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Kecenderungan Malnutrisi pada Pasien Tuberkulosis Paru Fase Intensif dengan Kecukupan Gizi Makro yang Rendah

Tendency of Malnutrition in Intensive Phase Pulmonary Tuberculosis Patients with Low Macro Nutrient Adequacy

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ABSTRAK

Latar Belakang: *Penyakit infeksi seperti tuberkulosis paru seringkali ditemukan di negara berkembang, tidak terkecuali di Indonesia. Saat terkena infeksi, tubuh akan mengalami hiperkatabolisme sehingga pemenuhan kebutuhan asupan makronutrien sangat dibutuhkan agar tidak terjadi malnutrisi terutama pada fase intensif.*

Tujuan: *Penelitian ini memiliki tujuan yaitu mengetahui dan menganalisis hubungan tingkat kecukupan energi dan gizi makro dengan status gizi pasien tuberkulosis paru fase intensif.*

Metode: *Penelitian ini menggunakan desain penelitian potong lintang dengan sampel sebanyak 32 responden. Prosedur pemilihan sampel menggunakan teknik purposive sampling. Pengambilan data pada penelitian ini menggunakan kuesioner food recall 2x24 hours. Analisis data menggunakan uji chi-square dengan software SPSS versi 20.*

Hasil: *Berdasarkan analisis yang telah dilakukan, didapatkan hasil bahwa kecukupan energi p<0,001 (OR=17,0) dan gizi makro (protein p<0,001 (OR=17,0); lemak p=0,0001 (OR=3,7); karbohidrat p<0,001 (OR=1,0)) berkaitan dengan status gizi pasien tuberkulosis paru fase intensif.*

Kesimpulan: *Pasien tuberkulosis diharapkan meningkatkan asupan energi dan zat gizi makro untuk mencegah terjadinya gizi kurang pada pasien.*

Kata Kunci: *Kecukupan Gizi Makro, Status Gizi, Tuberkulosis Paru*

ABSTRACT

Backgrounds: Infectious diseases such as pulmonary tuberculosis are often found in developing countries, not least in Indonesia. When infected, the body will experience hyper-catabolism so that the fulfillment of the needs of macronutrient intake is needed so as not to occur malnutrition especially in the intensive phase.

Objectives: This study aimed to determine and analyze the relationship between the level of energy and macro nutrient adequacy with the nutritional status of intensive pulmonary tuberculosis patients.

Methods: This study used a cross sectional research design with a sample of 32 respondents. The sample selection procedure used purposive sampling technique. Retrieval of data in this study using a 2x24 hour food recall questionnaire. Data analysis using the chi-square test with SPSS software

Results: Based on the analysis that has been done, the results showed that the adequacy of energy p=0.001 (OR=17.0) and macro nutrients (protein p<0.001 (OR=17.0); fat p=0.0001 (OR=3.7) ; carbohydrates p<0.001 (OR=1.0)) was related to the nutritional status of patients with intensive pulmonary tuberculosis.

Conclusions: The tuberculosis patient is expected to increase the daily energy and macro nutrition substance to prevent nutrition deficiency for the patient.

Keywords: Adequacy of Macro Nutrition, Nutritional Status, Pulmonary Tuberculosis

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INTRODUCTION

Tuberculosis (TB) is a disease caused by infection with the bacterium Mycobacterium tuberculosis. This infectious disease attacks almost all countries in the world, especially developing countries including Indonesia. Indonesia ranks as the second country with the largest TB burden in the world. In 2017 there were 420,994 TB cases in Indonesia[1]. Tuberculosis is also the 10th leading cause of death in the world[2]. Therefore, TB is still one of the main disease control priorities in the world.

TB patients are susceptible to health problems such as malnutrition. according toAdiningrum et al. (2016)the proportion of TB patients in a hospital in Bandung who are malnourished is still quite high at around 35%. In fact, another study reported that more than 60% of TB patients were undernourished based on BMI[4]. In Benin, TB patients receiving late-stage intensive treatment had a BMI below the normal limit of 44.4%, almost half of the total patients.[5]. Some of these studies show that the number of malnutrition due to TB infection is still relatively high in various regions.

