HUBUNGAN KADAR GULA DARAH DENGAN PENYAKIT TUBERKULOSIS PARU DI PUSKESMAS DESA BINJAI

SKRIPSI

OLEH:

DARNI

16 870 0003

ABSTRACT

High blood sugar in diabetes patient is a good space for bacteria growth including Mycobacterium tuberculosis. It is the main cause of tuberculosis and diabetes mellitus arise together. Tuberculosis is an infectious disease which is still main problem and is the second largest cause of death among other infectious diseases. The aim of this study is to determine relationship between blood sugar levels and pulmonary tuberculosis in Puskesmas Desa Binjai. The sample in this study consist of 31 people in age 15 until 50 years. The results showed that 21 samples in high blood sugar levels positively suffered from pulmonary tuberculosis. The results of correlation between blood sugar levels and pulmonary tuberculosis showed a moderate correlation value of r = 0.4724844. Correlation between blood sugar levels and pulmonary tuberculosis at Puskesmas Desa Binjai has moderate correlation. High blood sugar levels did not determine the severity of pulmonary tuberculosis for the sample at Puskesmas Desa Binjai.

Keywords: ***blood sugar levels, pulmonary tuberculosis, Mycobacterium tuberculosis.***

CHAPTER I

INTRODUCTION

1.1 Background of Study

Diabetes mellitus is a disease due to increased glucose levels in the blood that exceeds normal limits or is known as hyperglycemia. The World Health Organization (WHO) states that the increasing number of people with diabetes mellitus will become one of the world's health threats. Based on research conducted, WHO predicted that the the number of people with diabetes mellitus in Indonesia will increase from 8.4 million in 2000 to 21.3 million in 2035 (The Indonesian Society for Endocrinology, 2015).

According to the Ministry of Health of the Republic of Indonesia (1991), community health center (Puskesmas) is a functional health organization that serves as the center for community health development, fosters community participation, and provides comprehensive and integrated services to the community in its working area through main activities. The Community Health Center of Binjai Village is located in Medan Denai Subdistrict, North Sumatra. As many as 240 people check their blood sugar levels every month at the Community Health Center of Binjai Village. As for the diabetes examination, as many as 60 people regularly check their condition every month. The age range of those who request examination varied from the age of 18 – 65 years (Profile of the Community Health Center Binjai Village, 2018)..

Diabetes mellitus does not only affect those in old age range but also young people. Research by Rukmini & Chatarina (2010) states that tuberculosis mostly attacks the productive age, which is range of 35-54 years with a percentage of 48.7%. Diabetes mellitus at productive age can occur due to lifestyle, especially in cases of type II diabetes mellitus. In addition, productive age is also susceptible to diabetes mellitus due to environmental factors, such as obesity, insulin resistance, food consumption with high carbohydrate and fat intake, and lack of physical activity (Betteng et al, 2014).

Tuberculosis is one of the infectious diseases that become a major problem and ranks as the second-largest cause of death among other infectious diseases after HIV (Human Immunodeficiency Virus). The World Health Organization (WHO) reports that as many as three million people die per year due to tuberculosis. Nine million new tuberculosis cases and 75% of mortality and illness in the community are suffered by people in the productive age of 15-50 years (Indonesian Ministry of Health, 2018).

Nadliroh et al (2015) reveal 902 cases of diabetes mellitus in 2013 at Kariadi Hospital Semarang with an accumulation of 103 diabetes mellitus cases accompanied by tuberculosis. This is in line with Rohman's research (2018) that tuberculosis and diabetes mellitus are health problems that aggravate every year.

Sixteen cases of tuberculosis with a history of diabetes mellitus were found in the Kulon Progo area in 2014.

Patients with diabetes mellitus will experience physiological disorders in the lungs, including the impediment of fighting against infection by the immune system, thus infection spreads faster in patients faster (Novita et al, 2018). High blood sugar in people with diabetes mellitus is a good environment for bacteria to grow, including Mycobacterium tuberculosis. This is the main source of tuberculosis and diabetes mellitus occurring simultaneously (Mihardja et al, 2015).

Therefore, the explanation above motivates the author to conduct research and analyze "The Relationship between Blood Sugar Levels and Pulmonary Tuberculosis Disease at the Community Health Center of Binjai Village".

