

Analysis of Nutritional Status and The Incidence of Pulmonary Tuberculosis in The Puskesmas Martapura 1

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ABSTRACT

Tuberculosis (TB) is an infectious disease caused by bacteria and transmitted through the air. Indonesia, especially South Kalimantan, records a high number of TB cases. Martapura 1 Community Health Center, which is known for its significant number of pulmonary TB cases, requires special strategies in handling and prevention. This descriptive research uses a cross-sectional design. The research was carried out from February to June 2024, at Martapura 1 Health Center, Banjar Regency, South Kalimantan. The sample size was 50 people, with the sampling method being Accidental Sampling. Data collection techniques include BTA examination and BMI (Body Mass Index) assessment. Analysis of the relationship between nutritional status and the incidence of pulmonary TB in the working area of Martapura 1 Community Health Center, Banjar Regency, South Kalimantan based on statistical tests with chi-square obtained a p-value of 0.006 (p-value <0.05). Therefore, it can be concluded that there is a relationship between nutritional status and the incidence of pulmonary TB in the working area of Martapura 1 Health Center, Banjar Regency, South Kalimantan in 2024. The incidence of pulmonary TB can affect a person's nutritional status.

Keywords: Tuberculosis, nutritional status, community nutrition

INTRODUCTION

Tuberculosis (TB) is one of the most common infectious diseases causing high morbidity and mortality worldwide, particularly in developing countries. This disease is caused by the bacterium *Mycobacterium tuberculosis*, which primarily affects the lungs but can also impact other organs. One important aspect often overlooked in the management of TB is the interaction between TB and the nutritional status of the infected individual. Poor nutritional status is not only a consequence of TB but can also worsen the prognosis of the disease and affect the efficacy of treatment. Therefore, a deep understanding of the correlation between TB and nutritional status is essential for improving treatment outcomes and the quality of life of patients.¹

Malnutrition or undernutrition is frequently observed in patients with TB and can be considered both a risk factor and a consequence of the disease. Malnutrition exacerbates the disease process by reducing cellular immunity, thereby increasing susceptibility to infection and disease propagation. This mechanism operates through various pathways, including reduced function of

T lymphocytes, decreased macrophage activity, and reduced cytokine production that plays a role in the immune response. This results in a detrimental cycle where TB worsens nutritional status and poor nutrition, in turn, exacerbates TB.²

In the context of TB treatment, poor nutritional status has been shown to affect the efficacy of anti-TB therapy. Research has indicated that TB patients with malnutrition have lower treatment success rates and higher relapse rates compared to patients with good nutritional status. This is due to several factors including ineffective drug absorption, inadequate nutrient-drug interactions, and reduced immune response to the pathogenic bacteria.³ Furthermore, certain micronutrient deficiencies commonly seen in TB patients, such as deficiencies in zinc, iron, and vitamin D, can have a direct effect on the body's ability to fight infection. Zinc is an essential mineral involved in numerous enzymatic reactions and immune functions. Studies have shown that zinc supplementation can enhance the immune response in TB patients and accelerate recovery time. Vitamin D has also been demonstrated to play a significant role in

modulating the immune system and potentially reducing the inflammation caused by TB.⁴

In clinical practice, nutritional assessment and intervention should be an integral part of managing TB patients. Nutritional interventions can include increasing caloric and protein intake, as well as managing micronutrient deficiencies through supplementation. This not only helps in improving nutritional status but also enhances treatment outcomes and the quality of life of patients. In conclusion, the interaction between TB and nutritional status is a crucial area in both research and medical practice, given the mutual impact of both conditions. Improving the nutritional status of TB patients can be a key strategy in enhancing the effectiveness of treatment, reducing the duration of the disease, and ultimately minimizing the global burden of TB. Further research is needed to explore the most effective nutritional intervention strategies in the context of TB, with the ultimate goal of optimizing treatment protocols and improving health outcomes for affected populations.³

