

## CORRELATION OF ERYTHROCYTE SEDIMENTATION RATE (ESR) AND LYMPHOCYTE COUNTS IN PULMONARY TUBERCULOSIS PATIENTS DURING INTENSIVE TREATMENT IN PURWOKERTO CITY

### Hubungan Nilai Laju Endap Darah (LED) Dengan Jumlah Limfosit Pada Pasien Tuberkulosis Paru Masa Pengobatan Tahap Intensif Di Kota Purwokerto

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#### Abstrak

Tuberkulosis paru merupakan penyakit yang disebabkan oleh adanya bakteri *Mycobacterium tuberculosis* yang paling sering menyerang paru-paru dengan penyebarannya melalui udara pada pasien yang mengalami batuk, bersin ataupun meludah. Pada tuberkulosis pemeriksaan Laju Endap Darah digunakan untuk membantu mendiagnosis perjalanan penyakit dan membantu untuk keberhasilan terapi kronik, dan pemeriksaan hitung jumlah limfosit digunakan untuk menunjang diagnosis infeksi dari bakteri. Penelitian ini merupakan penelitian analitik dengan melalui pendekatan *cross sectional* dengan uji Korelasi Pearson. Hasil pada pemeriksaan LED sebanyak 8 sampel (21%) normal dan 30 sampel (79%) tidak normal. Pada pemeriksaan hitung jumlah limfosit 21 sampel (55%) mengalami limfopenia, 16 sampel (42%) pasien normal, dan 1 sampel (3%) mengalami limfositosis. Pada Uji korelasi pearson yaitu korelasinya searah namun berkorelasi moderat atau cukup ( $r=0.304$ ). Berdasarkan hasil tersebut dapat disimpulkan bahwa ada hubungan antara Laju Endap Darah dengan Hitung Jumlah Limfosit. Hal ini berarti jika Nilai LED besar maka jumlah limfosit juga akan meningkat.

#### Kata Kunci:

Tuberkulosis Paru  
Laju Endap Darah  
Jumlah Limfosit

#### Keywords:

*Pulmonary Tuberculosis*  
*Erythrocyte Sedimentation Rate*  
*Lymphocyte Count*

#### Abstract

*Pulmonary tuberculosis is a disease caused by the bacterium *Mycobacterium tuberculosis* which most often attacks the lungs by spreading through the air in patients who cough, sneeze or spit. In tuberculosis, the erythrocyte sedimentation rate examination is used to help diagnose the course of the disease and help for the success of chronic therapy, and the examination of the lymphocyte count is used to support the diagnosis of bacterial infection. This study is an analytic study through a cross sectional approach with the Pearson Correlation test. The results of this LED examination were 8 samples (21%) normal and 30 samples (79%) abnormal. On examination of the lymphocyte count, 21 samples (55%) had lymphopenia, 16 samples (42%) were normal patients, and 1 sample (3%) had lymphocytosis. In the Pearson correlation test, the correlation is unidirectional but moderately or moderately correlated ( $r=0.304$ ). Based on these results, it can be concluded that there is a relationship between erythrocyte sedimentation rate and lymphocyte count. This means that if the LED value is large, the number of lymphocytes will also increase.*

## INTRODUCTION

*Pulmonary tuberculosis* is a contagious infectious disease that is currently an important health problem in the world (United States Department of Health and Human Services, 2009). According to the World Health Organization (WHO) in one year, *Pulmonary tuberculosis* has killed about 2 million people, and WHO estimates that in 2002-2020 there were about 2 billion people

infected, of which 5-10% of infections will progress to disease. , and 40% of those who get sick can end up dying. Estimates from the WHO, that as many as 2-4 people will be infected with pulmonary tuberculosis every second and almost 4 people every minute die from pulmonary tuberculosis (WHO, 2006).

According to the 2016 WHO report, the number of *pulmonary tuberculosis* cases in Indonesia was 360,565

and in 2017 it increased to 425,085 cases. The highest number of *Pulmonary tuberculosis* cases was also reported, one of which was in the province of Central Java (Maelani & Cahyati, 2018). *Pulmonary tuberculosis* cases in Central Java in 2018 were reported as many as 143.9 per 100,000 population, this shows that the discovery of *Pulmonary tuberculosis* cases in Central Java has increased compared to the previous year in 2017 which was 132.9 per 100,000 population. Banyumas is one of the districts in Central Java, in 2018 the number of cases of pulmonary tuberculosis in Banyumas reached 194.9 per 100,000 population (Central Java Health Office, 2018).

