



Correlation study between capillary and venous blood glucose level measurements in non-diabetic healthy volunteers

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ABSTRACT

This study is for comparison between capillary and venous blood glucose levels among 200 non-diabetic healthy volunteers in non-fasting states. The benefit for the usage of glucometer in emergency conditions and self-monitoring of blood glucose among Diabetic patients. AIM To compare the accuracy of venous blood glucose levels compared to the capillary blood glucose levels. RESULTS Mean capillary blood glucose levels = 99.76 +/- 14.48mg/dl Mean venous blood glucose levels = 90.86 +/- 8.13mg/dl P value = <0.0001, the result is found to be statistically significant.

CONCLUSION: The capillary blood glucose levels estimated by glucometer overestimates blood glucose levels in non-diabetic individuals in non-fasting states. The venous blood glucose estimation gives the exact value of blood glucose, even though it is so time consuming and require more man-power.

KEY WORDS : Glucometer, venous and capillary blood glucose, non-diabetic healthy volunteers.

Introduction

The burden of diabetes in Asian countries is disproportionately high in young to middle-aged adults^{2,7}. Intensive blood glucose monitoring and strict blood glucose control significantly eliminate or postpone occurrence or development of chronic diabetic complications⁴. It is important to monitor accurate blood glucose concentrations which

may obviously fluctuate from time to time due to various factors such as daily activity, diet component, mental status, environmental change. Glucometer is essential and easy to assess the blood glucose level because it give the result within one minute but lab results take time to give results, so it is not conventionally used in emergency conditions⁶. American Diabetic Association 2017 recommends Diabetic self management education and Diabetic self monitoring¹.

The finger-prick blood sampling is to collect blood in peripheral capillaries and the blood glucose concentration approximates to the level of arterial blood glucose¹⁰. Despite few differences between fasting capillary blood glucose and fasting venous blood glucose, postprandial venous blood glucose is lower than postprandial capillary blood glucose by 7% because glucose absorbed by the human

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body is sequentially conveyed into arteries and tissue cells via diffusion in peripheral capillaries and some remaining glucose returns to veins⁸.

Evidence of glucometer in self monitoring of blood glucose in diabetes mellitus has been found satisfactory¹. Capillary blood glucose also being used for screening purpose in epidemiological studies³. In view of increased use due to its quick result and easy to use property it is imperative to conduct a study to know its efficacy and correlation venous blood glucose¹⁴.

Objective

To establish the correlation between capillary blood glucose measured by glucometer and venous blood sample tested by biochemistry laboratory.

Methodology

This prospective study will be carried out on 200 non-diabetic individuals aged 20–35 years on non fasting state. Two blood samples (capillary and venous) will be taken from each volunteer at the same time. Exclusion Criteria is a known case of diabetes, age <20 years, fasting state, any peripheral vascular disease, shock and critically ill patients⁸. Appropriate statistical method would be applied to analyse the results.

It was a cross sectional study carried out at Sri Lakshmi Narayana Institute of Medical Sciences, Puducherry, between JULY TO AUGUST 2017. Apparently healthy 200 non diabetic volunteers in the age group of 20 – 35 years were enrolled in the study.

Two samples were taken from each volunteer simultaneously in a non fasting state for assessment of capillary and venous blood glucose. Glucose levels were measured using glucometer for capillary sample.

Exclusion Criteria

Diabetes mellitus

Age < 20 yrs

Critically ill patients

Shock

Peripheral vascular disease.

Appropriate statistical method was applied to analyze the results.

Experiemental Procedures

In this study, the paired samples such as finger-prick blood sample and venous blood sample were collected. The subjects who arrived at the laboratory at eight to nine o' clock in the morning had experienced 10/12-hour overnight fast. Each subject was fed 50g glucose solution served with 220ml of water. A venous blood sample (1.5ml) was collected by one professional nurse who placed a scalp needle on one subject's forearm; a finger-prick blood sample (1.5ml) was gathered in an automatic lancet device [Safe – T – Pro; Roche Diagnostics GmbH Mannheim, Germany 11. All blood samples were taken immediately according to the rules; before eating (0mins) and every 15, 30,45,60,90 and 120 minutes after eating. The collected blood samples were injected in Heparinized tubes and centrifuged for 3mins at 12500 x g and 40C to obtain plasma. Plasma was spotted onto a slide which contained a reagent layer (glucose oxidase and peroxidase (YSI 7100 Multiparameter Bioanalytical System)) for glucose concentrations⁹.

Discussion

It can be seen from blood glucose concentrations based on two types of blood samplings: venous blood samplings and finger-prick blood samplings, in this study that the mean capillary blood glucose concentration is higher than the

mean venous blood glucose concentration by 35% and the phenomenon of capillary blood glucose concentrations, greater than venous blood glucose concentrations is common at all time points⁴.

Furthermore, the minimum difference between the fasting capillary, blood glucose concentration and the fasting venous blood glucose concentration is similar to the literature ¹¹.

Furthermore, our finger-prick blood samplings are to collect peripheral capillary blood in which blood glucose concentration approximate to arterial blood glucose concentrations ¹⁰ because glucose assimilated by the human body is sequentially conveyed into arteries and tissue cells via diffusion in peripheral capillaries and some remaining glucose returns to veins¹⁴. Accordingly, both arterial blood glucose concentrations and postprandial capillary blood glucose concentrations are higher than venous blood glucose concentration in virtue of capillaries close to an artery ¹².

Table : 1 Total No. Of Blood Samples Collected = 200

	CAPILLARY BLOOD GLUCOSE (NO.)	VENOUS BLOOD GLUCOSE (NO.)
<80	11	9
80-85	19	21
85-90	22	24
90-95	33	35
95-100	25	27
100-105	22	24
105-110	18	16
110-115	15	13
115-120	18	16
>120	17	15

Range of Difference between capillary and venous blood glucose values (mg/dl)	Number
<5	37
5 -10	33
10-15	34
15-20	26
20-25	20
25-30	23
25-30	12
>30	15

Table : 2 Mean Capillary Blood Glucose Levels = 99.76+/- 14.48Mg/Dl

Mean Venous Blood Glucose Levels = 90.86+/- 8.13Mg/Dl

Results

Two hundred healthy volunteers blood samples on analysis revealed a mean capillary blood glucose levels of 99.76 ±14.48 mg/dl and venous blood glucose levels of 90.86±8.13 mg/dl, which was statistically significant with a p value of <0.0001. The result was found to be statistically extremely significant.

Conclusions

As per the results the capillary blood glucose estimation using glucometer over estimates the blood glucose level in non diabetic individuals in non fasting state. The traditionally used venous blood glucose estimation gives an exact value of blood glucose, though it is time consuming and requires more man power⁷.

Capillary blood glucose estimation can hence be used in non diabetic individuals in an acute emergency where blood glucose estimation by venous blood glucose analysis is not feasible³. Use of capillary blood glucose is of limited help in assessing a diabetic status of an individual⁶.

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