Malnutrition in pulmonary tuberculosis patients can be caused by various factors. Weight loss in TB patients is caused by a decrease in appetite due to TB symptoms such as coughing, shortness of breath, to chest pain[6]. Tuberculosis also triggers malabsorption of nutrients and metabolic disorders thereby increasing the risk of wasting and low nutritional status[7]. TB patients undergoing the intensive treatment phase often experience decreased appetite. The effect of treatment with Anti Tuberculosis Drugs (OAT) is more felt in the first week and second week[8]. The provision of optimal nutrition services greatly affects the patient's condition. However, a study shows that often the nutritional services that support the effectiveness of treatment in the intensive care unit are still relatively weak[5]. Improved quality of life and maximum rehabilitation are the result of proper nutrition monitoring and handling[9].

The patient's condition will get worse if the pulmonary TB patient has a macronutrient deficiency[10]. In addition to infection-related hypercatabolism, another cause of malnutrition is the patient's lack of intake, especially calories and protein[11]. The risk of death will increase and the results of therapy are less than optimal if pulmonary TB patients have macronutrient intake that is less than needed. Almost 90% of TB patients in intensive care have lower intakes than they should[5]. In fact, an RCT study in India showed that pulmonary TB patients need to be given dietary supplements in order to maintain and increase their weight even though they have been diagnosed with wasting since the beginning of TB development.[12]. Based on the description above, the researcher wanted to analyze the relationship between the level of macronutrient adequacy and the nutritional status of pulmonary TB patients undergoing intensive care.

METHODS

This research was an analytic observational study used a cross sectional design. The respondents of this study were patients with pulmonary tuberculosis (TB) in the intensive phase in Bojonegoro Regency. The sample size was calculated using the Kuncoro formula in 2010 and then obtained the results of 32 respondents. This research was conducted in July-August 2020 at several health centers in Bojonegoro Regency including Kalitidu, Ngasem, Dander, Trucuk, Gayam, Bojonegoro, and Kapas Public Health Centers. These five puskesmas were selected based on the highest number of new cases in 2019[13].

The inclusion criteria of this study were: the patient was willing to be a research respondent, aged 19 years, was undergoing the intensive treatment phase, namely the first 2 months[14], as well as allowing to measure height and weight. While the exclusion criteria from this study were: the patient was pregnant, and the patient did not allow for an interview (unconscious). The population in this study were all patients with pulmonary tuberculosis who underwent intensive phase care at the Bojonegoro District Health Center. The sampling method used purposive sampling, namely the respondents were selected according to the criteria determined by the researcher. This was because not all samples have criteria that were in accordance with the phenomenon under study and the use of purposive sampling was expected to include samples that were truly appropriate to answer the research questions/objectives.

Characteristics of respondents identified include gender, age, income and knowledge. Income was classified into less (<UMR Bojonegoro) and sufficient (≥UMR Bojonegoro). Knowledge was identified through giving 10 questions about nutrition and pulmonary TB by Khomsan (2000) with less criteria (correct answer 80%) and sufficient (correct answer>80%)[15].

The independent variables of this study include the intake of macronutrients (protein, fat, carbohydrates), while the dependent variable to be studied was nutritional status. The data collection process was carried out through interviews, food recall 2 x 24 hours. Then the data that has been collected analyzed using household size (URT) which was then converted into grams. This food recall interview was not conducted directly due to the pandemic, so the researchers asked the respondent's food photos as a reference for researchers to convert food sizes. In this case, respondents were asked to take a photo of a full meal in 1 plate every time they eat (main meal or snack). Adequacy of patient intake was compared between intake through recall and the needs of each individual.[16]. The level of nutritional intake adequacy was classified into two categories according to the National Guidelines for Tuberculosis Management Medical Services, namely the inadequate category < 70% and the adequate category 70%[17]. Anthropometric measurements include the patient's weight and height. Body Mass Index (BMI) was obtained by measuring body weight using the help of a GEA brand digital scale (accuracy 0.1 kg), while the

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patient's height was measured using microtoise (accuracy 0.1 cm). Anthropometric measurements of both height and weight were carried out 2 times. BMI is calculated based on the ratio of body weight (kg) to height squared (m2). Then, nutritional status was categorized into 2, namely: poor (BMI < 18.5) and normal (BMI 18.5)[18].

Statistical analysis used was chi square test with 95% CI (α = 0.05). The independent variables include the adequacy of protein, fat, and carbohydrates (enough and not enough), while the dependent variable includes the nutritional status of less and normal. This research has passed the ethical test by the Health Research Ethics Commission, Faculty of Nursing, Universitas Airlangga with certificate number 1999-KEPK.