*Pulmonary tuberculosis* or commonly referred to as pulmonary TB is a disease that attacks the respiratory system (Sri Hartini, 2018). *Pulmonary tuberculosis* is a disease caused by the bacterium *Mycobacterium tuberculosis* which most often attacks the lungs by spreading through the air in patients who cough, sneeze or spit (Global tuberculosis report, 2020). *Pulmonary tuberculosis* in Indonesia is one of the national priorities established for the pulmonary disease control program because it has a wide impact on the quality of life, economy, and often causes death. This condition has resulted in the Indonesian government setting guidelines for controlling pulmonary tuberculosis as a legal entity. The control of pulmonary tuberculosis in Indonesia is regulated in the Decree of the Minister of Health of the Republic of Indonesia 364/MenKes/SK/V/2009 regarding guidelines for controlling tuberculosis.

*Erythrocyte Sedimentation Rate* (ESR) is one of the routine blood tests to determine the level of inflammation in a person's body (Danu Santoso, 2012). Examination of the erythrocyte sedimentation rate is used to help diagnose the course of the disease and help for the success of chronic therapy, for example in tuberculosis. If the *erythrocyte sedimentation rate* is fast it indicates an active lesion, and an increase in the erythrocyte sedimentation rate compared to the

previous one indicates an extensive process, while a decreased erythrocyte sedimentation rate compared to the previous one indicates an improvement (Gandasoebrata, 2010).

In the intensive treatment of pulmonary tuberculosis, *anti-tuberculosis drugs* (OAT) are usually given which can cause a decrease in the number of leukocytes and the type of leukocyte count, if at the beginning of the examination the number of leukocytes increases then this is due to infection and returns to normal after a few months of treatment (Amaylia Oehadian, 2003). ). Lymphocytes are leukocytes that are in the second most numerous in number, these cells are small and migrate to areas of inflammation in the early and late stages of the inflammatory process (Kemenkes RI, 2011). Examination of the lymphocyte count can be used to support the diagnosis of *Mycobacterium tuberculosis* bacterial infection, and can also be used to see the patient's immune response and response to treatment, as well as see the progress of the disease. Lymphocytosis is an increase in the number of lymphocytes above 4000/mm<sup>3</sup> of blood or more than 40% of the number of leukocytes found in viral and bacterial diseases. Pulmonary tuberculosis is the main cause of lymphocytosis, therefore lymphocytosis is considered as an active sign of *Mycobacterium tuberculosis* infection (N Abramson and B Melton, 2000).

## METHODS

This study uses a *quantitative analytical research* design with a *cross sectional* approach. The samples were a population of *pulmonary tuberculosis* patients at Wijayakusuma Hospital Purwokerto with a total of 38 samples, with inclusion criteria, namely the samples were *pulmonary tuberculosis* patients undergoing intensive treatment, who were tested for the ESR value and lymphocyte count at Wijayakusuma Hospital Purwokerto, and the samples were tested in October – December 2020. The exclusion criteria were that the

samples were a *pulmonary tuberculosis* patient undergoing advanced treatment and who had an infectious disease other than pulmonary tuberculosis.

Secondary data obtained from the results of laboratory examinations were then processed using tables and tested for correlation using SPSS.

## RESULT AND DISCUSSION

### RESULT

This study was conducted by taking secondary data on pulmonary tuberculosis patients at RST Wijayakusuma Purwokerto in October - December 2020 with 38 patient samples. Then the results obtained in the form of analysis as follows:

**Table I.** Results of *erythrocyte sedimentation rate* in patients with pulmonary tuberculosis during intensive treatment.

ESR	Freq (fi)	Persentase (%)
Normal	8	21
Abnormal	30	79
Σ	38	100

On Table I above, it can be seen that from 38 samples, the results of the erythrocyte sedimentation rate of pulmonary tuberculosis patients during the intensive stage of treatment with normal values were 8 samples (21%) and abnormal values were 30 samples (79%).

**Table II.** The results of the *lymphocytes count* in pulmonary tuberculosis patients during the intensive stage of treatment.

Lymph	Freq (fi)	Persentase (%)
<20%	21	55
20-40%	16	42
>40%	1	3
Σ	38	100

On Table II above, there are 21 samples (55%) experiencing lymphopenia, 16 samples (42%) normal patients, and 1 sample (3%) having lymphocytosis.

**Table III.** The results of the erythrocyte sedimentation rate in patients with pulmonary tuberculosis during the intensive stage of treatment based on Age factor.

Age	ESR					
	Normal		Abnormal		Σ	
	fi	%	fi	%	fi	%
>50 th	2	12,5	14	87,5	16	100
<50 th	6	27,3	16	72,7	22	100
Σ	8	21	30	79	38	100

On Table III above, it is known that from 16 samples with a variable age > 50 years, the normal erythrocyte sedimentation rate values were 2 samples (12.5%) and 14 samples were not normal (87.5%). Meanwhile, from 22 samples with a variable age <50 years, 6 samples (27.3%) of normal erythrocyte sedimentation rate values and 16 samples (72.7%).

