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The Relationship Between Blood Glucose Levels To The Results Mycobacterium Tuberculosis Examination In Tuberculosis Patients

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ABSTRACT

Tuberculosis (TB) is still high. 10.4 million new cases of TB occur and 1.4 million die from the disease is found The World Health Organization (WHO). Elevated blood glucose can lead to more severe tuberculosis infection, reactivation of dormant tuberculosis foci, and poor treatment outcomes. Determine the relationship of blood glucose levels to the results of Mycobacterium tuberculosis examination in suspected tuberculosis patients in Ketapang Banyuwangi area is the purpose of this of research study. The method was correlational analytic design of this study. The results conducted on 118 people who performed tuberculosis screening examinations, 32 people who qualified as a population. And 30 (thirty) people who meet the inclusion requirements as research samples. The results of the patient's molecular rapid test showed 6 (six) people were positive (+), and the results of the patient's culture showed 3 (three) people were positive (+) and 3 (three) other people were negative (-). While the results of fasting blood glucose level examination in 3 (three) tuberculosis patients conducted periodically (every week) for 5 (five) weeks were in the range of 78mg/dL - 150mg/dL. The conclusion is that there is a significant relationship between blood glucose levels and results of Mycobacterium tuberculosis examination of tuberculosis patients in the first, second and third patients in Ketapang Banyuwangi area.

INTRODUCTION

The highest cause of death is tuberculosis after heart disease (reduced blood intake to the heart) and cerebrovascular disease. (Ministry of Health, 2019). Tuberculosis continues to plague the people of Banyuwangi. From the beginning of January to the end of the year (22 December 2022), there were 2,400 recorded cases caused by the bacteria Mycobacterium tuberculosis.

The total number of suspected tuberculosis detected reached 74.6 percent of the target of 17,659. TB cases, which have reached 2,400 cases, have reached 73.4 percent of the incidence target of 3,270 cases. Meanwhile, in 2021, tuberculosis cases in Banyuwangi will be 1,885 people or 50.7 percent of the incidence target. Even though the percentage of cases continues to rise, the Banyuwangi Health Service is trying to find cases and control TB disease so that it can reach zero cases by 2030. (Banyuwangi Health Service, 2022)

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From data from the International Diabetes Federation (IDF) it can be predicted that in 2040 the burden of DM in the world will now be around 415 million, which is estimated to increase by >60% (642 million) . Tuberculosis infections that get worse, passive tuberculosis that is reactivated, as well as suboptimal therapy results can be caused by diabetes mellitus. Therefore, the author discusses in depth about diabetes mellitus as a risk factor for tuberculosis and it is hoped that this will motivate the awareness of doctors, tuberculosis program managers and those in diabetes mellitus regarding re-infection of tuberculosis in diabetes mellitus sufferers as well as how to screen and manage patients so that get better. (Yorke E, Atiase Y, Akpalu J, Sarfo-Kantanka O, Boima V, Dey ID., 2017). In the world the fourth largest cause of death is caused by Diabetes Mellitus. Every year there are 3.2 million deaths due to diabetes. The conclusion is that 6 people per minute or 1 person per 10 seconds are claiming lives due to diseases caused by diabetes. In 1995 the number of diabetes mellitus sufferers in Indonesia reached 4.5 million, which was the seventh largest in the world. In Indonesia, there are now more than 5 million diabetes mellitus sufferers. The prevalence of diabetes mellitus in Indonesia reached 2.5%, obtained from Riskesdas data in 2013. (Perdoki J, 2014)

International research states that 5–30% of tuberculosis sufferers suffer from diabetes mellitus (Ministry of Health of the Republic of Indonesia, 2019). The prevalence of pulmonary tuberculosis is increasing in line with the increasing prevalence of diabetes mellitus patients. About 10-15% of tuberculosis patients suffer from diabetes mellitus, a 2-5 times increase compared to patients without diabetes. (Ministry of Health of the Republic of Indonesia, 2019).

MATERIALS/METHOD

This research was conducted at the Klatak Banyuwangi Health Center and BBLK Surabaya at the end of February until May 2023.

This research refers to experimental research with a bias towards cross sectional research. This study used a population, namely patients suspected of tuberculosis in the Ketapang area who underwent tuberculosis screening and were referred to the Klatak Banyuwangi Community Health Center and met the inclusive criteria, namely patients suspected of tuberculosis and aged 15-65 years. which is then examined using the molecular rapid test method.

