Overview of Nutritional Status in Pulmonary Tuberculosis Patients Undergoing Outpatient Treatment at Tk.II Iskandar Muda Hospital Banda Aceh

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A B S T R A C T

Tuberculosis (TB), caused by Mycobacterium Tuberculosis (MTB) and transmitted through the air, primarily affects the lungs. In Aceh Province, the reported TB cases reached 41,596. Nutritional status is a pivotal factor influencing TB occurrence, as malnutrition can compromise immune function, increasing susceptibility to MTB. This study assesses TB patients' nutritional status based on BMI, malnutrition risk, and body weight changes during therapy. As quantitative research with a descriptive cross-sectional study design, the study used the medical records of outpatient pulmonary TB patients at the Pulmonary & TB-DOTS Polyclinic of TK—II Iskandar Muda Banda Aceh Hospital, who underwent intensive phase therapy from January to December 2023. Malnutrition risk screening utilizes the Malnutrition Universal Screening Tools (MUST) instrument. The study revealed a high prevalence of pulmonary TB cases, particularly among individuals aged 17-25. Based on the MUST instrument, patients over 60 showed a high risk of malnutrition, with the average patient having a MUST score of 3 (indicating high risk). Most patients experienced a significant increase in body weight during the intensive treatment stage. Weight gain significantly contributes to the success of tuberculosis treatment, influencing positive changes in the nutritional status of pulmonary tuberculosis patients.

INTRODUCTION

Tuberculosis is one of the leading causes of death and a global public health problem. Based on WHO (World Health Organization) data in the Global Tuberculosis Report 2022 from 202 countries, 10.1 million people were diagnosed with tuberculosis in 2021, 10.6 million were diagnosed with tuberculosis in 2022, and 1.6 million people died from TB (including 187,000 people accompanied by HIV / Human Immunodeficiency Virus). According to RISKESDAS 2018 data, the prevalence of TB in Indonesia reached 69.2%, and the number of TB patients in Aceh Province reached 41,596 cases (Kemenkes RI, 2018; Acharya *et al.*, 2020; Bagcchi, 2023).

TB is a disease that is strongly associated with poverty, and people with TB also experience discrimination and community stigma. Multisectoral efforts to fight the causes of TB, such as hunger, malnutrition, and HIV infection, reduce mortality. Consumption of nutritious food and supplements is essential for TB prevention. Epidemiologic studies suggest that malnutrition plays a critical role in the occurrence and progression of TB cases. TB patients with severe malnutrition (BMI/Body Mass Index <16) will show clinical symptoms of dyspnea, night sweats, and hemoptysis. Low body weight is also associated with TB case relapse (Kemenkes, 2013; Nyarko *et al.*, 2021; Guo *et al.*, 2022).

Malnutrition leads to impaired immune function and increased susceptibility to Mycobacterium Tuberculosis. Mycobacterium Tuberculosis bacterial invasion causes an acute inflammatory response that activates antibodies and boosts the body's metabolism. The acute inflammatory response in the body accelerates protein loss and inhibits serum albumin production. Increased metabolism will have the effect of decreasing appetite, leading to reduced nutritional status. The relationship between TB and malnutrition is bidirectional, as TB can also be caused by malnutrition (Kemenkes, 2013; Guo *et al.*, 2022; Ockenga *et al.*, 2023).

Malnutrition in TB patients can aggravate and require a longer time for the healing process, resulting in a risk of secondary infection. Nutritional therapy in TB can maintain and improve nutritional status, aiming to increase TB patients' life expectancy (Kemenkes, 2013; Indonesia, 2011; Guo *et al.*, 2022; Ockenga *et al.*, 2023).

This is because one factor can influence the occurrence of TB, namely nutritional status. From this background, researchers are interested in examining the description of the nutritional status of pulmonary tuberculosis patients undergoing outpatient care at Tk.II Iskandar Muda Banda Aceh Hospital. The purpose of this study was to determine the nutritional status of TB patients based on BMI, the risk of malnutrition in TB patients, and the increase in BW during TB therapy.

METHOD

This study is a descriptive study with a cross-sectional design. The population in this study were all patients diagnosed with pulmonary TB by a pulmonary specialist who was on outpatient treatment at the Pulmonary Polyclinic and TB - DOTS Tk.II Iskandar Muda Hospital Banda Aceh. The sample in this study met the inclusion criteria: diagnosis of pulmonary TB, adult age $\geq$ 18 years—sampling using the total sampling method. Total sampling is a sampling method in research where subjects or elements are selected as samples with all populations sampled.

The data needed are age, gender, medical diagnosis, weight, height, and weight change. This study was conducted using secondary data, which is medical record data. The population of this study was the medical records of pulmonary TB patients registered at the Pulmonary Polyclinic and TB - DOTS Tk.II Iskandar Muda Hospital from January - December 2023. The research sample is all populations meeting the inclusion criteria for research.