**Table IV.** The results of the *lymphocyte count* in patients with pulmonary tuberculosis during the intensive stage of treatment based on the age factor.

	Lymph							
	<20%		20-40%		>40%		Σ	
	Fi	%	fi	%	fi	%	fi	%
>50 th	1	68,75	5	31,25	0	0	1	10
th	1	75					6	0
<50 th	1	50	10	45,5	1	4,5	2	10
th	1						2	0
Σ	2	58	15	39,4	1	2,6	3	10
	2						8	0

On Table IV above, it is known that from 16 samples with a variable age > 50 years, 11 samples (68.75%) had lymphopenia, 5 samples (31.25%) were normal patients, and none had lymphocytosis. Meanwhile, from 22 samples with a variable age <50 years, 11 samples (50%) had lymphopenia, 10 samples (45.5%) were normal patients, and 1 sample (4.5%) had lymphocytosis.

**Table V.** The results of the *erythrocyte sedimentation rate* in patients with pulmonary tuberculosis during the intensive stage of treatment based on gender.

Gender	ESR					
	Normal		Abnormal		$\Sigma$	
	fi	%	fi	%	fi	%
M	4	16	21	84	25	100
F	4	31	9	69	13	100
$\Sigma$	8	21	30	79	38	100

On Table V, it is known that from 25 samples with the male category gender variable, the normal erythrocyte sedimentation rate values were 4 samples (16%) and 21 samples (84%). Meanwhile, from the 13 samples with the female category, the normal erythrocyte sedimentation rate was 4 samples (31%) and 9 samples (69%).

**Table VI.** The results of the *lymphocyte count* in patients with pulmonary tuberculosis during the intensive stage of treatment based on gender factor.

Gender	Lymph						$\Sigma$	
	<20%		20-40%		>40%		fi	%
	fi	%	fi	%	fi	%	fi	%
M	15	60	9	36	1	4	25	100
F	6	46	7	54	0	0	13	100
$\Sigma$	21	55	16	42	1	3	38	100

On Table VI. above, it is known that from 25 samples with male category variables, 15 samples (60%) had lymphopenia, 9 samples (36%) were normal patients, and 1 sample (4%) had lymphocytosis. Meanwhile, from 13 samples with female category, 6 samples (46%) had lymphopenia, 5 samples (54%) were normal patients, and none had lymphocytosis.

**Tabel VII.** Pearson Test Correlation Test Results

		ESR	Lymph
ESR	Pearson Correlation	1	.304
	Sig. (2-tailed)		.063
	N	38	38
Lymph	Pearson Correlation	.304	1
	Sig. (2-tailed)	.063	
	N	38	38

The results of the ESR and the lymphocytes count were tested for normality of the distribution of the data

using the Saphiro Wilk test. The results obtained were normal data so that the Pearson correlation test was continued with the results of Sig. ( $r=0.063$ ) and Pearson Correlation  $r=0.304$ . So it can be interpreted that there is no correlation between the two ( $r = 0.063$ ), and if there is a correlation, the correlation is in the same direction but weakly correlated ( $r = 0.304$ ).

## DISCUSSION

This research conducted on 38 *pulmonary tuberculosis* patients during the intensive stage of treatment, the results showed that the *erythrocyte sedimentation rate* of pulmonary tuberculosis patients during the intensive stage of treatment with normal values as many as 8 samples (21%) and abnormal values as many as 30 samples (79%). This study is in line with Widya Lestari's research in 2017 on the *erythrocyte sedimentation rate* of pulmonary tuberculosis patients at South Tangerang General Hospital with a total of 105 pulmonary tuberculosis patients found in 6 patients (5.72%) with normal ESR values and 99 patients (94.28%) with increased ESR value.

The increased ESR value is one of the side effects of intensive treatment in patients such as Anti Tuberculosis Drug (ATD) therapy. In the mechanism of action of ATD on Isoniazid and Rifampicin drugs when consumed, the patient will experience a lot of decreased metabolism, with this condition the patient will experience impaired appetite intake which then affects the hemoglobin level to decrease accompanied by a high ESR value because when the hemoglobin decreases, the erythrocyte mass will be lighter. and if the erythrocyte mass is lighter then the erythrocyte deposition will be longer so that the ESR value will be elongated. Disruption of the patient's body metabolism can make the patient experience a lot of weakness, this atd treatment is indeed gradual from drug adjustment to healing and must be supported with adequate nutrition and nutrition (Lestari, 2017).