RESULTS AND DISCUSSION

Respondents in this study were patients with pulmonary tuberculosis (TB) with intensive phase therapy who were doing outpatient treatment at the Bojonegoro District Health Center. There were 7 health centers studied, including Kalitidu, Bojonegoro, Ngasem, Kapas, Gayam, Trucuk and Dander health centers. Based on the puskesmas, patients were selected according to the criteria set by the researcher. Data on the characteristics of respondents which include gender, age, income and knowledge are listed in table 1.

Table 1. Distribution of Respondents Characteristics

No	Variable	Amount	
		n	%
1	Gender		
	Woman	14	43.8
	Man	18	56.2
2	Age		
	Adult (19-59 years)	26	81.2
	Elderly (≥ 60 years)	6	18.8
3	Income		
	Less (< UMR Bojonegoro Regency)	27	84.4
	Enough (≥ UMR Bojonegoro Regency)	5	15.6
4	Knowledge		
	Less (correct answer 80%)	14	43.8
	Enough (correct answer >80%)	18	56.2

Note: UMR Kab. Bojonegoro in 2019 = IDR 1,858,613. -

Based on table 1, in this study, male respondents (56.2%) suffered from pulmonary tuberculosis more than women (43.8%). This was in line with the Dotulong study (2015), which reported that men were at greater risk of developing pulmonary tuberculosis than women. The reason is because men usually have a habit of smoking and drinking alcohol more often than women[19]. Nicotine in cigarettes and alcohol can weaken the body's immune system, making it more susceptible to infectious diseases, especially pulmonary tuberculosis. Not only smoking and alcohol, other exposures that can increase a man's risk of developing pulmonary TB were work due to the work environment and industrial exposure[20]. In addition, according to Rochmah (2013), the higher prevalence of pulmonary TB in men can also be caused by access to health that tends to be easier for men than women, so that early detection of intensive pulmonary TB is more common in men.[21]. Women were sometimes still socially stigmatized and were considered to have lower access and control to health services than the opposite sex[22].

The results of data collection of research subjects according to age were found to be more dominant than the elderly. This was also revealed by Korua (2010) that intensive pulmonary TB was more experienced in the 15-55 year age group as much as 64.7%[23]. The incidence of intensive pulmonary TB was more prone to be experienced by the productive age group, namely 15-54 years with a percentage of 67%.[19]. Based on age group, Manalu (2010) explained that three-quarters of people with pulmonary TB in Indonesia are of productive age[24]. Research with data sources Riskesdas 2013 reported that the risk factors for pulmonary TB in productive age include smoking behavior, ownership index, room conditions, food processing fuel, and education.[20]. Productive age is more often outside the home because of the demands of activity so that the risk of exposure from the environment and people infected with intensive pulmonary TB is greater[25]. Based on the results of data collection, it was found that the incidence of intensive pulmonary TB was mostly experienced by respondents with less income, namely 84.4% (<Rp 1,800,000) while respondents with sufficient income were only 15.6% (>Rp 1,800,000). Income was the amount of wages earned in return for a job that has been done. Income could affect a person's behavior pattern or lifestyle in terms of maintaining health. This is because a person's income could contribute to the level of education and knowledge regarding nutritional intake, drug consumption, sanitation hygiene, and a balanced lifestyle. A person's knowledge was the basis for attitude and behavior towards the progression of TB disease. Based on the results of data collection, it was found that the group of respondents with sufficient knowledge level was more dominant (56.2%) compared to those with less knowledge level (43.8%). The proportion of patients who were undernourished and normal was the same, namely 50% (Table 2). The average BMI of patients with malnutrition was 17.1 kg/m2, while the average BMI of patients with normal nutritional status was 22.8 kg/m2. A

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study states that the nutritional status of patients with intensive pulmonary TB could improve with the help of nutritional counseling during the initial 2 months[26]. The provision of nutritional counseling for 30 days was proven to improve nutritional status in new pulmonary TB patients (new cases) in Manado[27].

Table 2. The Relationship of Macro Nutrient Adequacy with Nutritional Status in Pulmonary Tuberculosis Patients Intensive