The data obtained were collected based on the research variables, and after the data were collected, data processing was carried out manually and computerized. Furthermore, the data will be presented as frequency distribution tables. Malnutrition risk screening in this study used the Malnutrition Universal Screening Tools (MUST) instrument.

RESULT

The results of the research that has been carried out obtained 86 cases of Pulmonary TB—the results of the study at the Pulmonary and TB - DOTS Polyclinic of TK. II Iskandar Muda Banda Aceh Hospital found 85 patients who met the inclusion criteria with characteristics based on age and gender. Characteristics of pulmonary TB patients based on age are presented in Table 1; the characteristics of pulmonary TB patients are dominant at the age of 17-25 years with a total of 18 patients, age 26-35 years totaling ten patients, age 36-45 years totaling 16 patients, age 46-55 years totaling 15 patients, age 56-65 years totaling 16 patients, and age> 65 years totaling ten patients.

Table 1. Patient characteristics by age

Age (Years)	Frequency (n)	Percentage (%)
17-25	18	21,2%
26-35	10	11,8%
36-45	16	18,8%
46-55	15	17,6%
56-65	16	18,8%
>65	10	11,8%
Total	85	100,0%

The characteristics of pulmonary TB patients based on gender are presented in Table 2; it was found that the characteristics of pulmonary TB patients were dominant in the male gender with a total of 60 patients (70.6%) compared to the female gender with a total of 25 patients (29.4%).

Table 2. Patient characteristics by gender

Gender	Frequency (n)	Percentage (%)
Male	60	70,6 %
Female	25	29,4%
Total	85	100,0%

Data from the results of the study based on Table 3, namely the characteristics of the risk of malnutrition based on age and MUST Score, was found that the high risk of malnutrition was Pulmonary TB patients at the age of> 65 years with a total of 9 patients (90%), the dominant moderate risk of malnutrition was found at the age of 26-35 years and >65 years with one patient each (10%). Pulmonary TB patients who have a low risk of malnutrition are most dominantly found at the age of 46-55 years with a total of 8 patients (53.3%), followed by age 17-25 years with a total of 8 patients (44.4%) and age 36-45 years and age 56-65 years each seven patients (43.8%).

Table 3. Characteristics of patient malnutrition risk based on age and MUST Score

Age (Years)	Score MUST						Total	
	Low		Moderate		High			
	n	%	n	%	n	%	n	%
17-25	8	44,4%	1	5,6%	9	50%	18	100%
26-35	2	20%	1	10%	7	70%	10	100%
36-45	7	43,8%	1	6,3%	8	50%	16	100%
46-55	8	53,3%	1	6,7%	6	40%	15	100%
56-65	7	43,8%	0	0%	9	56,3%	16	100%
>65	0	0%	1	10%	9	90%	10	100%
Total	32	37,6%	5	5,9%	48	56,5%	85	100%

The characteristics of the risk of malnutrition of Pulmonary TB patients based on gender and MUST Score are presented in Table 4; it was found that the male gender was dominant in having a risk of malnutrition, a high risk of malnutrition amounted to 35 patients (58.3%), a moderate risk of malnutrition with three patients (5%) and a low risk of malnutrition found 22 patients (36.7%).

Table 4. Characteristics of patient malnutrition risk based on gender and MUST Score

Gender	Score MUST						Total	
	Low		Moderate		High			
	n	%	n	%	n	%	n	%
Male	22	36,7%	3	5%	35	58,3%	60	100%
Female	10	40%	2	8%	13	52%	25	100%
Total	32	37,6%	5	5,9%	48	56,5%	85	100%

Data characteristics based on age and Score MUST obtain the highest data distribution at the age of> 65 years with a mean of 2.60, minimum of 1.00, maximum of 3.00, median of 3.00, and standard deviation of 0.70; this is because the data obtained at the age of> 65 years is very dominant to have a Score MUST of 3, and the least Score MUST of 1. No one has a Score MUST of 0; this means that there is a high risk of malnutrition at that age.

Table 5. Data characteristics based on age and MUST Score

Age (Years)	Score MUST				
	Mean	Minimum	Maximum	Median	Deviation standard
17-25	1,50	,00	3,00	1,50	1,47
26-35	2,00	,00	3,00	2,50	1,25
36-45	1,50	,00	3,00	1,50	1,46
46-55	1,27	,00	3,00	,00	1,49
56-65	1,56	,00	3,00	2,00	1,46
>65	2,60	1,00	3,00	3,00	,70
Total	1,66	,00	3,00	2,00	1,39

During intensive pulmonary TB therapy, in the first two months, most patients experienced an increase in body weight ≥ 1 kg. In the first month of OAT therapy, 70 patients (82.4%) experienced an increase in body weight, and in the second month of OAT therapy, 66 patients (77.6%) experienced an increase in body weight ≥ 1 kg from the first month.