RESULTS AND DISCUSSION

Based on the results of research regarding the relationship between blood glucose levels and examination results Mycobacterium tuberculosis tuberculosis patients in the Ketapang Banyuwangi area obtained data which can be seen in table 1 as follows :

Table 1. Patient Characteristics Based on Age and Gender

Variable	Frequency (n=30)	%
Gender		
Woman	18	60.0
Man	12	40.0
Age (Years)		
17-25	5	16.7
26-35	5	16.7
36-45	7	23.3
46-55	5	16.7

56-65	7	23.3
65-70	1	3.3

Based on table 1 (one) above showed that out of 30 (thirty) people, 18 (eighteen) women were female and (60.0%) and 12 (twelve) people (40.0%) were male, while the patient's age showed that some Most aged 36-45 years amounted to 7 people (23.3%), some aged 56-65 years amounted to 7 people (23.3%), and aged 65 - 70 years totaled 1 (one) person (3.3 %).

Table 2 . Molecular Rapid Test Results and Bacterial Culture Results

Molecular Rapid Test Results	**Sample**	**Percentage**
Positive (+)	6	20.0
Negative (-)	24	80.0
Total	30	100.0
Culture results	**Sample**	**Percentage**
Positive (+)	3	50.0
Negative (-)	3	50.0
Total	6	100.0

In table 2 above that out of 30 samples who had undergone a rapid molecular test examination, 6 (six) people positive results (+) and 24 people with negative results. Culture results from 6 (six) patients showed that 3 were positive (+), and the other 3 were negative (-).

Table 3 Patient Characteristics Based on BTA Examination, Bacteria/Field of View, and First Week Fasting Blood Glucose Results

BTA	**Sample**	**Percentage**
2+	1	33.3
3+	2	66.7
Bacteria per field of view	**Sample**	**Percentage**
9	1	33.3
20	1	33.3
27	1	33.3
Results of fasting blood glucose examination	**Sample**	**Percentage**
90mg/dL	1	33.3
115mg/dL	1	33.3
123mg/dL	1	33.3
Total	**3**	**100**
Spearman Rank Test	**<0.05**	**0,000**

Patient in the first and second weeks showed that if there was an increase in bacteria per visual field, fasting blood glucose levels also increased. In the third and fourth weeks the number of bacteria found remained constant, but fasting blood glucose levels decreased. In

the fifth week there was a decrease in bacteria per visual field and fasting blood glucose levels also decreased.

Table 4 Characteristics of BTA examination results, bacteria per field of view and blood glucose levels per week in the first patient

Period	BTA	Bacteria per Field of View	Fasting Blood Glucose Levels (mg/dL)
Week 1	3+	20	115
Week 2	3+	17	112
Week 3	2+	9	97
Week 4	2+	9	89
Week 5	2+	8	87

In the first patient in the first and second weeks, it showed that if there was an increase in bacteria per field of view, fasting blood glucose levels also increased. In the third and fourth weeks the number of bacteria found remained constant, but fasting blood glucose levels decreased. In the fifth week there was a decrease in bacteria per visual field and fasting blood glucose levels also decreased.

Table 5 Characteristics of BTA Examination Results, Bacteria per Field of View and Blood Glucose Levels per Week in the Second Patient

Period	BTA	Bacteria per Field of View	Fasting blood glucose levels (mg/dL)
Week 1	3+	27	90
Week 2	3+	25	83
Week 3	3+	23	81
Week 4	3+	20	78
Week 5	3+	29	97

In the second patient, in the first, second, third, fourth and fifth weeks, there was an increase in bacteria per field of view and fasting blood glucose levels also increased.

Table 6 Tick Characteristics of BTA Examination Results, Bacteria Per Field of View and Blood Glucose Levels Per Week in the Third Patient

Period	BTA	Bacteria/Field of View	Fasting blood glucose levels (mg/dL)
Week 1	2+	9	123
Week 2	2+	7	103
Week 3	2+	6	95
Week 4	2+	6	94
Week 5	3+	19	150

In the first patient, in the first and second weeks, if there was an increase in bacteria per visual field, fasting blood glucose levels also increased. In the third and fourth weeks the

number of bacteria found remained constant, but fasting blood glucose levels decreased. In the fifth week there was a decrease in bacteria per field of view and blood glucose levels in fasting people (8-12 hours) also decreased.