Variable	Nutritional Status		*p-value*	OR (95% CI)
	Less (n=16) (BMI < 18.5 kg/m2) n(%)	Normal (n=16) (BMI 18.5 kg/m2) n(%)		
Energy Adequacy Level (kcal)	893.24±207.71 (48.00%)ᵛ	1908,42±292.85 (104.65%)ᵛ	<0.001	17,00
Not enough (< 70% TEE)	15 (46.9)	0 (0%)		
Enough (≥ 70% TEE)	1 (3.1)	16 (50%)		
Protein Adequacy Level (gr)	35.87±11.42 (51.39%)ᵛ (16.06%)ᵝ	67.53±13.43 (98.77%)ᵛ (14.15%)ᵝ	<0.001	17,00
Not enough (< 70% TEE)	15 (46.9%)	0 (0%)		
Enough (≥ 70% TEE)	1 (3.1%)	16 (50%)		
Fat Adequacy Level (gr)	32.87±12.47 (63.70%)ᵛ (33.12%)ᵝ	76.88±15.27 (156.20) (36.26%)ᵝ	0.001	3.66
Not enough (< 70% TEE)	10 (31.3%)	0 (0%)		
Enough (≥ 70% TEE)	6 (18.7%)	16 (50%)		
Carbohydrate Adequacy Level (gr)	114.67±22.14 (41.08%)ᵛ (51.35%)ᵝ	241.91±42.53 (88.45%)ᵛ (50.07%)ᵝ	<0.001	1.00
Not enough (< 70% TEE)	16 (50%)	0 (0%)		
Enough (≥ 70% TEE)	0 (0%)	16 (50%)		

Note: TEE = Total Energy Expenditure (Nutritional needs of each individual calculated using the Harris Benedict formula); = % of total energy demand; = % of total energy intake

Patients with intensive pulmonary TB received daily therapy for 2 months. If treatment was regular, then usually will not be able to transmit the disease after 2 weeks and there was conversion of positive acid-fast bacteria to negative, so the focus of therapy during this phase was very important to determine disease progression.[26]. In patients with intensive pulmonary TB, the bacteria that cause disease were still very active and affect the overall energy intake. In addition, administration of red medicine during the intensive phase has side effects of nausea and vomiting. Case-control research in Central Java shows that one of the factors that influence the success of intensive phase therapy was the symptoms or side effects of anti-tuberculosis drugs[28]. In Medan, various anti-tuberculosis drugs have side effects that were proven to trigger bacterial conversion failure[29]. Therefore, patients with intensive pulmonary TB were very susceptible to malnutrition[8]. The nutritional status of pulmonary TB patients could contribute to the conversion of sputum from positive to negative smears in pulmonary TB patients in the first 2 months[30]. The low intake of macronutrients can reduce the intake of micronutrients which were also contained in it, whereas vitamins and minerals play an important role in accelerating the intensive phase of healing and optimizing nutritional status.[31–33].

Based on table 2, it could be seen that in intensive pulmonary TB patients who have insufficient energy and macronutrient intake, they were undernourished, while in normal patients, all of them were classified as having sufficient energy. The average energy intake of respondents is 1400.83±250,28kcal. This figure is lower than a study in Uganda in TB patients[34]. Research by Gurung et al. (2018) in Nepal also reported that only one fifth of pulmonary TB patients had adequate intake compared to the RDA (Recommended Dietary Allowance), although the mean figure was 3239.39 ± 1352.47 kcal.[35]. A longitudinal study found that in the first 8 weeks, TB patients tended to experience an increase in energy intake. However, this did not last continuously because at the 16th week the increase was only one seventh of the previous one[36]. The higher the severity of TB disease, the lower the intake that the patient can receive[34]. The results of correlation analysis showed that energy adequacy in intensive TB patients was related to nutritional status (p<0.001). The OR value shows the number 17.00 which means that intensive TB patients who have insufficient energy intake have 17 times the risk of experiencing malnutrition. The results of this study were different from the study in Semarang in general pulmonary TB patients who reported that there was no relationship between energy intake and nutritional status of patients (p = 0.139).[37]. Giving energy intake gradually

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starting from 80% of the need can increase the weight of intensive pulmonary TB patients[38]. The frequency of eating in intensive pulmonary patients can increase by more than 2 times, one of which was with the help of nutritional counseling[26].