Tuberculosis requires global attention. The WHO (World Health Organization) aims to reduce tuberculosis mortality by 90% and incidence by 80% by 2030 compared to 2022, in line with the 2030 Sustainable Development Goals. Indonesia has the second highest number of tuberculosis cases globally, following India. In 2022, Indonesia reported 969,000 tuberculosis cases, an increase compared to the total cases in 2015, which was 330,729 cases. The highest number of cases were reported in provinces with large populations such as West Java, East Java, and Central Java. However, South Kalimantan itself ranks seventh in TB cases in Indonesia, with cases in the province accounting for 44% of all new cases in Indonesia. The highest TB cases in South Kalimantan cities, on Banjarmasin ranking first with 11,800 cases, followed by Banjar Regency with 8,064 cases. Among the primary health care centers in Banjar Regency,

Martapura 1 recorded 1,364 cases or.⁵ Martapura 1 Primary Health Care, as one of the areas with a relatively high number of Pulmonary TB cases, requires special attention in the management and prevention of this disease. Good nutritional knowledge and appropriate food consumption behavior play a vital role in enhancing body immunity, thereby reducing the risk of Pulmonary TB infection. Good nutritional status is reflected in adequate, balanced, and varied nutritional intake, supporting the body's immune system in fighting infection. The purpose of this study is to examine the relationship between nutritional status and the incidence of pulmonary tuberculosis at Martapura 1 Public Health Center.

METHOD

In the analysis of the relationship between nutritional status and the incidence of pulmonary TB in the working area of Martapura 1 Public Health Center, Banjar District, South Kalimantan, it was observed that out of 20 respondents who contracted pulmonary TB, 14 or more than half (63.6%) were undernourished, and out of 30 respondents who did not contract TB, 8 (36.4%) were undernourished. The statistical test using Chi-square resulted in a p-value of 0.006 (p-value < 0.05), leading to the conclusion that there is a significant relationship between nutritional status and the occurrence of pulmonary TB in the working area of the Puskesmas Martapura 1, Banjar District, South Kalimantan, in the year 2024.

RESULT AND DISCUSSION

Nutritional status

This data shown that there are more respondents with normal nutrition than respondents in the underweight category at Puskesmas Martapura 1 Banjar District South Kalimantan.

Table 1. Frequency Distribution of Nutritional Status

No	Nutritional Status	f	Presentase (%)
1	Underweight	22	44,0
2	Normal	28	56,0
3	Overweight	0	0
4	Obese	0	0
Total		50	100

From Table 1 above, it is observed that nearly half (44.0%) of the 50 respondents have an underweight nutritional status, while cases of

overweight and obesity were not found in the area served by Puskesmas Martapura 1, Kab Banjar, South Kalimantan.

Incidence of pulmonary tuberculosis

This data shows that there are more respondents with non-Pulmonary TB than

respondents in the Pulmonary TB category at Puskesmas Martapura 1, Banjar District, South Kalimantan.

Table 2. Frequency Distribution of Pulmonary Tuberculosis

No	Incidence of Pulmonary Tuberculosis	f	Presentase (%)
1	Pulmonary TB	20	40,0
2	Non-Pulmonary TB	30	60,0
Total		50	100

From Table 2 above, it is known that out of 50 respondents, nearly half (40.0%) of the respondents suffer from Pulmonary TB in the working area of Martapura 1 Public Health Center, Banjar Regency, South Kalimantan.

This data shows that there are more analysis of the relationship between nutritional status and the incidence of pulmonary TB at Puskesmas Martapura 1, Banjar District, South Kalimantan.

Table 3. The Analysis of The Relationship Between Nutritional Status and The Incidence of Pulmonary TB

No	Nutritional Status	TB Incidence		Total	p
		Positive	Negative		
1	Undernourished	4	18	22	0,006
2	Normal	16	12	28	
Total		20	30		

In the analysis of the relationship between nutritional status and the incidence of pulmonary TB in the working area of Puskesmas Martapura 1, Banjar District, South Kalimantan, it was observed that out of 20 respondents who contracted pulmonary TB, 14 or more than half (63.6%) were undernourished, and out of 30 respondents who did not contract TB, 8 (36.4%) were undernourished. The statistical test using Chi-square resulted in a p-value of 0.006 (p-value < 0.05), leading to the conclusion that there is a significant relationship between nutritional status and the occurrence of pulmonary TB in the working area of the Puskesmas Martapura 1, Banjar District, South Kalimantan, in the year 2024.

