Nat. Volatiles & Essent. Oils, 2022; 9(1): 823-836

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Natural Volatiles &
Essential Oils

Comparison Of The Results Of Counting The Number Of Blood Cells In The Veins And Capillary Blood Samples Using Medonic Hematology Equipment M-32 Series

Nurlia Naim[1,a*] , Kalma[2,b] , Artati[3,c] , Rudy Hartono[4,d] , Aan Yulianingsih[5,e]

[1,2,3,4] Medical Analyst Departement, Makassar Health Polytechnic, Makassar, Indonesia.

[5] Medical Analyst Departement, Ternate Health Polytechnic, Ternate, Indonesia.

Abstract : Examination of the blood cell count is an examination to determine the number of the three blood cells, namely leukocytes, erythrocytes, and platelets, which is part of a routine blood examination. Examination of the blood cell count can be taken from venous blood and capillary blood, but in capillary blood sampling there can be a dilution of the blood by tissue fluids so that the results of the blood cell count allow different between capillary blood samples and venous blood samples. The purpose of this study was to determine the differences in results. Count the number of blood cells in the venous and capillary blood samples using the Medonic M-32 series hematology device. This research was conducted at the Laboratory of Batara Siang Hospital, Pangkep Regency on June 2 – September 30 with a sample of 30 subjects. This type of research is descriptive quantitative. The overall data were tested for normality by the Kolmogorov Smirnov test and the comparative hypothesis test of the Paired t Test. The results of the examination using the Paired t Test showed a significant value for the P value of Leukocytes = 0.013, the P value of Erythrocytes = 0.000, and the P value of Platelets = 0.000. Paired t test statistic test shows the significant value of the three types of blood cell count, the P value is 0.05. So it can be concluded that there is a significant difference in the results of the blood cell count examination in venous and capillary blood samples using the Medonic Hematology Series M-32.

Keyword: count blood cell, Venous blood, Capillary blood

1. Introduction:

The Hematological examination is a routine examination performed on almost all patients who come to the hospital. The Hematological examination was carried out on venous blood samples that had been mixed with the anticoagulant EDTA (ethylene diamine tetraacetic acid) to prevent blood clots from occurring.

A hematology analyzer is a device used to measure the components in the blood. This tool is the main instrument used in clinical laboratories. This tool is used in the primary laboratory / at the public health center level to the main laboratory or reference laboratory

(1).

Along with the development of hematology examination technology in the laboratory, progress has been made very rapidly as evidenced by the presence of a hematology analyzer which is used to examine a complete blood count (CBC). The increasing number of patients visiting hospitals and health centers requires every laboratory to issue examination results quickly, precisely, and accurately.
The fact is not only in the laboratories of hospitals and health centers in big cities, but several laboratories in hospitals districts are now using a hematology analyzer. Even at the puskesmas level though. This condition is the impact of the increasing number of patients visiting the laboratory since the policy of the National Health Insurance System (JKN) was implemented by the government.

Hematological examination usually uses capillary blood or venous blood, capillary blood collection in adults is at the fingertips. While venous blood in adults is all superficial veins but the median cubitti is often used, because it has more fixation making it easier for sampling (2).

In the Medonic M-32 Series hematology analyzer, there are several methods of sample measurement. In addition to using venous blood samples mixed with EDTA (Open Tube method), samples can also be measured using capillary blood samples inserted into capillary micropipette tubes containing the anticoagulant K2EDTA (Micro Pipet Adapter/MPA method).

Routine hematological examinations at the Batara Siang Pangkep Hospital Laboratory using capillary blood samples are often an alternative method used by analysts who have difficulty in the process of taking venous blood samples, especially in infants and children.

The purpose of this study was to see differences in the results of the examination of the blood cell count in venous and capillary blood samples using the Medonic Hematology Series M-32 tool.

2. Experimental:

2.1 Materials:

K2EDTA vacuum tube, Tube rack, Spoit/needle, Tourniquet,Lancet, Cotton, Plaster/handsplast, sample label, 70% alcohol, diluent reagent, lyse reagent, Venous blood and capillary blood

2.2 Preparation of Complexes:

A. Using Capillary Blood

1. Procedure taking capillary blood

Prepare the tools and materials to be used, disinfect the finger to be pierced with

70% alcohol cotton and then let it dry by itself, after drying the fingertip is pressed and then pricked using a disposable lancet, the first drop of blood is wiped with dry cotton/ tissue. Then using tongs / capillary micropipette tube hook, one end of the capillary micropipette tube is touched to the blood part of the finger that has been punctured so that the capillary blood will enter the capillary micropipette tube by itself, let it run until it is full, place the capillary micropipette and its clamp on the workbench. Then a dry cotton swab is placed on the pricked fingertip, and the patient is asked to press for a moment with the patient's thumb. Capillary blood samples in the Capillary Micropipette are ready to be read on the Medonic M32 series hematology analyzer.

