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## Analysis of Examination Results of Erythrocyte Index in Pulmonary TB Patients Labuang Baji General Hospital, Makassar City

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### Abstract

The high rate of transmission of tuberculosis (TB) in Makassar City is very concerning. Data from the Makassar Health Office (Dinkes) in 2019 there were 5,412 TB cases. The data then decreased during the pandemic to 3,260 cases in 2020. And 3,911 cases in 2021 with a recovery rate of 83% in 2019 and 85% in 2020. The purpose of this study was to determine the value of the erythrocyte index in patients with pulmonary tuberculosis at the Hospital of Labuang Baji, Makassar City. The type of research used is laboratory observation with descriptive method. The population in this study were all patients with pulmonary tuberculosis as many as 11 people with pulmonary tuberculosis. The results obtained are known for the MCV value, 8 tuberculosis patients have a normal MCV value, 2 patients have a low MCV value and one has a high MCV value, for the MCH value, 6 tuberculosis patients have a normal MCH value, 4 patients have a high MCH value. low and one patient had a high MCH value, for the MCHC value 4 people with tuberculosis had a normal MCHC value and 7 patients had a low MCHC value.

**Keywords:** Tuberculosis, Erythrocyte, Transmission of TB

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### Abstrak

Tingginya angka penularan tuberkulosis (TB) di Kota Makassar sangat memprihatinkan. Data Dinas Kesehatan (Dinkes) Makassar tahun 2019 terdapat 5.412 kasus TB. Data tersebut kemudian menurun pada masa pandemi menjadi 3.260 kasus pada tahun 2020. Dan 3.911 kasus pada tahun 2021 dengan angka kesembuhan 83% pada tahun 2019 dan 85% pada tahun 2020. Tujuan dari penelitian ini adalah untuk mengetahui nilai indeks eritrosit pada pasien dengan tuberkulosis paru di RSUD Labuang Baji Kota Makassar. Jenis penelitian yang digunakan adalah observasi laboratorium dengan metode deskriptif. Populasi dalam penelitian ini adalah seluruh penderita tuberkulosis paru sebanyak 11 orang penderita tuberkulosis paru. Hasil yang didapatkan diketahui nilai MCV, 8 pasien tuberkulosis memiliki nilai MCV normal, 2 pasien memiliki nilai MCV rendah dan 1 pasien memiliki nilai MCV tinggi, untuk nilai MCH, 6 pasien tuberkulosis memiliki nilai MCH normal, 4 pasien memiliki nilai MCH yang tinggi. rendah dan satu pasien memiliki nilai KIA tinggi, untuk nilai MCHC 4 orang penderita tuberkulosis memiliki nilai MCHC normal dan 7 pasien memiliki nilai MCHC rendah.

**Kata kunci:** Tuberculosis, Eritrosit, Transmisi TB

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## INTRODUCTION

Tuberculosis can affect all series of hematopoiesis, especially in erythrocytes, when infected erythrocytes a reaction will occur where the life span of erythrocytes is about 10-20 days shorter while in normal conditions the life span of erythrocytes is 120 days. In this condition, it affects the poor production of erythrocytes so that they are damaged and can affect lower hemoglobin concentrations and experience anemia. Laboratory tests are needed in diagnosing tuberculosis (TB), one of the laboratory tests in the field of hematology that can be done is the examination of the erythrocyte index. This examination is carried out to determine the classification of various types of anemia. Erythrocytes are produced by red bone marrow. In a day Produced about 3.5 million cells/kg body weight. These red blood cells survive and function for 90-120 days, then are destroyed by macrophages in the spleen and liver<sup>1,2,3</sup>.

Tuberculosis is still a health problem for the people of Indonesia, especially for active smokers. There are many risk factors that can cause tuberculosis in active smokers including age at starting smoking, number of cigarettes consumed per day, and how long smoking has been done. The purpose of this study was to

determine the results of the identification of mycobacterium tuberculosis in active smokers with the Ziehl–Neelsen staining acid resistance test method. This type of research is a descriptive analytic study that aims to determine the results of the identification of Mycobacterium tuberculosis in active smokers. The Ziehl–Neelsen staining acid resistance test was conducted at the Tourism Hospital Laboratory of the University of East Indonesia Makassar on September 22 to October 6, 2022. The population in the study this is 10 people. The sample was determined using a total sampling technique so that 10 samples were obtained. The research variables were active smokers. The data obtained are presented in the form of tables and narratives. The conclusion after laboratory testing using the Ziehl–Neelsen staining method was found that 1 out of 10 samples of active smokers was identified as Mycobacterium Tuberculosis<sup>4</sup>.