Nutritional status

From the study of 50 respondents suspected of having Pulmonary TB in the working area of Martapura 1 Public Health Center, Banjar Regency, South Kalimantan, as shown in Table 4.1, it is evident that nearly half, 22 (44.0%), of the respondents are undernourished, and 28 (56.0%) respondents have a normal nutritional status. This finding is consistent with the research by Afifah, 2022⁵, which states that out of 64 respondents, nearly half, 30 (46.8%), were undernourished.

Generally, being undernourished reflects a condition where the nutritional intake is inadequate to meet the body's needs, thereby affecting the immune system and increasing

vulnerability to various diseases, including pulmonary tuberculosis (TB). Inadequate nutrition can weaken the body's defense mechanisms against Mycobacterium tuberculosis, the pathogen responsible for TB. Therefore, a deep understanding of this relationship is crucial for developing effective intervention strategies to reduce the incidence of pulmonary TB. It is hoped that from the results of this study, a clearer understanding of the extent to which nutritional status influences the risk of developing pulmonary TB can be obtained. This research is also expected to lay the groundwork for the development of nutritional intervention programs as part of the efforts to prevent and control pulmonary TB. Proper and good nutritional interventions are expected not only to improve an individual's nutritional status but also indirectly help reduce the risk of developing pulmonary TB.

Furthermore, the findings of this study are hoped to prompt stakeholders, both in the health sector and in other sectors, to pay more attention to nutritional aspects in public health programs, especially those related to pulmonary TB. Inter-sectoral collaboration is key in efforts to improve the nutritional status of the population, which ultimately is expected to reduce the incidence of pulmonary TB in the working area of the Puskesmas Martapura 1, Banjar District, South Kalimantan, and generally in Indonesia.

The importance of integrating TB and nutrition programs within the public health

system must be emphasized more, considering that these two aspects are interrelated and have a significant impact on public health outcomes. Thus, the results of this study are expected not only to provide new insights into the relationship between nutritional status and pulmonary TB but also to contribute to efforts to improve public health through a more comprehensive and integrated approach.

Nutritional status is an important indicator that reflects the balance between the nutrient intake consumed by an individual and the nutritional needs required by the body to perform its functions. Good nutritional status is essential for growth, health maintenance, and optimal physical and mental performance. Conversely, poor nutritional status can lead to various health disorders, ranging from undernutrition to overnutrition, each with negative health consequences.⁶

Nutritional status assessment in adults is often conducted through the evaluation of Body Mass Index (BMI), which is one of the simplest and most widely used methods. BMI is calculated by dividing an individual's weight in kilograms by their height in meters squared (kg/m^2). The results of this BMI measurement are then categorized into several classifications according to the standards set by the World Health Organization (WHO) to assess whether an individual is underweight, normal, overweight, or obese.⁷

The BMI categories for adults are as follows: less than 18.5 indicates underweight, 18.5 to 24.9 is considered a normal range, 25 to 29.9 indicates overweight, and 30 or above is categorized as obese. These classifications help health professionals identify individuals at risk of nutrition-related health problems, such as osteoporosis and anemia for those underweight, or cardiovascular disease, type 2 diabetes, and some types of cancer for those who are overweight or obese.⁸

The importance of nutritional status assessment lies not only in identifying the current condition but also in planning and implementing appropriate nutritional interventions to prevent or address nutritional issues. Regular BMI assessments can motivate individuals to adopt healthy behaviors, such as balanced eating and regular exercise, which are key factors in maintaining good nutritional status.⁹

Furthermore, factors such as age, gender, ethnicity, and specific health conditions also affect nutritional needs and how the body manages weight. This indicates that a holistic and individualized approach to nutritional status assessment and management is crucial. Health professionals should consider all these factors

when planning nutritional interventions to ensure that the recommendations provided are appropriate and effective for the individual.¹⁰ Nutritional status is a critical aspect of health and well-being that requires proactive attention and action. BMI measurement is a useful tool in assessing nutritional status, but it should be used as part of a broader approach to understanding and addressing nutritional issues. Through accurate assessment and appropriate intervention, we can move towards achieving optimal health for all individuals, regardless of their background or condition.^{11,12}

Incidence of pulmonary tuberculosis

The research on 50 respondents suspected of having Pulmonary TB in the working area of Martapura 1 Public Health Center, Banjar Regency, South Kalimantan, as shown in Table 4.2, indicates that nearly half, 20 (40.0%), of the respondents were affected by Pulmonary TB, and 30 (60%) respondents were not affected by Pulmonary TB. This research aligns with the study conducted by Asrianto, 2020 (1), which reported that more than half, 48 (68.5%), of the respondents were affected by Pulmonary TB.