2. Capillary Blood Sample reading (micro pipette adapter)

a) Pressed the start menu on the display

b) Click on the “blood” tab located at the top right, then fill in the identity of the sample

c) Pull the MPA (micropipette adapter) from the tool and insert the capillary micropipette which already contains capillary blood into the Micropipette Adapter (MPA).

d) Put the MPA back into its original place and automatically the blood will be sucked into the instrument to be measured. The results will come out within 57 seconds and will appear on the screen stored in the device memory.

e) Remove the capillary micropipette from the MPA.

f) Replace the MPA into place on the Medonic Device.

B. Using blood vein

1. Venous Blood Collection Procedure

Prepare tools and materials to be used. Then a tourniquet/ rubber dam is placed about 3 fingers above the elbow crease, the patient is then asked to make a fist. Clean the part of the arm that will be punctured (vein) with 70% alcohol cotton. allowed to dry by itself. The skin over the vein is slightly tensed with one finger on the left hand. Then the vein is pierced with a needle at an angle of 30 to 45 degrees. Immediately release/stretched

2. Procedure for Reading Venous Blood Samples (Open Tube)

a) Pressed start menu on Display

b) click on the “blood” tab located at the top right of the display

c) Filled with the identity of the sample in the column provided

d) Sample homogenization process is carried out

e) Insert the patient's blood sample into the open tube needle then press the start plate, the blood will be sucked into the tool

f) The sample is withdrawn from the open tube needle after a beep sound is heard (there will be an inscription remove tube). The results will come out within 57 seconds and will appear on the screen and be stored in memory.

3. Post analytic

Table 1. Normal values for blood cell count

Inspection parameters	Normal value
Erythrocytes	4,5 – 5,5 juta sel/ul
Platelets	150.000 – 400.000 sel/ul
leukocytes	4000 – 10.000 sel/ul

Sumber : Gandasoebrata,2017

3. Results and Discussion:

From the results of the examination of venous and capillary blood samples using the Medonic M-32 Hematology tool, the statistical distribution data obtained from the count of the three blood cells are as follows:

Table 1. Statistical distribution of leukocyte count results in venous and capillary blood samples using the M-32 series medonic hematology device

Specimen type	N	Mean	Standard Deviation	Minimun	Maksimun	95 % CI	
						Lower	Upper
Venous blood	30	7,890	1,7541	3,7	10,6	7,234	8,543
Capillary blood	30	7,543	1,6260	4,1	10,5	6,953	8,156

Based on table 1 above, the results of the descriptive analysis of the leukocyte count of 30 subjects showed that in the venous blood sample the average value of the leukocyte count was 7,890 cells/ul of blood with a minimum number of 3,700 cells/ul and a maximum number of 10,600 cells/ul, and a standard deviation of 1 ,7541. Meanwhile, in capillary blood samples, the average number of leukocytes was 7,543 cells/ul of blood, with a minimum number of 4,100 cells/ul, a maximum number of 10,500 cells/ul, and a standard deviation of 1,6250.

Table 2. Statistical distribution of erythrocyte count results in venous and capillary blood samples using the M-32 series medonic hematology device

Specimen type	N	Mean	Standard Deviation	Minimun	Maksimun	95 % CI	
						Lower	Upper
Venous blood	30	4.5460	0,45755	3,58	5,28	4.3851	4.7023
Capillary blood	30	4.3743	0,48483	3,58	5,43	4.2047	4.555

Based on table 2 above, the results of the descriptive analysis of the erythrocyte count of 30 subjects showed that in the venous blood sample the average value of the erythrocyte count was 4,546,000 cells/ul of blood with a minimum number of 3,580,000 cells/ul and a maximum number of 5,280,000 cells/ul. ul, and the standard deviation of 0.45755. Meanwhile, in capillary blood samples, the average number of erythrocytes was 4,373,300 cells/ul of blood, with a minimum number of 3,580,000 cells/ul, a maximum number of 5,280,000 cells/ul, and a standard deviation of 0.48483.