The average protein intake of patients with malnutrition was 35.87 ± 11.42 g, whereas in normal patients it was almost 2 times (67.53 ± 13.43 g). Even so, when viewed from the percentage of calorie intake, nutritional patients were more or less in consuming protein (16.06%). However, the amount consumed was still far from the needs of patients with malnutrition, which reaches 70gr. Protein plays a role in regeneration and formation of new damaged tissue, as well as increasing the speed of sterilization of microorganisms that cause pulmonary tuberculosis by increasing the amount of interferon gamma (IFN-γ), Tumor Necrosis Factor alpha (TNF-α), and induced synthesis of nitric oxide (iNOS).[39]. Antibodies formed by proteins play a role in fighting pathogenic bacteria and suppressing infection by binding these foreign particles in the body[40]. Therefore, lack of protein intake could affect the progression of infectious diseases including intensive pulmonary TB. Based on the correlation analysis test, the p-value<0.001 with the interpretation that there was a significance between protein adequacy and nutritional status. All pulmonary TB patients with insufficient protein adequacy experience malnutrition, which was as much as 100%. Similar to energy analysis, inadequate protein intake in intensive pulmonary TB patients has a 17 times greater risk of experiencing malnutrition than adequate protein intake. High protein intake is needed in the treatment of infectious diseases including intensive pulmonary TB. However, sometimes some food sources of protein, especially animal protein, can trigger nausea and vomiting, and further inhibit the appetite of patients with intensive pulmonary TB.[41]. In the city of Padang, there was a significant relationship between nutritional status and albumin levels in pulmonary TB patients (p = 0.017) which of course was also associated with protein intake.[42]. Albumin was one type of protein that was closely related to the nutritional status of pulmonary TB patients who were undergoing treatment to accelerate sputum conversion[43]. In addition, other studies also state that lack of protein intake is a risk factor for developing intensive pulmonary TB as much as 6.5 times greater[44]. This shows that protein intake was very important for the prevention and control of infectious diseases, especially TB in the early phase of infection.

The average fat intake of patients with malnutrition was 32.87 ± 12.47 g. In normal patients, fat intake exceeds 2 times, which was about 76.88±15.27 g. However, in percentage terms, fat intake in normal patients was 3.14% higher than in malnourished patients. When viewed through the balance of macronutrient intake to total intake, fat was consumed in high amounts (>30%) compared to the figure that should be 20-25%.[45]. This amount could be given to pulmonary TB patients without shortness of breath, while in pulmonary TB patients who experience shortness of breath, fat intake could be increased because it did not produce CO2 in the blood.[46]. Although fat intake was high compared to the total caloric intake, fat intake in malnourished patients was still relatively low when compared to the average need of patients (63.70%). Based on the relationship analysis test, the p-value = 0.001 with the interpretation that there was a significant relationship between the level of fat adequacy and nutritional status. Intensive pulmonary TB patients with low fat intake had a 3.7 times greater risk of experiencing malnutrition than adequate fat intake. Insufficient fat intake was also associated with the infectious degree of TB disease and later could be at risk of malnutrition[6]. Activation of the immune system will occur when a person experiences TB infection in his body in response to the presence of disease-causing pathogens. Catabolism was also increased in someone infected with pulmonary TB, especially in the intensive phase[47]. If a person has an energy deficiency, the body would use fat reserves to produce energy through gluconeogenesis. When there was insufficient fat in the body, there would be a decrease in nutritional status which results in malnutrition[48]. Even so, fat intake should not be excessive so as not to aggravate the condition of intensive pulmonary TB[7].

All patients who were malnourished have insufficient carbohydrate intake, and conversely, all patients with normal nutritional status have sufficient carbohydrates. The average carbohydrate intake of patients with malnutrition was 114.67 ± 22.14 g. On the other hand, in patients with normal nutritional status the same as fat intake, which was more than 2 times the intake of undernourished patients. This figure was lower than other studies which state that carbohydrate intake in wasting pulmonary TB patients reached 283±135 g, although the two variables did not find a significant relationship.[34]. Research by Frediani et al. (2016) found that in intensive pulmonary TB patients during the first 2 months there was an increase in carbohydrate intake, but in the next 2 months there was a decrease in carbohydrate intake[36]. Supplementary feeding in pulmonary TB patients during the initial stage (intensive phase) could increase body weight 1 to 2.8 kg[46]. Based on the chi square analysis test showed that there was a significant relationship between the level of adequacy of carbohydrate intake and nutritional status (p = 0.000; OR = 1.0). Budi (2009) also reported that lack of carbohydrate intake was experienced by 2 out of 3 pulmonary TB patients[49]. The increase in transaminase enzymes in this patient in the early phase of nutritional care (intensive phase) could be caused by the starvation period that had lasted since the previous 2 months. Poor nutritional status was caused by significant weight loss that occurs during starvation[50].

CONCLUSION

A significant relationship has been identified between energy adequacy and macronutrients which include protein, fat and carbohydrates with the nutritional status of patients with intensive pulmonary tuberculosis. Patients who have macronutrient insufficiency tend to experience low nutritional status (underweight). On the other hand, the group of patients

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with adequate macronutrient intake had normal nutritional status. The intake of macronutrients will significantly affect the nutritional status of the patient. Pulmonary tuberculosis patients are expected to be able to meet their daily energy needs, especially macronutrients.

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