The results of the lymphocyte count on table II. By analyzing data from 38 samples, 21 samples (55%) had lymphopenia, 16 samples (42%) were normal patients, and 1 sample (3%) had lymphocytosis. This study is in line with the research conducted by Sahal et al, 2013. Where 85% of patients still have lymphopenia, and 15% of patients are normal. Factors for the occurrence of lymphopenia in patients with pulmonary tuberculosis can be caused by side effects of anti-pulmonary tuberculosis drugs. Malnutrition is caused by a catabolic process that causes weight loss, starting before the patient is diagnosed. At the same time, food intake is reduced due to anorexia. This is in accordance with the theory, which states that pulmonary tuberculosis can cause hematological disorders, namely lymphopenia (decreased lymphocyte count below 1500/mm<sup>3</sup>) (Oehadian, 2003).

This study is in line with the study conducted by Yanagisawa N, et al, in Japan, who studied the erythrocyte sedimentation rate and related factors affecting ESR values in 32 patients with pulmonary tuberculosis. ESR values tend to be higher for subjects over 60 years of age. The erythrocyte sedimentation rate will continue to increase with age. Overall, the erythrocyte sedimentation rate will increase by 0.85 mm/hour for every 5 years of increasing age. After menopause, around the age of 50 the erythrocyte sedimentation rate rises more rapidly for women than for men. The cause of the increase in the *erythrocyte sedimentation rate* with age is not known with certainty, but it can be shown from the increase in fibrinogen levels that occur in pregnancy, diabetes mellitus, and infections. ESR is said to often increase in active processes, but a normal ESR does not rule out tuberculosis.

As stated by Hiswani in Manalu in 2010 pulmonary tuberculosis was most often found at a young age or productive age, namely 15-50 years. Where the productive age is someone who is at the stage of socializing with a large external environment. Social

attitudes that do not think about or do not know about the surrounding conditions are also factors that can affect the exposure to an infection around the environment. When interacting in the external environment with a decreased immune system will greatly affect exposure to infection from the surrounding environment.

From table V, it is known that from 25 samples with male category gender variables, the normal *erythrocyte sedimentation rate* values were 4 samples (16%) and 21 samples (84%). Meanwhile, from the 13 samples with the female category, the normal erythrocyte sedimentation rate was 4 samples (31%) and 9 samples (69%). This study is in line with Widya Lestari's 2017 value of the *erythrocyte sedimentation rate* of pulmonary tuberculosis patients at South Tangerang General Hospital with a total of 105 pulmonary tuberculosis patients obtained including 71 male patients (67.62%) and 34 female patients (32.38%) and showed that there were fewer female patients but had a higher erythrocyte sedimentation rate in women. Whereas in male patients, it shows that patients have more numbers with a lower erythrocyte sedimentation rate. This can be attributed to men tend to have a habit of smoking and consuming alcohol. This habit causes a decrease in the body's resistance which can make it easier for someone to contract tuberculosis. However, the erythrocyte sedimentation rate in women rose faster than in men. This can be shown by an increase in fibrinogen levels that occur in conditions of pregnancy, diabetes mellitus, and infections (Lestari, 2017).

On table VI, it is known that from 25 samples with male category sex variables, 15 samples (60%) had lymphopenia, 9 samples (36%) were normal patients, and 1 sample (4%) had lymphocytosis. Meanwhile, from 13 samples with female category, 6 samples (46%) had lymphopenia, 5 samples (54%) were normal patients, and none had lymphocytosis. In another study, it was also shown that the number of patients with pulmonary tuberculosis was more in men than in women. In a study

conducted by Pratiwi et al in 2016 there were 9 men and 6 women. And in Abbas's research in 2017 there were 39 men, while only 19 women. The thing that causes the male sex to be more dominant in this disease, can be due to the lifestyle factors of a man who mostly smokes and consumes alcohol. So that it can reduce the body's defense system which causes the body to be more easily exposed to the bacteria *Mycobacterium tuberculosis* that causes pulmonary tuberculosis.

Statistical Test for the Results of the ESR and Lymphocyte Count, a normality test of the distribution of the data using the Saphiro Wilk test was performed. The results were normal, so the Pearson correlation test was carried out with the results of Sig. ( $r=0.063$ ) and Pearson Correlation  $r=0.304$ . So that it can be interpreted that there is no correlation between the two ( $r = 0.063$ ), and if there is a correlation, the correlation is unidirectional but the correlation is moderate or sufficient ( $r = 0.304$ ). This means that if the ESR value is large, the lymphocytes count will also increase.

## CONCLUSION

Based on the results of the study of the correlation of erythrocyte sedimentation rate (ESR) and the number of lymphocytes, it can be concluded that there is a moderate correlation between the erythrocyte sedimentation rate and the number of lymphocytes in patients with pulmonary tuberculosis during the intensive stage of treatment in purwokerto city.

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