This research underscores the importance of examining the relationship between nutritional status and the incidence of pulmonary tuberculosis (TB). Poor nutritional status is known to decrease an individual's immunity, making them more susceptible to various kinds of infections, including pulmonary TB. Conversely, pulmonary TB can also negatively impact an individual's nutritional status, resulting in a cycle that exacerbates the patient's condition. Therefore, understanding the relationship between nutritional status and pulmonary TB is crucial in the efforts to prevent and treat pulmonary TB.

The study conducted by Asrianto in 2020 also supports these findings, where more than two-thirds of respondents, 48 out of 70 individuals (68.5%), were affected by pulmonary TB.¹ The comparison between the previous research and this study shows variations in the prevalence of pulmonary TB, which could be influenced by differences in location, population, and research methodology. Nonetheless, both studies consistently demonstrate a significant proportion of individuals with pulmonary TB, reaffirming the importance of paying attention to risk factors such as nutritional status. From the results of this study, it is hoped that a better understanding of the relationship between nutritional status and the incidence of pulmonary TB can be achieved. With clear identification of risk factors, interventions can

be more targeted to improve nutritional status as part of a comprehensive strategy in the prevention and treatment of pulmonary TB. This includes nutritional education programs, nutritional supplementation, and improvements in access to quality food for at-risk populations. Through an integrated approach between the treatment of pulmonary TB and the improvement of nutritional status, it is hoped that the incidence can be reduced and the prognosis of pulmonary TB in the region can be improved.

Pulmonary tuberculosis (TB) is an infectious disease caused by the bacterium *Mycobacterium tuberculosis*, which most commonly affects the lungs but can also impact other organs.¹³ As a major public health problem in many countries, including Indonesia, pulmonary TB remains a primary focus in research and disease control efforts.¹ In adults, pulmonary TB is characterized by clinical symptoms that vary from chronic cough lasting more than three weeks, accompanied by sputum production sometimes mixed with blood, mild fever especially in the evenings or at night, night sweats without excessive physical activity, weight loss, and persistent fatigue. Transmission of pulmonary TB occurs through droplets containing *M. tuberculosis* bacteria, released into the air when an infected person coughs, sneezes, or even talks. Individuals inhaling this contaminated air may get infected, although not everyone exposed will develop active TB disease due to an efficient immune system that can prevent the bacteria's proliferation.¹⁴

Risk factors for developing pulmonary TB in adults include conditions that weaken the immune system, such as HIV infection, diabetes, malnutrition, and the use of certain medications that suppress immune response.¹⁵ Smoking and exposure to tobacco smoke also increase the risk, as well as living or working in environments with a high prevalence of TB, such as prisons or healthcare facilities. Diagnostics for pulmonary TB involve using the tuberculin skin test, sputum examination to detect the presence of *M. tuberculosis*, chest radiography, and interferon-gamma release assays (IGRAs) to detect immune responses to *M. tuberculosis*. Treatment of pulmonary TB requires an integrated approach involving the administration of anti-TB drugs for a minimum of 6 months, aimed at eliminating the infection and preventing drug resistance.¹⁴

Pulmonary TB control strategies, including early detection and effective treatment, are key components in reducing the disease burden. Public health education about the modes of transmission and prevention of TB

is also crucial in reducing stigma and raising awareness. Global efforts, such as the Stop TB Partnership supported by the World Health Organization (WHO), focus on improving access to care and treatment, as well as the development of new vaccines and diagnostic strategies.¹²

Recent research in the field of pulmonary TB focuses on developing new vaccines that are more effective than BCG, which is currently the only vaccine available for TB.¹⁶ Additionally, studies on drug resistance mechanisms in *M. tuberculosis* bacteria aid in the development of new treatment strategies aimed at addressing the challenges of multi-drug-resistant (MDR) and extensively drug-resistant (XDR) TB. Personalized and genomic-based approaches to TB therapy are being explored to improve treatment efficacy and reduce side effects.¹⁷

Prevention of pulmonary TB in adults involves a combination of vaccination, infection control strategies in healthcare facilities and communities, and nutritional interventions to enhance resistance to infection. Secondary prevention strategies, including preventive treatment for individuals infected with *M. tuberculosis* but who have not developed active TB disease, are also important in reducing the risk of transitioning from latent infection to active TB.

