health challenge, particularly in developing countries such as India. The prevalence of diabetes has increased substantially over the past few decades, contributing significantly to morbidity, mortality, and healthcare burden.^[1] India, in particular, has a high burden of diabetes, with a large proportion of the population either living with undiagnosed diabetes or being at increased risk of developing the disease.

Blood glucose estimation is a fundamental component in the diagnosis, monitoring, and management of diabetes mellitus. Assessment of blood glucose levels is commonly performed using fasting and postprandial blood glucose measurements. In clinical practice, glucose estimation is frequently performed using glucometers, which generally utilize capillary blood obtained by finger prick, and laboratory-based automated analyzers, which commonly use venous blood samples.

The diagnostic criteria for diabetes mellitus and impaired glucose tolerance are primarily based on standardized laboratory measurements of plasma glucose. WHO has specified the criteria for diagnosis of diabetes mellitus and impaired glucose tolerance for venous blood samples only.^[2]

Laboratory-based venous blood glucose estimation using automated analyzers is considered a standardized and reliable method for assessment of glycemic status. However, glucometers are widely used in clinical settings, particularly in emergency and bedside situations, because they provide rapid results and are convenient to use.^[3] They also allow patients and healthcare professionals to monitor fluctuations in blood glucose levels with minimal technical requirements.

Despite their widespread use, differences may exist between glucose values obtained from capillary and venous blood samples. These differences may be influenced by several factors, including the type of blood sample, physiological conditions, timing of sampling, and the analytical method or instrument used for glucose estimation. Consequently, glucose values obtained using a glucometer may not always be directly comparable with values obtained through laboratory-based automated analyzers.

Several studies have reported variations in blood glucose concentrations when measured using capillary blood samples with glucometers compared with venous blood samples analyzed using automated laboratory methods.^[4] Such differences are clinically relevant because blood glucose measurements are frequently used to make decisions regarding diagnosis, treatment, and monitoring of diabetes mellitus. Therefore, the aim of the study was undertaken to estimate blood glucose levels using a glucometer and an automated analyzer and to

compare the glucose values obtained by the two methods.

MATERIALS AND METHODS

After obtaining Institutional Ethical Committee clearance the study was conducted in the Biochemistry Lab, Blood samples were collected from the 50 participants irrespective of diabetic or not. An informed consent was taken from all the subjects. After explaining the procedure to the subjects the blood samples were drawn. For measuring the blood glucose levels using glucometer finger prick sample was collected. The finger from which the sample was to be taken was cleaned and sterilized. The pulp of the finger was drained and squeezed for a while. Taking precaution that the finger does not move, a sterile capillary puncture was made. The first drop of blood was discarded and the next drop was introduced into the glucometer strip and the values were noted down. In the same subject the venous blood sample was collected. The forearm was clean and the area for collecting the sample was sterilized. The blood was collected from the antecubital vein and sample was immediately transferred into anticoagulated tubes and the sample

was used to measure the glucose levels with the auto analyzer.

Statistical Analysis

All the data was collected and the mean and standard deviation of the blood glucose level was analyzed. All the data was expressed as Mean $\pm$ SD. The results were analyzed using SPSS software. t-test was used and p value <0.05 was considered statistically significant.

RESULTS

The study was conducted on 50 subjects of the age group between 25 to 60 years irrespective of gender and whether diabetic or not. Blood sugar level was measured using glucometer (Capillary blood) and auto analyzed (Venous blood) for each participant. The data obtained was analyzed and the glucose levels obtained by both the methods were compared. It was found that the mean blood glucose levels using glucometer was 118.76 $\pm$ 39.02 and the mean value of blood sugar levels as obtained by the auto analyzer was 107.78 $\pm$ 32.08. The p value was greater than 0.05 indicating that there was no statistical significance between the two values. The difference in mean values was 10.98 mg/dl.

Table 1

Method used	Sample	Mean blood glucose	P value
GLUCOMETER	Capillary blood	118.76 $\pm$ 39.02	>0.05
AUTOANALYZER	Venous blood	107.78 $\pm$ 32.08	Not significant

DISCUSSION

In the study conducted it was found that the mean blood glucose levels as obtained by the glucometer was higher than that obtained by venous blood using auto analyzer by 9.37 mg/dl. The results obtained were similar to those obtained on performing a similar study.^[5,6]

The capillary blood glucose levels are comparable to arterial blood glucose levels. Studies have shown that there is a difference of about 7% between post prandial anterior blood glucose and post prandial venous blood glucose levels. This is because there is absorption of glucose by the tissue cells through diffusion in capillaries and some amount of glucose returns to the veins. The venous blood glucose levels is an estimation of glucose after it is utilized by the tissues and also depends on hormonal effect.^[7] This could be the reason for the lower blood glucose levels in venous blood as compared to those obtained using glucometer. Previous studies which were done in order to measure the efficacy of glucometer against auto analyzer have given different results.^[8,9] The American diabetic association has recommended that glucometers agree to up to 15% of lab method at all concentration. Studies shows that the probable error of measurement of blood glucose using glucometer might be due to fluctuation in temperature, humidity, edema etc.

In the present study it was found that there was no statistical significance in blood glucose levels obtained by glucometer and auto analyzer. As blood glucose level variation show a difference of 5 to 10% in individual subject variation. So, it can be said that blood glucose measurement using glucometer is a good alternative to venous blood sample when quick easy and less invasive results are required.^[10] but, it has its own disadvantages that is gives an assessment of the glycemic status when blood glucose levels are less than 200mg/dl. Although the venous blood sugar measurement should be considered when the plasma blood glucose levels are very high.

CONCLUSION

The study concludes that the blood sugar levels are comparatively higher using glucometers than venous plasma samples but there is no statistical significance. Hence glucometer can be used as a simple easy, patient compliant alternative for measuring the blood glucose levels in short duration but it should always be confirmed with venous blood glucose levels for better management.

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