From the 2010 WHO Global Report, obtained data on pulmonary TB in Indonesia, the total of all pulmonary TB cases in 2009 was 294,731 cases, of which 169,213 were cases of new smear-positive pulmonary TB, 108,616 cases of smear-negative pulmonary TB, 11,215 extra pulmonary TB cases, 3,709 pulmonary TB cases<sup>5</sup> Relapse and 1,978 cases of re-treatment outside of relapse cases. Pulmonary TB

is not a new disease in Indonesia, but until now it is still a major health problem. It is estimated that the number of pulmonary TB cases in Indonesia accounts for around 5.8 percent of the total number of pulmonary TB in the world. The prevalence of tuberculosis in Indonesia is 281 cases per 100,000 population with a treatment success rate of 90.3%. This number decreased compared to 2010 of 289 per 100,000 population<sup>6</sup>. On March 3 2014, the Stop TB Partnership Forum for the Southeast Asia, West Pacific and East Mediterranean Regions was held in Jakarta. The forum involved 100 participants from 13 countries consisting of national TB program managers, national stop TB partnerships, and related NGOs<sup>6 7</sup>.

Previous studies have shown a relationship between pulmonary TB and the erythrocyte index, that anemia of chronic disease is more common in tuberculosis patients compared to iron deficiency anemia, anemia of chronic disease occurs due to suppression of erythropoiesis by inflammatory mediators. Severe tuberculosis infection with anemia status will disappear with successful adherence to treatment such as Anti-Tuberculosis Drugs (OAT) such as iron (Fe), hydroxycobalamin (Vitamin B12) and folic acid, erythropoietin, and consuming foodstuffs that contain lots of protein. So for that erythrocyte indices such as Mean Corpuscular Volume (MCV) are used to determine

cell size, Mean Corpuscular Hemoglobin (MCH), and Mean Corpuscular Hemoglobin Concentration (MCHC) are used to determine the size, shape and color of erythrocytes and the value of hemoglobin can support laboratory diagnosis in classifying anemia or as a support in distinguishing various types of anemia<sup>8</sup>.

Red blood cells (erythrocytes) are the most abundant cells in comparison with other blood cells which have an erythrocyte count of approximately 5 million/mm<sup>2</sup> and function to transport oxygen gas (O<sub>2</sub>) into all cells and tissues of the body to enable metabolic activities in them. Normal erythrocytes are biconcave or disc-shaped with a diameter of about 8 microns<sup>9</sup>. Red blood cells do not have a nucleus but have a central pallor. The mature erythrocyte is a biconcave disk about 7 microns in diameter. Erythrocytes are cells with an incomplete structure. This cell only consists of a cytoplasmic membrane without a cell nucleus. Red blood cells in the body are useful for transporting oxygen needed in the lungs to be circulated throughout the body and transporting carbon dioxide to be removed from the body<sup>10</sup>.

Review of the mean corpuscular values or erythrocyte index provides information about the average size of erythrocytes and the amount of hemoglobin per erythrocyte. a. Mean Corpuscular Volume (MCV) MCV is also called the Average Erythrocyte

Volume (VER) is an average of an erythrocyte called a femtoliter. b. Mean Corpuscular Hemoglobin MCH is also called the Average Erythrocyte Hemoglobin (HER) is the amount of hemoglobin per erythrocyte called picogram. c. Mean corpuscular hemoglobin concentration (MCHC) MCHC is also called the Average Erythrocyte Hemoglobin Concentration (KHER) is the hemoglobin level obtained per erythrocyte, expressed as a percentage.

## METHODOLOGY

The type of research used is laboratory observation with descriptive method, The population in this study were all patients with pulmonary tuberculosis in Labuang Baji Hospital, Makassar City with a total sample of 11 people. The sampling technique used was saturated sampling, where all populations were used as samples. This research took place in August 2022, with the object of research being the erythrocyte index in patients with pulmonary TB.

The research procedures were:

- (1) Sampling in the sampling room which consisted of a 3cc syringe, tourniquet, EDTA vacutainer tube, the ingredients included EDTA blood, alcohol cotton and plaster.
- (2) working procedure by preparing the tools and materials to be used and then asking patient to stretch out his hand,

then palpate the patient's arm, then put a tourniquet on the patient's upper arm + 7cm from the elbow fold then disinfect the skin around the place where the blood was taken (the median cubital vein area) with alcohol cotton and let it dry, then puncture the vein with the needle position 30° from skin, if blood is seen flowing into the syringe, immediately release the tourniquet and pull the pin slowly until the blood is obtained as needed. after that carefully remove the needle and insert it into the EDTA vacutainer tube which has been given an ID for each patient, after that close the injection site with dry cotton and plaster. then homogenize the blood sample until smooth to avoid hemolysis, or blood clots after that throw away the needle that has been used into the safety box.

(3) Examination of the Erythrocyte Index The method used is the Hematology Analyzer method with tools such as the material analyzer, including EDTA blood through pre-analysis, preparation of venous blood samples with EDTA anticoagulant, then the analytical prepares the tools and materials to be used. Then the words "please wait" will appear on the display screen, it will automatically carry out the operation. Pressing the analysis button and making sure it's on the whole blood method (the writing is in the lower middle position). Pressing

the button (patient demographics). Enter the patient ID then press the "OK" button. The blood sample to be used must first be homogenized. Insert the sample into the probe until it touches the bottom of the tube. Pressing the probe button then the sample will be processed. Then after the sample has been sucked in and the examination results will appear on the screen, record the results according to the patient's ID, in post-analytic Interpretation of Results MCV = 80-96 fl MCH = 27-33 pg/cell MCHC = 33-35 g/dl.

