

Comparison of the Results of Some Hematological Parameters in Venous and Capillary Blood Samples

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Abstract

Background: Blood which considered one of the most important sample of body fluid due to use for hematological, biochemical, immunological assay and others.

Objective: The purpose of this study is to compare the results of certain hematological parameters with both venous and capillary blood samples to find out any differences in their results by using the same laboratory methods.

Methodology : In this study, we compare the results of some hematological parameters including hemoglobin concentration (Hb) , packed cell volume (PCV) , white blood cell count (WBCs), platelets count , and differential white blood cell count in both venous and capillary blood samples. Venous (forearm) and capillary (fingertip) blood samples were collected at the same time from 50 healthy male adults (20-23 years). Volunteer students of the College of Health and Medical Technology / Baghdad.

The measurements of the hematological parameters were carried out manually by routine hematological methods. All the tests were done immediately after blood collection at the teaching laboratory in the College of Health and Medical Technology / Baghdad for the period from November 2012 till March 2013.

Results: Capillary blood has significantly higher ($P<0.001$) hemoglobin concentration measurement than venous samples, while other hematologic parameters (PCV, WBCs, platelets, while differential WBC counts show no significant variation ($P>0.05$) between capillary and venous blood samples, except the lymphocyte count, which indicate a significant rise ($P<0.05$) in venous samples.

Recommendations: This study focused on some hematologic tests that can be done by either capillary or venous samples. It is necessary for future studies include hematological and biochemical parameters to find out if there is any difference regard in these two samples.

Key words: Hematological parameters, venous blood, capillary blood.

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Introduction

Many body samples and secretions can be investigated from different sites of a human body. Among these samples is the blood, which can be detected for

hematological, biochemical and immunological studies. Certain blood parameters (e.g blood counts) can be measured by samples taken from either sites i.e venous and capillary. Therefore, we

proposed to choose both to compare any variation in their results.

Venous and capillary blood are not quite similar. Difference of blood counts in venous and fingertip blood, including hematocrit and hemoglobin concentration have long been recognized, however, controversy remains about the exact aspects or mechanism of the difference [1]. Blood from a skin puncture is a mixture of blood from arterioles, veins and capillaries, therefore contain some interstitial and intracellular fluid [2,3,4].

Although some studies have suggested negligible differences in free flow of blood. [1], others have shown definite differences in composition between skin puncture and venous blood samples in neonates [5], children [6] and adults [6]. The differences may be exaggerated by cold with resulting slow capillary blood flow [2].

Materials and Methods

The study performed in the teaching laboratory of the College of Health and Medical Technology / Baghdad, from November 2012 to March 2013. Both capillary and venous samples were taken at the same time from each subject. We analyzed capillary (fingertip) and venous (forearm) blood samples from 50 healthy volunteer adult males subjects. Capillary samples were taken by a finger puncture by means of lancets, and the tests were performed immediately, while venous samples were drawn by means of disposable syringes and transferred into tubes containing EDTA as anticoagulant to be used for the requested tests. Care was taken that all tests were done in a short time to avoid changes in hematological values during the

readings... Hemoglobin (Hb), packed cell volume (PCV), white blood cell count (WBC), platelets count, differential WBC count were measured using routine manual hematological methods.

Hb concentration was determined by Cyanomethemoglobin photometric method, while PCV was measured by using the microcapillary centrifuge method. All cell counts (WBCs and platelets) were calculated using the Improved Neubauer Counting Chamber, whereas blood films were prepared and stained by Leishman stain to derive the percentage of each type of the white blood cells.

Data of this study were analyzed statistically using the (T test) for comparison after analysis of variance, mean standard deviation, and standard error 95% confidence intervals for population mean value by using the SPSS (version 10) program.

Results

Venous and capillary blood samples were obtained from 50 healthy young adult volunteers male, whose ages ranged from 20 to 23 years, the certain hematological parameters in the two samples were compared.

As shown in table (1), there was a highly significant difference ($P < 0.01$) in Hb values between venous and capillary blood samples (16.260 gm/dl) and (16.492 gm/dl) respectively, while no significant differences were found in each of PCV percentage, WBC count and platelets count between the two blood samples ($P > 0.05$).