Relationship between nutritional status and pulmonary TB incidence

The analysis of the relationship between nutritional status and the incidence of Pulmonary Tuberculosis (TB) in the working area of Martapura 1 Public Health Center, Banjar Regency, South Kalimantan, shows that out of 20 respondents with Pulmonary TB, 14 or approximately (63.5%) respondents were undernourished. Meanwhile, out of 30 respondents without Pulmonary TB, 8 (36.4%) respondents were undernourished.

From the statistical test using chi-square, a p-value of 0.006 (p-value < 0.05) was obtained, concluding that there is a significant relationship between nutritional status and the incidence of Pulmonary TB in the working area of Martapura 1 Public Health Center, Banjar Regency, South Kalimantan, in 2024. Research on the relationship between nutritional status and the incidence of pulmonary tuberculosis (TB) in the working area of Martapura 1 Public Health Center, Banjar District, South Kalimantan, reveals crucial aspects in understanding the risk factors of this disease. Tuberculosis, an infectious disease caused by *Mycobacterium tuberculosis*, stands as a primary cause of morbidity and mortality globally, including in Indonesia. The disease

shares a complex relationship with an individual's nutritional status, which can act both as a risk factor and a consequence of the disease. This study aims to investigate the correlation between nutritional status and the occurrence of pulmonary TB in the area covered by the Puskesmas Martapura 1, Banjar District, employing statistical chi-square analysis method to test the proposed hypothesis.

Nutritional status is a significant indicator of public health that reflects the balance between nutrient intake and the body's needs. Malnutrition, especially undernutrition, can decrease body immunity, thus increasing susceptibility to various infectious diseases, including pulmonary TB. On the other hand, pulmonary TB can also deteriorate a patient's nutritional status through complex mechanisms related to metabolism and nutrient intake. Therefore, understanding the relationship between nutritional status and pulmonary TB is crucial for the prevention, control, and treatment of this disease.¹⁸

This study utilized an observational design with a cross-sectional approach to evaluate the relationship between nutritional status and the incidence of pulmonary TB. The research sample included individuals from the area served by the Puskesmas Martapura 1, selected through specific sampling techniques. Nutritional status was measured using anthropometric indicators such as Body Mass Index (BMI), while the diagnosis of pulmonary TB was based on clinical criteria and laboratory confirmation. The collected data were then analyzed using the chi-square statistical test to determine the relationship between nutritional status and the occurrence of pulmonary TB.

The analysis results showed a p-value of 0.006, meaning less than 0.05. This indicates a statistically significant relationship between nutritional status and the occurrence of pulmonary TB in the area covered by the Puskesmas Martapura 1. In other words, these results affirm that nutritional status plays a crucial role in the incidence of pulmonary TB, where individuals with poor nutritional status are more likely to develop the disease compared to those with good nutritional status.

The significant relationship between nutritional status and pulmonary TB can be explained through various biological mechanisms. The lack of certain nutrients, such as protein, vitamin D, and micronutrients, can affect the function of the immune system, thus influencing the body's ability to fight *M. tuberculosis* infection. Furthermore, malnutrition can also lead to changes in the structure and function of the lungs, which can increase

susceptibility to infection. This finding underscores the importance of nutritional interventions as part of the strategy for the prevention and control of pulmonary TB.

Nutritional status is a crucial health indicator, playing a significant role in the risk and progression of various diseases, including Pulmonary Tuberculosis (Pulmonary TB) in adults.¹⁹ Pulmonary TB, an infectious disease caused by the bacterium *Mycobacterium tuberculosis*, is predominantly found in developing countries, including Indonesia. It poses a serious public health problem due to its high morbidity and mortality rates. Various factors can influence the risk and course of Pulmonary TB, one of which is an individual's nutritional status. Suboptimal nutritional status, both in the form of undernutrition and overnutrition, can affect the body's immune system, subsequently influencing susceptibility to Pulmonary TB infection and the body's ability to control the infection.²⁰