Of the 30 (thirty) samples examined, it showed that the patient's gender was female 60.0% or 18 (eighteen) people are female and 40% 12 (twelve) people are male. The age of the patients showed 36-45 years old, 7 (seven) people (23.3%), 56-65 years old, 7 (seven) people or 23.3%. The results of the patient's rapid molecular test showed that 6 (six) people had positive results (+), and Bacterial culture results showed 3 (three) people were positive (+), and 3 (three) other people were negative (-).

Mycobacterium tuberculosis infection is strongly influenced by high glucose concentrations in the blood. So that a high level of tuberculosis severity will also cause blood glucose levels to rise (Anggraeni et al., 2022). The increase in the incidence of diabetes mellitus is related the emergence of tuberculosis infection (Aziz, 2019). Mycobacterium tuberculosis Tuberculosis is a contagious infectious disease caused by. The development of active tuberculosis is due to diabetes mellitus.

In general, interpretation of the results of supporting examinations including sputum tests and x-rays is returned to the doctor responsible because these results need to be evaluated by comparing the clinical symptoms that appear. The results of a rapid molecular test examination are negative if accompanied by X-ray examination results and clinical symptoms or close contact with a strong suggestion of pulmonary tuberculosis, they can also be called pulmonary tuberculosis sufferers (BTA negative tuberculosis) so they still have to undergo treatment (Ministry of Health of the Republic of Indonesia, 2020). Meanwhile, the results of the molecular rapid test are bacteriological confirmation results if obtained in patients who have never received therapy. The culture results are negative if the patient has received treatment and anti-tuberculosis drugs, the condition of transporting the specimen, examining the culture using the wrong method can also cause the bacteria to die, contamination, insufficient number of specimens, and transcription errors in the laboratory (Ministry of Health of the Republic of Indonesia, 2020).

In the first week, 2 people (66.7%) obtained BTA 3+ test results, 9 , 20 and 27 were found . bacteria per field of view, while the results of a fasting blood glucose examination showed glucose levels of 90 mg/dl, 115 mg/dl, and 123 mg/dl. The results of the correlation test showed a p value of 0.000 (<0.05), meaning that in the first week there was a relationship between blood glucose levels and the results of Mycobacterium tuberculosis examination of tuberculosis patients in the Ketapang Banyuwangi area.

In the second week, 2 people (66.7%) obtained BTA 3+ test results, 7, 17 and 25 were found. bacteria per field of view, while the results of a fasting blood glucose examination showed glucose levels of 83mg/dl, 103mg/dl, and 112mg/dl. The results of the correlation test showed that the p value was 0.000 (<0.05), meaning that in the second week there was a relationship between blood glucose levels and the results of Mycobacterium tuberculosis examination of tuberculosis patients in the Ketapang Banyuwangi area.

In the third week, the results of the BTA 2+ examination were obtained in 2 people (66.7%), 6, 9 and 23 bacteria were found per field of view, while the results of the fasting blood glucose examination showed glucose levels of 81 mg/dl, 95 mg/dl. dl, and 97 mg/dl. The results of the correlation test showed that the p value was 0.000 (<0.05), meaning that in the third week there was a relationship between blood glucose levels and the results of Mycobacterium tuberculosis examination of tuberculosis patients in the Ketapang Banyuwangi area.

In the fourth week, the results of the BT examination were 2+ for 2 people (66.7%), found a number of 6, 9 and 20 bacteria per field of view, while the results of the fasting blood glucose examination showed glucose levels of 78mg/dl, 89mg/dl and 94mg. /dl. The

results of the correlation test showed that the p value was 0.866 (>0.05), meaning that in the fourth week there was no relationship between blood glucose levels and the results of Mycobacterium tuberculosis examination of tuberculosis patients in the Ketapang Banyuwangi area.

In the fifth week, 2 people (66.7%) obtained BTA 3+ test results, 8, 19 and 29 bacteria were found per field of view, while fasting blood glucose examination results showed glucose levels of 87mg/dl, 97mg/dl and 150mg. /dl. The results of the correlation test showed that the p value was 0.866 (>0.05), meaning that in the fifth week there was no relationship between blood glucose levels and the results of Mycobacterium tuberculosis examination of tuberculosis patients in the Ketapang Banyuwangi area.