Tabel 3. Statistical distribution of platelet count results in venous and capillary blood samples using the M-32 . series medonic hematology device

Specimen type	N	Mean	Standard Deviation	Minimun	Maksimun	95 % CI	
						Lower	Upper
Venous blood	30	269,97	61,288	183	420	249,93	291,36
Capillary blood	30	246,30	53,936	171	407	229,44	265,36

Based on table 4.3 above, the results of the descriptive analysis of the platelet count of 30 subjects showed that in the venous blood sample, the average value of the platelet count was 269.97 cells/ul of blood with a minimum number of 183,000 cells/ul and a maximum number of 420,000 cells/ul, as well as the standard deviation of 61,288. Meanwhile, in the capillary blood sample, the average number of platelets was 246.30 cells/ul of blood, with a minimum number of 171,000 cells/ul, a maximum number of 407,000 cells/ul, and a standard deviation of 53.936.

Data from the results of the examination of blood cell counts in venous and capillary blood samples using the Medonic M-32 series hematology tool, then normality tests were carried out first to determine whether the research data was normally or not normally distributed with the Kolmogor of Smirnov One-Sample test.

Tabel 4. Kolmogorov-Smirnov normality test analysis of the results of counting the number of blood cells in venous and capillary blood samples using the M-32 series medonic hematology tool

Tests of Normality			
	Kolmogorov-Smirnov[a]		
	Statistic	Df	Sig.
venous blood leukocytes	,074	30	,200*
capillary blood leukocytes	,150	30	,082
venous blood erythrocytes	,093	30	,200*
capillary blood erythrocytes	,095	30	,200*
venous blood trombosit	,144	30	,116
capillary blood trombosit	,127	30	,200*

Based on the results of the Kolmogor of Smirnov One-Sample test, the data significance value for the leukocyte count in the venous blood sample was 0.200 and the capillary blood sample was 0.082. The significance value for counting the number of erythrocytes in venous blood samples was 0.200 and capillary blood samples were 0.200.

While the significance value for the platelet count in the venous blood sample is 0.116 and the capillary blood sample is 0.200. Thus all categories have a significance value > 0.05 so it can be concluded that the research data is normally distributed, then the data can be continued with the analysis of the t-paired sample test.

Tabel 5. Analysis of paired sample t test count the number of blood cells in venous and capillary blood samples using the M-32 series medonic hematology tool

Variabel	**N**	**Mean**	**Standard Deviation**	**Minimun**	**Maksimun**	**Sig (2 tailed) / Value**
venous blood leukocytes	30	7,890	17,541	3,7	10,6	0.013
capillary blood leukocytes	30	7,543	16,260	4,1	10,5	

venous blood erythrocytes	30	4.5460	0,45755	3,58	5,28	0.000
capillary blood erythrocytes venous blood erythrocytes	30	4.3743	0,48483	3,58	5,43	
venous blood trombosit	30	269,97	61,288	183	420	0.000
capillary blood trombosit venous blood trombosit	30	246,30	53,936	171	407	

Table 5 above shows that the results of the paired sample t test for the three examination parameters obtained the P value of Leukocytes = 0.013, P value of Erythrocytes = 0.000 and P value of Platelets = 0.000. Thus, the three types of blood cell count have a P value of 0.05, so Ho is rejected, Hi is accepted. So it can be concluded that there is a significant difference from the results of the blood cell count examination in venous and capillary blood samples using the Medonic Hematology Series M-32.

Discussion

Examination of the blood cell count is part of routine hematological examinations that are often carried out to determine a person's health condition. In addition to functioning as a screening test, it also has a high diagnostic value in diseases caused by infection, leukemia, anemia and blood clotting disorders, and bleeding disorders, both before and after treatment.

A Routine hematological examination can be done manually and automatically. Automatic examination using a hematology Analyzer has a higher level of precision and accuracy and a faster inspection time. Hematological examination usually uses capillary blood or venous blood, capillary blood collection in adults is at the fingertips. While venous blood in adults is all superficial veins but the median cubitti is often used, because it has more fixation making it easier for sampling (2).