Table (1): Comparison of (Hb, PCV, WBC, and Platelets) results in capillary & venous blood samples.

Parameter	Capillary blood	Venous blood	t	P. value	C.S
Hb (gm/dl)	16.492	16.260	2.699	P<0.01	HS
PCV (%)	47.06	47.84	1.244	P>0.05	NS
WBC (cell/c.mm)	7169	5607	0.850	P>0.05	NS
Platelets count (cell/c.mm)	343.900	339	1.073	P<0.05	NS

T: test, C.S: Comparison of significance

The results of the differential count of WBCs in table (2) show non-significant variations in each of neutrophils, eosinophils, basophils and monocytes differential counts between venous and capillary blood samples

(P>0.05), whereas a significant difference shown in lymphocyte differential count between venous and capillary blood samples (62.300 %) and (62.100%) respectively.

Table (2): Comparison of (Differential WBC count) results in capillary & venous blood samples.

parameter	Capillary blood	Venous blood	t	P. value	C.S
Neutrophils (%)	62.100	62.300	1.418	P>0.05	NS
Eosinophils (%)	1.260	1.340	0.562	P>0.05	NS
Basophils (%)	0.100	2.400	1.000	p>0.05	NS
Lymphocytes (%)	34.220	35.040	2.006	P<0.05	S
Monocytes (%)	2.140	2.240	0.759	P>0.05	NS

Discussion

Measurement of a large number of laboratory blood tests (particularly hematological) is usually carried out either from veins (arm) or from capillaries (finger). Finger-stick blood testing for complete blood count may be useful in remote sites, rural areas, physician clinics, and in developing countries [7]. However, there have been conflicting results from several studies that shown significant differences between capillary and venous blood parameters [8].

In our study, we estimated the hematological parameters (Hb, PCV, WBCs count, Platelets count and differential WBC counts). In both venous and capillary blood samples were taken from (50) young healthy adult students as volunteers and compared results. No significant variation between the results of certain parameters such as PCV,

WBC count, platelets count, neutrophils, eosinophils, basophils, and monocytes, while a highly significant difference was revealed between the values of Hb and a significant difference was shown between the lymphocyte counts in both samples.

One study conducted on healthy adult volunteers [1] reported no statistically significant difference between capillary and venous samples for Hb and platelets counts , but mentioned to statistically significant elevated WBCs in capillary samples. Another study [6], on healthy volunteers reported platelets count, elevated WBCs and Hb values in capillary blood compared to venous samples.

The result of Hb variation in our study is in a good agreement with the results of [9], who found that Hb in capillary blood was on average and indicated that this difference

likely reflects biological variability between Hb in those sites, thus may influence reliability of Hb estimates. In his study [10], also found higher capillary than venous Hb and explained this variation to the relative content of blood cells and plasma in a drop of blood after pricking the skin which altered compared with the blood of not opened vessels, and blood cells from smaller vessels enter a blood drop with greater velocity.

Previous studies demonstrated a decreased [6] or increased [11] platelets count in the fingertip blood compared to venous blood, while in the present study, no significant difference was detected between the two blood samples. In capillary blood the platelet is clotted so its count becomes less than venous blood. As also known, platelet count was one of the most unstable hematology parameters, to which the above discrepancies may be ascribed. The relatively large variation for platelet count in all blood samples may indicate a relative unstable status of delaying anticoagulation of blood in vitro, to which platelets are most sensitive [1].

Regarding the total and differential WBC counts, our results agreed with [10] who indicated small or (no significant) bias values for the total WBC, granulocyte, and monocytes counts, suggested that the two blood sampling methods are essentially interchangeable for these healthy populations. Whereas a significantly lower lymphocytes count was observed in the finger prick samples, which was attributed by [6] to the fact that blood sampled of the fingertip lancet method employed was predominantly arteriolar, rather than capillary, with the larger granulocytes and monocytes becoming more concentrated along the center of fast-flowing arterioles. This could explain our observation of a decrease in small-sized lymphocyte counts in

finger prick compared to venous blood samples.

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