Table 6. Characteristics of weight gain during intensive pulmonary TB therapy

Body weight (Kg)	1st Month		2nd Month	
	n	%	n	%
BW Increased	70	82,4	66	77,6
BW unchanged or decreased	15	17,6	19	22,4
Total	85	100%	85	100%

DISCUSSION

Data distribution of pulmonary TB patients based on age is presented in Table 1; the characteristics of pulmonary TB patients are dominant at the age of 17-25 years with a total of 18 patients, age 36-45 years totaling 16 patients, age 46-55 years totaling 15 patients and age 56-65 years totaling 16 patients. Most patients with pulmonary TB in the study results are of a productive age.

Productive age is the age range of 15-59 years. Productive age has a 2-3 times greater risk of being exposed to TB germs. The productive age period is the most active period of activity outside the home for work, educational activities, and social interaction, thus increasing the risk of exposure to TB patients, which results in a straightforward process of pulmonary TB transmission (Martial, Mubarik and Yu, 2021; Agustian and Masria, 2022; Dong et al., 2022).

Data characteristics of pulmonary TB patients based on gender were dominant in male patients with 60 patients (70.6%) compared to female patients with 25 patients (29.4%). Men are affected by TB at least two times more than women. Before pulmonary TB treatment, men have a higher number of bacterial smears and a shorter time to positive culture than women (Martial, Mubarik and Yu, 2021; Agustian and Masria, 2022; Dabitao et al., 2022).

The relationship between gender and time to a positive culture, after adjusting for smear bacterial count. This finding confirms that males have higher bacterial counts than females. It is also possible that MTB isolates from males have an increased growth capacity faster than in females, which means that there are sex-specific host-pathogen interactions that can potentially affect disease and treatment outcomes (Martial, Mubarik and Yu, 2021; Agustian and Masria, 2022; Dabitao et al., 2022).

This is in line with the results of Agustian et al.'s research, where the male gender has a greater chance of suffering from pulmonary TB because men have high mobility compared to women. Hence, the possibility of exposure is more significant; besides, habits such as smoking and consuming alcohol can make it easier for men to become infected with pulmonary TB (Agustian and Masria, 2022; Dabitao et al., 2022).

Data from the results of the study based on Table 3, namely the characteristics of the risk of malnutrition based on age and Score MUST, it was found that age> 65 years with pulmonary TB had a high risk of

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malnutrition with a total of 9 patients or 90% of pulmonary TB cases aged> 65 years. Data characteristics based on age and Score MUST obtain the highest data distribution at the age of >65 years with a mean of 2.60, minimum of 1.00, maximum of 3.00, median of 3.00, and standard deviation of 0.70 this is because the data obtained at the age of >65 years is very dominant to have a MUST Score of 3, and the least has a MUST Score of 1, this means that at that age has a high risk of malnutrition.

Old age and Body Mass Index (BMI) are the main factors affecting BTA conversion at the end of standard pulmonary TB treatment. Low BMI reduces cure rates. High BMI values have a favorable impact on BTA negativity at the 6th-month visit. Old age conditions with low BMI have a higher risk of death (Thamaria, 2017; Kemenkes, 2013; Martial, Mubarik and Yu, 2021; Agustian and Masria, 2022; Dong *et al.*, 2022).

Individuals at high risk are pulmonary TB patients with chronic disease, high alcohol consumption, elderly people, individuals with immunosuppression, and vulnerable social groups (e.g., incarcerated populations, the military, and people living in densely populated environments). A validated nutritional screening and diagnostic tool that can be implemented by health professionals (e.g., nurses) with minimal training. This includes the Malnutrition Universal Screening Tool (MUST) for screening the general population's malnutrition risk (Kemenkes, 2013; Guo *et al.*, 2022; Ockenga *et al.*, 2023).

The relationship between TB and malnutrition is bidirectional because malnutrition can also be caused by TB itself and caused by cachexia, anorexia, and malabsorption associated with inflammation. Malnutrition caused by TB is characterized by a loss of fat mass regardless of BMI, including in obese and overweight individuals (Kemenkes, 2013; Guo *et al.*, 2022; Ockenga *et al.*, 2023).

Weight loss is a common condition among the elderly population, which may be caused by "physiological anorexia due to aging." Coughing is reported to occur more frequently in adults, but dyspnea occurs more frequently in the elderly group. This is caused by several factors, namely having a history of pulmonary TB, being a former smoker or active smoker, and a BMI <18.5. The factors that have the greatest influence on pulmonary TB in the elderly are smoking and low BMI. Nutritional deficiencies in the respiratory muscles in older people can cause dyspnea (Cheng *et al.*, 2020; Ma *et al.*, 2022; Sakthivadivel, Gaur and Geetha, 2023).