1.2 Formulation of Study

The formulation of the problem in this study is how the relationship between blood sugar levels and pulmonary tuberculosis was at the Community Health Center of Binjai Village.

1.3 Objective of Study

The objective of this study was to determine the relationship between blood sugar levels and pulmonary tuberculosis at the Community Health Center of Binjai Village.

1.4 Significance of Study

The significance of study was to provide information about the relationship between blood sugar levels and pulmonary tuberculosis at the Community Health Center of Binjai Village.

CHAPTER II

LITERATURE REVIEW

2.1 Diabetes Melitus

Diabetes mellitus (DM) is a chronic metabolic disorder because the pancreas is not able to produce sufficient insulin or the body cannot use the insulin it produces effectively. Insulin is a hormone that regulates the balance of blood sugar levels. As a result, there is a rise of glucose concentration in the blood or hyperglycemia (Indonesian Ministry of Health, 2014). Insulin deficiency can occur as the result of three basis; damage to pancreatic cells due to external influences (viruses and chemicals), desensitization or decrease in glucose receptors of the pancreas gland, and desensitization or damage to insulin receptors in peripheral tissues (Lanywati, 2001).

There are two main categories of diabetes: type 1 and type 2. Type 1 diabetes, formerly called insulin-dependent or juvenile/childhood-onset diabetes, is characterized by a lack of insulin production. Type 2 diabetes, formerly called non-insulin-dependent or adult-onset diabetes, is caused by the body's ineffective use of insulin. Type 2 diabetes dominates 90% of diabetes cases. Gestational diabetes is hyperglycemia that arises during pregnancy. Impaired Glucose Tolerance (IGT) and Impaired Fasting Glycaemia (IFG) are transitional conditions between normal and diabetes. People with IGT or IFG are at high risk of developing type 2 diabetes. With weight loss and lifestyle changes,

progression to diabetes can be prevented or delayed (Decroli, 2019).

There are risk factors that cause a person to experience diabetes mellitus. In type 1, people will be more susceptible if there is a family medical history of diabetes. This indicates that genetic factors play a significant role in type 1 DM prevalence. Type 1 DM can also be prompted by a virus. Meanwhile, in type 2 DM the causal factors are more diverse, such as obesity, lifestyle, and lack of exercise (physical activity). Physical activity will help control weight, burn glucose for energy, and build body cells to be more sensitive to insulin. The subsequent factor is age. In type 2 DM, the risk of the disease will multiply together with age and high blood pressure (Purnama, 2009). To date, Indonesia ranks among the top 10 most diabetics countries in the world. In fact, in 2013, it was estimated that 8.5 million people in Indonesia with an age range of 20-79 years suffered from this disease (Fernandez et al, 2014).

2.1.1 Symptoms of Diabetes Mellitus

Symptoms of diabetes mellitus are known as trio-P, namely polyuria, polydipsia, and polyphagia (Lannywati, 2001).

1. Polyuria (excessive urine)

   Polyuria or excessive urine production is a common symptom of diabetes mellitus. This is promoted by the high level of blood sugar, thereby stimulating the body to

excrete it through the kidneys with urine. Generally, polyuria occurs at night (Lannywati, 2001).

2. Polydipsia (excessive thirst)

   Polydipsia reaction ensues as the body's reaction to the amount of urine excreted. To prevent dehydration, the body will respond with thirst which causes the desire to drink (Lannywati, 2001).

3. Polyphagia (excessive eating)

   The desire to eat in people with diabetes mellitus occurs due to reduced sugar reserves in the body regardless of the high blood sugar levels. This condition will force the body to obtain sugar reserves from the food it receives (Lannywati, 2001).

According to Lanywati (2001), in addition to the three criteria above, other symptoms that appear in people with diabetes mellitus include:

1. Weight loss
2. Tired for no apparent reason
3. The onset of itching and chronic inflammation of the skin
4. Tingling feeling (numbness) or pain in the hands and feet
5. Slow-healing wounds on body parts such as hands and feet
6. Loss of consciousness

2.2 Tuberculosis Disease

2.2.1 Epidemiology

Tuberculosis is an infectious disease caused by the bacteria Mycobacterium tuberculosis. These bacteria are rod-shaped and acid-fast so they are also known as acid-fast bacillus (AFB), which were discovered by Robert Koch in 1882 (Maetaniarsih et al, 2013).