## RESULT AND DISCUSSION

Tuberculosis is an infectious disease caused by the bacterium *Mycobacterium tuberculosis* which results in hematological abnormalities, especially in the erythrocyte index so that it can affect the process of erythropoiesis, namely shortening the life span of erythrocytes in the bone marrow before they go to body tissues. A limit for the size and content of hemoglobin is expressed by the red cell index. The erythrocyte index consists of the contents/volume and size of the MCV (mean corpuscular volume) in femtoliter (fL), MCH (mean corpuscular hemoglobin) in picogram (pg), MCHC (mean corpuscular hemoglobin concentration or average erythrocyte hemoglobin level) in units of grams/deciliter (g/dL). Erythrocyte index or Mean Corpuscular Value is an

average value that can provide information about the average erythrocyte and the amount of hemoglobin per erythrocyte. Examination of the erythrocyte index is used as a screening test to diagnose anemia and determine anemia based on its morphology.

Based on the results of a study of 11 tuberculosis patients at the Labuang Baji Hospital, Makassar City on 15-25 August 2022, it was found that 8 of them had normal MCV values and 2 people had low MCV while 1 person had high, for normal MCH values, namely 6 people, the low 4 people and the high 1 person, then the normal MCHC value is 4 people, the low is 7 people, as shown in the table 1 below.

The erythrocyte index in patients with pulmonary tuberculosis is usually low. This is due to the occurrence of anemia (iron deficiency) in patients. This situation is characterized by decreased transferrin saturation and decreased bone marrow ferritin or hemosiderin levels. From the results of the study it was known that some TB sufferers had a normal erythrocyte index, some had a low erythrocyte index and some had a high erythrocyte index. For patients who have a normal erythrocyte index, this could be influenced by the consumption of anti-tuberculosis drugs that have been carried out for 5-6

months or because there are no haematological changes in patients that

can be caused by the daily habits of pulmonary TB patients.

**Table 1.** Examination Results of Erythrocyte Index in Patients with Pulmonary Tuberculosis

No	Sample Code	Sex	Age	MCV (fL)	MCH (pg)	MCHC (g/dL)
1	1	L	39	79.2	24.1	30.4
2	2	P	22	86	27.8	32.4
3	3	P	39	85	27.3	32.1
4	4	L	53	87.1	27.8	31
5	5	L	29	85.2	29	34
6	6	L	28	85.4	28.3	33.2
7	7	P	26	72.7	21.1	29.1
8	8	L	81	87.7	31.1	35.4
9	9	P	58	80.2	23.4	29.2
10	10	L	65	108.4	36.6	33.8
11	11	L	51	83.1	28.4	34.2

(Source: Primary data, 2022)

Normal value of Erythrocyte Index

MCV = 80.0 – 96.1 (fL)

MCH = 27.5 – 33.2 (pg)

MCHC = 33.4 – 35.5 (g/dL)

Patients who have an abnormal (low) erythrocyte index due to reduced iron. This is caused by a low intake of total iron in food or decreased bioavailability of consumed iron. This can occur due to reduced appetite, insomnia in tuberculosis sufferers. For those who have a high erythrocyte index, it is usually caused by interference from other diseases such as infection, sample lysis and because the hemoglobin concentration is more than normal. The results of the above research are in line with research that has been conducted by, Jonuarti, R<sup>11</sup>, which found that out of 20 pulmonary

TB sufferers it was found that the MCV value was normal, namely 11 sufferers and 9 patients were abnormal, while the normal MCH values were 12 patients and those who were not normal were 8 patients, and for normal MCHC values were 14 patients and those who were not normal were 6 patients. For the abnormal results above, there is an indication of anemia. From the research conducted by Arma Yunis (2020) at the Kendari City Hospital, it was also found that out of 12 patients with pulmonary tuberculosis, it was found that 8 patients had normal MCV values and 4

patients who were abnormal, while 4 patients had normal MCH values and those who were not normal 8 patients, and for normal MCHC values there were 10 sufferers and 2 patients who were abnormal. Of the 12 patients with pulmonary tuberculosis who were examined for the erythrocyte index, the normal values were more than abnormal.

## CONCLUSION

Based on the results of the research on the description of the results of examining the erythrocyte index in patients with pulmonary tuberculosis at the Labuang Baji Hospital, Makassar City, it was found that out of 11 people with pulmonary tuberculosis, the results of examination of normal MCV values were 8 patients, 2 patients who were low and 1 patient high, the results of the examination normal MCH values were 6 patients, 4 patients who were not normal and 1 patient who had high, MCHC examination results were normal in 4 patients and those who were low were 7 patients.

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