Malnutrition that occurs in old age is caused by the effects of long-standing pulmonary TB disease or due to side effects of TB drugs. Apart from that, pulmonary TB in the elderly is also usually accompanied by degenerative diseases such as hypertension and CHD, which is different from the productive age group with pulmonary TB. Catabolism related to malnutrition can result in acute weight loss and malnutrition, changes in appetite regulation in older age, and postprandial metabolic changes are associated with gradual changes that result in acute weight loss and malnutrition. The increasing incidence of aspiration

and inflammatory diseases related to old age, such as chronic obstructive pulmonary disease and pulmonary fibrosis, makes older people more likely to have a lung environment that is susceptible to infection, including TB infection (Chandrasekaran *et al.*, 2017; Cheng *et al.*, 2020; Norman, Haß and Pirlich, 2021; Sakthivadivel, Gaur and Geetha, 2023).

Patients who are malnourished or at risk of malnutrition should be examined by a professional nutritionist or other nutrition specialist to receive counseling and therapy and provide additional food if necessary to improve nutritional status, including increasing body weight and muscle mass. Given the association between body weight and clinical outcomes, dietary optimization should also be undertaken in individuals with a normal BMI to mitigate weight loss during TB. Increased food intake and medical nutrition are prescribed when food intake is insufficient to meet nutritional goals through oral dietary supplements and enteral or parenteral nutrition as indicated (Ter Beek *et al.*, 2021; Ma *et al.*, 2022; Ockenga *et al.*, 2023).

Malnutrition screening and systematic assessment of nutritional status should be carried out at diagnosis and regularly (every four weeks) during TB treatment, with high priority given to patient groups potentially at high risk of malnutrition. If necessary, a systematic nutritional assessment should include a nutritionally oriented history and examination as well as anthropometric, dietary, and laboratory assessments (Ter Beek *et al.*, 2021; Ma *et al.*, 2022; Ockenga *et al.*, 2023).

Patients with overweight and obesity accompanied by catabolic diseases such as pulmonary TB can lose >20% of their body weight and muscle mass within 3–6 months and still show BMI values at or above the normal range. Disease-related malnutrition is a (sub)acute condition where a decrease in body weight and muscle/fat-free mass does not automatically result in a low BMI. In contrast, a reduction in body weight and fat-free mass is associated with poor clinical outcomes, including increased morbidity and mortality. BMI assessment is the most used method in clinical practice because WHO recommends BMI to assess malnutrition/malnutrition (Ter Beek *et al.*, 2021; Ma *et al.*, 2022; Ockenga *et al.*, 2023).

Changes in body weight (BW) of pulmonary TB patients increased after treatment. This is because giving food supplements at the beginning of the TB treatment phase can contribute to the patient's weight. Gradual weight gain indicates treatment success and patient progress during TB treatment. Nutritional interventions and support must be prioritized to address the burden of malnutrition effectively (Sabiti, Febrinasari and Aulia, 2021; Ma *et al.*, 2022; Nursyfah and Muflihah, 2023; Wagnew *et al.*, 2024).

Increased weight can also be caused by the consumption of TB drugs, which affect nutritional conditions so that the intake and use of nutrients are fully processed. Apart from TB treatment, adequate energy and protein are also needed to support the healing process and improve the nutritional status of adult pulmonary TB sufferers (Sabiti, Febrinasari and Aulia, 2021; Ma *et al.*, 2022; Nursyfah and Muflihah, 2023; Wagnew *et al.*, 2024).

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This treatment can maximize the body's protective mechanisms by minimizing bacteria. In this study, BW increased significantly during the intensive stage of pulmonary TB treatment. Changes in body weight during the treatment period can be a parameter that the patient has recovered and completed tuberculosis treatment because changes in body weight contribute to the success of tuberculosis treatment by influencing changes in the nutritional status of tuberculosis patients (Sabiti, Febrinasari and Aulia, 2021; Ma *et al.*, 2022; Nursyfah and Muflihah, 2023).

CONCLUSION

At productive age, there were high cases of pulmonary TB, especially at the age of 17-25 years, totaling 18 cases. Males with pulmonary TB were the most common cases, reaching 60 cases out of 85 study samples. The characteristics of the risk of malnutrition in pulmonary TB patients based on the Malnutrition Universal Screening Tools (MUST) found a high risk of malnutrition at the age of > 60 years with a mean of 2.60, which means that on average these patients have a MUST score of 3 (high risk). In this study, 48 cases were found to have a high risk of malnutrition. Still, most patients experienced a significant increase in body weight (BB) in the intensive stage of Pulmonary TB treatment. In the first month, there were 70 cases, and in the second month, there were 66 cases that experienced an increase in body weight. Changes in body weight contribute to the success of TB treatment by influencing changes in the nutritional status of TB patients.

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