M. tuberculosis bacteria have a size of 0.5 - 4 microns x 0.3 - 0.6 microns with a rod shape, straight and slightly curved, granular, or have no sheath but a thick outer layer consisting of lipids (mainly mycolic acid). These bacteria can withstand color washing with acid and alcohol, therefore called AFB (acid-fast bacillus), and are chemically and physically resistant to dry and cold conditions, dormant and aerobic (Widoyono, 2005).

The main symptom of patients with pulmonary tuberculosis is coughing up white mucus for 2 weeks or more. Coughing can be followed by other symptoms, including blood in phlegm, coughing up blood, shortness of breath, weakness, loss of appetite, weight loss, malaise, night sweats without physical activity, fever for more than one month (Indonesian Ministry of Health, 2017).

The prevalence of tuberculosis in Indonesia in 2014 was 297 per 100,000 population. Tuberculosis elimination is also one of the three main focuses of the government in the health sector in addition to reducing stunting and increasing immunization coverage and quality. The vision established regarding

this disease is a world free from tuberculosis, zero mortality, disease, and suffering due to tuberculosis (Indonesian Ministry of Health, 2018).

Tuberculosis infects all age groups and genders, and has spread not only to low socioeconomic group but to others as well. Indonesia's health profile in 2002 describes the largest percentage of tuberculosis sufferers aged 25-34 years (23.67%), followed by 35-44 years (20.46%), 15-24 years (18.08%), 45-54 years (17.48%), 55-64 years (12.32%), over 65 years (6.68%) and the lowest was 0-14 years (1.31%). Of all these patients, the recovery rate only reached 70.03% of the target 85%. The low recovery rate is motivated by several factors, such as patient (behavior, characteristics, socioeconomic), health officers (behavior, skills), drug availability, environment (geography), MS (medication supervision) as well as virulence and the number of germs (Nizar, 2017).

2.2.2 Transmission of Tuberculosis

Tuberculosis disease caused by Mycobacterium tuberculosis is transmitted through the air (droplet nuclei) when a tuberculosis patient coughs and droplets of saliva containing the bacteria are inhaled by others when breathing. When the patient coughs, sneezes, or talks with other people, M. tuberculosis is expelled and inhaled into the lungs. The incubation period for these bacteria is 3-6 months (Magee, 2011).

Pulmonary tuberculosis occurs when the immune system drops. From an epidemiological perspective, the emergence of tuberculosis is the result of interactions between three components; the host, the agent, and the environment.

On the host aspect, susceptibility to Mycobacterium tuberculosis infection is strongly influenced by a person's immune system at that time. Those with HIV/AIDS or poor nutritional status are more easily infected and transmitted by tuberculosis (Indonesian Ministry of Health, 2018).

The risk of infection is related to the duration and quality of exposure to the source of infection and is irrelevant to genetic and other host factors. The highest risk of developing the disease is in children under 3 years of age, the risk modulates once entering childhood, and reraise in adolescence, young adulthood, and old age. Bacteria enter the human body through the respiratory tract and spread to other body parts through blood circulation, lymph vessels, or directly to nearby organs (Rukmini & Chatarina, 2010).

Each positive acid-fast bacillus (AFB) will infect 10-15 people so the probability of each contact being infected with tuberculosis is 17%. A patient with AFB smear (+) whose degree is highly positive possibly transmits this disease. On the other hand, patients with AFB smear (-) are deemed non-infectious. The incidence rate of tuberculosis infection in Indonesia is 1-3%, which implies that among 100 residents, 1-3 residents will be infected with tuberculosis. It is estimated that half of these patients will entail a positive AFB smear (Widoyono, 2005).