Based on the results of research that has been carried out on 30 subjects, it shows that in venous blood samples the average value of the leukocyte count is 7,890 cells/ul of blood with a minimum number of 3,700 cells/ul and a maximum number of 10,600 cells/ul, and a standard deviation of 1.7541. Whereas in capillary blood samples the average value of

leukocytes is 7,543 cells/ul of blood, with a minimum number of 4,100 cells/ul, a maximum number of 10,500 cells/ul, and a standard deviation of 1,6250.

The erythrocyte parameter shows that in the venous blood sample the average number of erythrocytes is 4,546,000 cells/ul of blood with a minimum number of 3,580,000 cells/ul and a maximum number of 5,280,000 cells/ul, and a standard deviation of 0.45755. Meanwhile, in capillary blood samples, the average number of erythrocytes was 4,373,300 cells/ul of blood, with a minimum number of 3,580,000 cells/ul, a maximum number of 5,280,000 cells/ul, and a standard deviation of 0.48483.

Meanwhile, the platelet parameter shows that in the venous blood sample, the average value of the platelet count is 269.97 cells/ul of blood with a minimum number of 183,000 cells/ul and a maximum number of 420,000 cells/ul, and a standard deviation of 61,288. Meanwhile, in the capillary blood sample, the average platelet count was 246.30 cells/ul of blood, with a minimum number of 171,000 cells/ul, a maximum number of 407,000 cells/ul, and a standard deviation of 53.936.

Furthermore, based on Table 4.5 the results of the paired sample t-test analysis for the three examination parameters obtained Leukocytes p-value = 0.013, Erythrocytes p-value = 0.000, and Platelets p-value = 0.000). The three parameters each have a P value of 0.05, then Ho is rejected, Hi is accepted. So it can be concluded that there is a significant difference from the results of the blood cell count examination in the sample venous and capillary blood using the Medonic M-32 Hematology apparatus.

This is in line with Helda Ramadhanti's 2017 research with an automatic method which obtained research results where the average value of the platelet count obtained on the examination of the platelet count with a venous blood sample was greater, namely 306,180/mm3 compared to a capillary blood sample, which was 269,770/ mm3 indicates that there is a significant difference between venous blood and capillary blood on the examination of the platelet count.

Meanwhile, according to research by Ade Yunita Imroanul, 2018 regarding the difference in the number of leukocytes in venous and capillary blood using dilution in a tube as many as 28 research samples. The results of the study concluded that there was a significant difference between venous blood and capillary blood in the examination of leukocytes using the tube dilution method, where the P-value was 0.013 < 0.05.

Dacie & Pearce's opinion is that capillary blood and venous blood have different blood compositions. The number of platelets is higher in venous blood than in capillary blood. The difference is about 9% or 32%. The occurrence of this condition is related to platelet adhesion at the site of skin leakage (3)

The significant difference was caused by the dilution of the capillary blood sample which could be caused by a less deep puncture. So that the blood that comes out is not smooth and

usually in this condition the patient's finger will be pressed or squeezed. This situation will cause dilution of blood by tissue fluid so that the results of the examination of blood cell counts tend to be low or decreased for the three types of blood cells, namely leukocytes, erythrocytes, and platelets.

In addition, according to Pearce (2013), capillaries are very small blood vessels where arteries end. The smaller the arteriole, the more the three layers of its wall will disappear, so that when it reaches the capillary as fine as a hair, the wall remains only one layer, namely the endothelium layer (tunicaintima). This thin layer allows lymph to seep out to form tissue fluid and carry water. Minerals and nutrients for cells, provide oxygen and remove waste materials including carbon dioxide (4).

The walls of the capillaries are very thin which causes plasma and nutrients to easily seep out and form tissue fluids so that during the capillary blood sampling process, where the patient's finger is pierced and then squeezed/pressed to get the desired blood volume, this condition can result in This causes the dilution of blood by tissue fluids which results in lower blood cell count results.

4. Conclusion:

Based on the results of research that have been carried out on the comparison of the results of the blood cell count in venous and capillary blood samples using the Medonic M-32 series hematology tool where the results of research data analysis using the Paired t-test, the P-value of Leukocytes = 0.013, the P- value Erythrocytes = 0.000 and P-value Platelets = 0.000, so the significance value of the three types of blood cell count P-value is 0.05. So it can be concluded that there is a significant difference from the results of the blood cell count examination in venous and capillary blood samples using the Medonic Hematology Series M-32 tool.

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