Determining the therapy to be given should not use the results of rapid molecular tests and analysis of the patient's clinical condition (Ministry of Health, 2020). The increasing degree of severity in tuberculosis sufferers is diabetes mellitus. Increased risk factors for developing tuberculosis 2-3 times compared to people who do not suffer from diabetes mellitus. One of the examination corrections for tuberculosis treatment namely examination of sputum for acid-fast bacilli (BTA). There is a correlation between the results of the examination BTA sputum after treatment is one of the characteristics of success and the patient 's recovery rate tuberculosis. Successful routine treatment Tuberculosis is influenced by many things, such as routine compliance and adherence to taking medication, the existence of a Medication Monitor (PMO), the patient's immune system, the age of the patient with tuberculosis, lifestyle and the patient's environment and activities. Diabetes mellitus can also cause a decrease in the patient's immune system which results in the survival of bacteria in tuberculosis sufferers in the congenital disease diabetes mellitus. Blood glucose levels are less well maintained contributes to the increased risk of death and patient recurrence tuberculosis. Duration of patient treatment tuberculosis in congenital diabetes mellitus it becomes 9 - 12 months (Sari et al., 2023). Diabetes mellitus patients are influenced by blood glucose levels. Complications for diabetes mellitus sufferers increase if glucose levels in the blood are not maintained properly, thus causing disruption of cellular immunity in the body. A person has a greater risk of being infected and getting worse if they have diabetes mellitus compared to people without diabetes mellitus. Diabetes mellitus can also increase the severity of tuberculosis.

This research is also in line with research by Sari et al (2023), which states that there is significant correlation between HbA1c values and successful treatment of tuberculosis sufferers with congenital type 2 diabetes mellitus, the failure rate of antituberculosis drugs in patients with abnormal HbA1c is 3 (three) times higher than in patients with normal HbA1c. Importance Good control of blood glucose levels results in failure of antituberculosis treatment in patients with type 2 diabetes mellitus and pulmonary tuberculosis to a lower level.

Research from Anggraeni et al (2022) showed that the results of blood sugar levels which influence the severity of tuberculosis were 281 - 300 mg/dl and BTA results were 3 + . The conclusion is that a high level of tuberculosis disease severity can result in increased blood glucose levels as well.

Another study conducted by Susanto et al (2019), the results of research obtained from 31 tuberculosis patients who were seeking treatment showed that tuberculosis patients with BTA positive sputum who had not taken medication had an average blood glucose level of 176 mg/dL who had been on treatment for 2 months on average. the average blood glucose was 144 mg/dL, those who had been on treatment for 5 months had an average blood glucose of 107 mg/dL . and those who had received treatment for 6 months had an average blood glucose of 159 mg/dL. Overall, the average blood glucose level for tuberculosis sufferers at the Cakranegara Community Health Center was 145 mg/dL. The conclusion of this research

is that blood glucose levels in tuberculosis sufferers at the Cakranegara Community Health Center are in the uncertain category of diabetes mellitus.

Based on the results of this research, it is proven that the more Mycobacterium tuberculosis bacteria in the body of a person suffering from tuberculosis, the higher the value of glucose levels in the blood. So it can be concluded that there is a relationship between levels glucose blood to results of Mycobacterium tuberculosis examination in tuberculosis patients in the Ketapang area of Banyuwangi.

CONCLUSIONS

The conclusion from the results of this study is that of the 30 (thirty) samples examined using the molecular rapid test method, 6 (six) people (20%) showed positive results and 24 (80%) negative results from the total samples examined. . After obtaining positive results from the molecular rapid test examination, it was followed by bacterial culture examination with positive results for 3 (three) people (10%) and negative results for 3 people (10%) in total of the samples examined. Furthermore, for positive sample culture results, glucose and BTA examinations were carried out periodically (per week) for 5 (five) weeks and the results showed that there was an increase in bacteria per field of view with the result that fasting blood glucose levels also increased, the number of bacteria found remained constant but Fasting blood glucose levels decrease and the number of bacteria per visual field decreases with the result that fasting blood glucose levels also decrease.

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