The number of new tuberculosis cases in Indonesia was reported to reach 420,994 cases in 2017 (data as of May 17, 2018). According to gender, the

number of new cases of tuberculosis in 2017 was 1.4 times greater for men than for women. Even based on the Tuberculosis Prevalence Survey, the prevalence in men is 3 times higher than in women. The corresponding findings were discovered in other countries. This might occur because men are more exposed to risk factors for tuberculosis, such as smoking and lack of medication adherence. This survey found that 68.5% of all male participants smoked and only 3.7% of female participants smoked (Indonesian Ministry of Health, 2018).

2.3 Tuberculosis and Diabetes Mellitus

People of productive age are those who are able to work and finance their own lives (Mihardja et al, 2013). Based on data from Statistics Indonesia in 2018, 181.3 million people were of productive age. Several studies on tuberculosis in productive age were carried out on samples with an age range of 15– 44 years old (Kesek et al, 2019) and 15 – 50 years old (Setiawan et al, 2019). Therefore, the productive age group is limited to the economically productive age group of 15-50 years

The findings of the 2013 Basic Health Research (Riset kesehatan dasar/Riskesdas) reveal a rising in diabetes mellitus incidence in Indonesia. The rate grew from 1.1% to 2.1%. It was discovered that the incidence of diabetes mellitus was higher in the educated group

and productive age group. This has to do with lifestyle changes, lack of physical activity, and unhealthy eating patterns.

Wherdani (2010) states that as many as 75% of tuberculosis patients are economically productive age group. Crofton (2005) in Setiawan et al. (2019) states that one third of the global population has been infected by tuberculosis, most of which come from the age group of 15-50 years and are included in the productive age. Tuberculosis can spread to the brain, kidneys, bones, and lymph nodes.

At productive age, tuberculosis and diabetes mellitus are the most common opportunistic infections. This arises because of a poor lifestyle pattern that allows infection to affect the body (Setiawan et al, 2019).

2.4 Immune System against Tuberculosis and Diabetes Mellitus

The immune system functions as the defense in preventing infection, repairing human DNA, and producing antibodies to fight infection with foreign microorganisms that penetrate the body. The main responsibility of the immune system in the body is to destroy harmful invaders in the human body. Along with age, immune system will decline. In the productive age group, immune system will work properly (Fatmah, 2006).

Patients with diabetes mellitus will experience pathological changes, including thickening of the alveolar walls of epithelial and capillary

basal laminae. The processes secondary to complications of microangiopathy are similar to those retinopathy and nephropathy. Neuropathic disorders of the autonomic nerves can be in the form of central hypoventilation and sleep apnea. Furthermore, a decrease in lung recoil elasticity, a decline in diffusion capacity of carbon monoxide, and an increase in endogenous carbon dioxide production may occur (Rohman, 2018).

The prevalence of pulmonary infections such as tuberculosis among patients with diabetes mellitus is caused by impaired function of the respiratory epithelium as well as ciliary motility. Impaired function of the pulmonary vascular endothelium, the rigidity of the red blood cell corpus, and the changes in the oxygen dissociation curve due to prolonged hyperglycemia are factors that fail in the defense mechanism against infection. Cytokines produced by the immune system both innate immunity and adaptive immunity play a role in the body's defense against Mycobacterium tuberculosis bacteria which can later induce type 1 cellular immunity, which is the body's main response to fight tuberculosis (Rohman, 2018).

CHAPTER III

RESEARCH METHODS

3.1 Location of Study

This research was conducted from July 2020 to October 2020 at the Community Health Center of Binjai Village in Medan Denai Subdistrict, North Sumatra.

3.2 Tool and Material

The tools used in this study were sputum pot, object glass, scalpel, microscope, stationery, and cameras for documentation. Meanwhile, the materials consisted of sputum, Ziehl Nielsen dye, Bunsen, 70% alcohol (antiseptic), and sodium hypochlorite.

3.3 Population and Sample

The population in this study comprised all patients with a medical history of diabetes mellitus who had an examination at the Community Health Center of Binjai Village, North Sumatra.

The sample in this study were patients with diabetes mellitus aged 15 – 50 years indicated for tuberculosis and underwent examination as well as treatment at the Community Health Center of Binjai Village, Medan Denai Subdistrict, North Sumatra.

