

# A comparative study of venous and capillary blood glucose levels by semi auto analyser and glucometer

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## Abstract

**Introduction:** Diabetes Mellitus(DM) is a non communicable disease and most common metabolic disorder reaching epidemic proportions globally. Both type 1 and type 2 diabetes show direct relationship between the glycemic control and the risk of systemic complications. Blood glucose estimation is the mainstay of diagnosis and management of diabetes mellitus. **Aim:** To compare the blood glucose estimation methods from capillary blood by glucometer and venous plasma glucose estimation by Semi auto analyser and to find out variation percentages in results. **Material and Methods:** 80 patients attending Outpatient department of a tertiary care level hospital who were advised blood glucose estimation were selected. Finger prick (capillary) blood glucose was measured by glucometer and venous plasma glucose estimation was measured by Semi auto analyser in central laboratory. **Results and Conclusion:** Capillary blood glucose estimation by glucometer is better alternative to venous plasma glucose estimation for diagnosis follow up and in emergency conditions in diabetic as well as non- diabetic patients.

**Key Words:** Semi Auto analyser estimation, Blood glucose, Finger prick capillary, Glucometer, Plasma.

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## INTRODUCTION

Diabetes Mellitus(DM) is the most common metabolic disorder in nearly 5-10 % of western population aged more than 40 years.<sup>1</sup> In developing country like India, its prevalence is rapidly increasing since last few decades. India would be the largest host of diabetes mellitus by 2020.<sup>2</sup> Every 4<sup>th</sup> person above the age of 40 years may have impaired glucose tolerance or avert diabetes mellitus. WHO has specified the criteria for diagnosis of DM and impaired glucose tolerance for only venous plasma sample.<sup>3</sup> Blood glucose estimation is the main stay of diagnosis and management of DM. Blood glucose

monitoring is also recommended in emergency complications of DM; even one hourly, in management of diabetic ketoacidosis, hyperosmolar state and hypoglycemia. In such cases, glucometer monitoring is most convenient, cheaper and a quicker method than laboratory analysis. So, it is essential to compare to the results of different methods of blood collection and methods of estimation. In our study, we have tried to compare the results of blood glucose estimation in capillary whole blood by glucometer and venous plasma glucose estimation by Semi auto analyser. Estimation of blood glucose level was done in all patients irrespective of their diabetic or non diabetic status. Capillary blood sample's blood glucose is comparable to the level of arterial blood glucose. There are a few differences between fasting capillaries glucose and fasting venous glucose, while postprandial venous blood glucose level is lower than postprandial capillaries blood glucose by 7%, as glucose is absorbed by the tissue cells via diffusion in peripheral capillaries, and some remaining glucose return to veins.<sup>4</sup>

## MATERIALS AND METHODS

The present study was conducted in the Department of Biochemistry, Dr. S. C. Govt Medical College, Vishnupuri, Nanded. The subjects selected in the study were all adults both male and female between age group of 20 -60 years, attending Out Patient Department (OPD) of a tertiary care level hospital, and advised to get blood glucose estimation done by their consultant. Blood sugar samples were collected from all subjects, whether a known case of diabetes or not. After informed consent and registration, venous blood sample collection from antecubital vein of the subject was done. The collected sample was sent for plasma glucose estimation by Semi auto analyzer in central laboratory. At the same time, capillary sample was collected by finger prick method and blood glucose estimation was done by glucometer.<sup>5</sup> Both the results were recorded in a master chart. Blood sample types and the methods of estimation are shown in the below table 1.

**Table 1:** Blood Sample type and Methods of Estimation

Blood Sample type	Method of blood glucose estimation
Capillary whole blood glucose	By glucometer
Venous plasma glucose	By GOD-POD Method

In the above table 1 the glucometer used was Apollo glucometer in which glucose in the sample reacts with the chemicals and produces an electric current which is measured by glucometer and calculates the amount of glucose. Venous plasma glucose estimation was done by using GOD-POD method on semi auto analyser CHEM 7. Principle of GOD-POD method: Glucose oxidase (GOD) oxidizes the specific substrate beta D-glucose to gluconic acid and hydrogen peroxide is liberated. Peroxidase enzyme acts on hydrogen peroxide to liberate nascent oxygen (O). Nascent oxygen then couples with 4-amino antipyrine and phenol to form red quinoneimine dye. The intensity of the colour is directly proportional to the concentration of the glucose present in blood. The intensity of colour is measured colorimetrically at 530 nm and compared with that of a standard treated similarly. GOD-POD reagent is used to calculate plasma glucose of venous sample in central laboratory.<sup>6,7</sup>

## RESULTS

**Table 2:** Comparison of capillary blood glucose on glucometer by venous plasma glucose measured by GOD-POD method

Average Standard Deviation	Levels of capillary blood glucose done on glucometer	Levels of venous plasma glucose done by GOD-POD method	p Value
Mean±SD	156.31±57.4	129.3±53.8	0.0025 < 0.005

In the above table 2 mean and standard deviations of the blood glucose levels done by glucometer and by GOD-POD method of all the 80 subjects are mentioned. It suggests that both mean and standard deviation of the values of blood glucose levels of capillary whole blood by glucometer is higher than the venous plasma glucose levels. The p value is 0.0025 which is very less than 0.05, so the null hypothesis is rejected that is, results obtained by glucometer and semiauto analyser has significant variation.

## DISCUSSION

Blood glucose concentration estimation is based on two types of samples .1) Venous blood sample estimated by laboratory Semi auto analyzer method and, 2) Capillary whole blood estimated by glucometer. In this study finger prick capillary mean blood glucose by glucometer is significantly higher than venous plasma glucose estimation. In emergency conditions ,in case of OPD diagnosis utilization of finger prick method with glucometer is better alternative to venous blood glucose estimation.<sup>8</sup> Similar observations were noted in other

studies also.<sup>9, 10</sup> The level of capillary blood glucose is comparable to arterial blood glucose level while venous plasma glucose level is the estimate glucose after utilization of glucose by tissues. The remaining amount returns to the venous side. So on lower side, change in concentration depends on tissue extraction of glucose. It is also depends on effects of insulin, glucagon, growth hormone and cortisone and also on demand of tissues and postprandial and preprandial status as well as the level of blood glucose.

The percentage change is explained by all these factors, but change is insignificant in clinical practice as blood glucose for diagnostic as well as monitoring criteria is well under 200 mg/dl, i.e., Fasting Blood glucose is 126 mg/dL, while post- prandial blood glucose is 200mg/dl or more in the WHO recommendations for the diagnosis of diabetes mellitus. The disadvantages of venous blood glucose estimation are many. 1. More painful than finger prick, 2. Expert phlebotomist required. 3. More punctures. 4. Counter puncture of vein and hematoma. 5. Long time consumed in laboratory process, nearly 3 hours. Finger prick estimation on the contrary has all the

advantage 1. Spot result 2. Convenience and also acceptability for patient. 3. No loss of precious time in emergency management.<sup>11</sup> Results of glucometer reading and venous plasma blood glucose reading have variations which suggests that capillary blood glucose done on glucometer is good for but it should also be confirmed by venous plasma glucose .

## CONCLUSION

Taking into consideration above all statistical analysis, Capillary blood glucose estimation is better alternative for OPD diagnosis, also in emergency conditions in both diabetic and non-diabetic patients but it should also be confirmed by venous plasma glucose measured by GOD-POD method.

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