3.4 Stage of Study

Before collecting data, the researcher first managed the application for research permit from the Faculty of Biology, Universitas Medan Area. Subsequently, the researcher obtained a recommendation letter from the Head of

the Community Health Center of Binjai Village. After the issuance of the research permit, the examination of pulmonary tuberculosis in patients with diabetes mellitus was conducted.

3.5 Data Collection of Study

The data used in this study are primary data. Primary data were taken from the results of direct tuberculosis examinations of diabetes mellitus patients at the Community Health Center of Binjai Village.

3.6 Implementation Stages of Study

3.6.1 Sputum cytology examination

Sputum examination serves to establish a diagnosis, assess the success of treatment, and determine the transmission potential. Sputum examination for diagnosis is carried out by collecting three sputum specimens collected in two consecutive visits in the form of spot-morning-spot (SMS). This method refers to the reference book for the examination of acid-fast bacillus (AFB) by the Hasanuddin University Microbiology Team (2017).

a. S (Spot)

Sputum was collected when a suspected tuberculosis patient came to visit for the first time. On returning home, the suspect brought a sputum pot to collect the early morning sputum on the second day.

b. M (Morning)

Sputum was collected at home on the early morning of the second day, immediately after waking up. The sputum pot was brought and returned to the officers at the community health center.

c. S (Spot)

Sputum was collected at the community health center on the second day when the specimen was delivered in the morning.

3.6.2 Staining of *Mycobacterium tuberculosis* Bacteria

The object glass was sanitized of dust and then labeled or sample coded. Sputum was collected using a scalpel and placed on the surface of the object glass. The sputum was homogenized with a spiral motion. The scalpel was disposed into sodium hypochlorite after use and rested for 24 hours to remove residual germs on the surface of the scalpel. The preparation was dried at room temperature then fixed by passing it over a Bunsen burner. The preparation was dyed using carbol fuchsin (Ziel Neelsen A) evenly on the surface. The glass was heated by passing the flame at the bottom until steam appeared. Subsequently, it was rested for 5 minutes. Alcoholic acid (Ziel Neelsen B) of 3% was poured over the preparation. It was then rinsed with water. Methylene blue solution (Ziel Neelsen C) of 0.3% was added and rested for 30 seconds. It was then rinsed with running water and dried at a temperature of 25^0C – 30^0C (Karuniawaty et al, 2005).

3.6.3 Preparation Examination

The stained and dried preparations were examined under a microscope with a magnification of 1000 times. BTA rod-shaped and red bacteria were searched. The smears were read systematically to ensure that the reported results represent all parts of the smear.

The reading started from the left end to the right end and was carried out on a preparation whose cells were visible; if the preparation is empty, slide it to another area (Hasanuddin University Microbiology Team, 2017). Preparations that had been checked were cleaned with xylol cotton and stored in the preparation box. The results obtained after the observations were then recorded as research data.

3.6.4 Research Data

The data obtained from the results of the pulmonary tuberculosis examination were recorded and displayed in form of tabulated data and analyzed descriptively.

3.6.5 Correlation of Blood Sugar Levels with Tuberculosis

The correlation of blood sugar levels with tuberculosis was calculated by the formula from Sugiyono (2010):

$$r = \frac{[\sum XY - \frac{\sum X^* \sum Y}{n}]}{\sqrt{[\sum X^2 - \frac{(\sum X)^2}{n}][\sum Y^2 - \frac{(\sum Y)^2}{n}]}}$$

$$R = r^2 \times 100\%$$

Information:

R value	Interpretation
0,00 - 0,199	Very Low
0,20 - 0,399	Low
0,40 - 0,599	Moderate
0,60 - 0,799	Strong
0,80 - 1,000	Very Strong

CHAPTER V

CONCLUSION AND SUGGESTION

5.1 Conclusion

Based on the research findings that had been conducted, the relationship (correlation) between blood sugar levels and pulmonary tuberculosis at the Community Health Center of Binjai Village had a moderate correlation with a value of r = 0.4724844 and the contribution of diabetes mellitus to the incidence of pulmonary TB was only 22% (R-value = 22%), implying 78% of the causes of pulmonary TB in diabetics were caused by other factors, such as smoking, night shift and so on.

5.2 Suggestion

For further research, it is encouraged to analyze the relationship betweenblood sugar levels and other diseases.