Undernutrition, characterized by a low Body Mass Index (BMI), is a significant risk factor for Pulmonary TB infection. Undernutrition can weaken the immune system by reducing the phagocytic ability of immune cells, decreasing the production and activity of pro-inflammatory cytokines, and affecting the function of T and B cells, which are essential components in the adaptive immune response to *M. tuberculosis*. Individuals with undernutrition are at a higher risk of progressing from latent TB infection to active Pulmonary TB due to an immune system incapable of controlling the bacteria. Epidemiological studies indicate that individuals with undernutrition are two to three times more likely to develop Pulmonary TB compared to individuals with normal nutritional status.³

Conversely, overnutrition, often associated with obesity, also has implications for the risk of Pulmonary TB. Excess weight and obesity are linked to chronic inflammation, which can modify the body's immune response to infection. Although the specific mechanisms are still under investigation, obesity is believed to affect macrophage function and cytokine production, potentially reducing the effectiveness of the immune response to *M. tuberculosis*. Additionally, obesity is often associated with other disease conditions such as diabetes mellitus, which itself is a risk factor for Pulmonary TB. Therefore, overnutrition not only directly affects susceptibility and the course of Pulmonary TB but also indirectly through comorbid conditions.^{20,22}

Research on the relationship between nutritional status and the incidence of pulmonary tuberculosis (TB) in the working area

of Martapura 1 Public Health Center, Banjar District, South Kalimantan, reveals crucial aspects in understanding the risk factors of this disease. Tuberculosis, an infectious disease caused by *Mycobacterium tuberculosis*, stands as a primary cause of morbidity and mortality globally, including in Indonesia. The disease shares a complex relationship with an individual's nutritional status, which can act both as a risk factor and a consequence of the disease. This study aims to investigate the correlation between nutritional status and the occurrence of pulmonary TB in the area covered by the Puskesmas Martapura 1, Banjar District, employing statistical chi-square analysis method to test the proposed hypothesis.

Nutritional status is a significant indicator of public health that reflects the balance between nutrient intake and the body's needs. Malnutrition, especially undernutrition, can decrease body immunity, thus increasing susceptibility to various infectious diseases, including pulmonary TB. On the other hand, pulmonary TB can also deteriorate a patient's nutritional status through complex mechanisms related to metabolism and nutrient intake. Therefore, understanding the relationship between nutritional status and pulmonary TB is crucial for the prevention, control, and treatment of this disease.¹⁸

Optimal nutritional status management is a crucial strategy in the prevention and management of Pulmonary TB. Nutritional interventions, aimed at addressing both undernutrition and overnutrition, can help improve the immune response to infection and expedite recovery in Pulmonary TB patients. Adequate and balanced intake of macronutrients such as proteins, carbohydrates, and fats, as well as micronutrients like vitamins A, C, D, E, zinc, and iron, play an essential role in modulating the immune response and repairing lung tissue damaged by infection. Therefore, nutritional status assessment and appropriate nutritional interventions should be an integral part of Pulmonary TB management, alongside standard anti-TB treatment.^{19,20}

Furthermore, understanding the relationship between nutritional status and Pulmonary TB can aid in developing more effective prevention strategies. These strategies could include public health nutrition education programs aimed at reducing the prevalence of undernutrition and overnutrition, as well as raising awareness of the importance of nutrition for the prevention of infectious diseases like Pulmonary TB.²¹ Targeted public nutritional intervention programs could be a vital

component of comprehensive efforts to reduce the burden of Pulmonary TB, especially in countries with high prevalences of undernutrition and overnutrition. In conclusion, nutritional status has a complex and significant relationship with the risk and progression of Pulmonary TB in adults. Both undernutrition and overnutrition can affect immune function and increase susceptibility to *M. tuberculosis* infection.^{3,20}

Therefore, the assessment and management of optimal nutritional status are critical components of Pulmonary TB prevention and management strategies. Integrating nutritional interventions into public health programs can contribute to more effective and sustainable Pulmonary TB control efforts.

CONCLUSION

Based on the research conducted on the relationship between nutritional status and the incidence of pulmonary tuberculosis (TB) in the working area of the Puskesmas Martapura 1, Banjar District, South Kalimantan in 2024, the conclusion was drawn that there is a relationship between nutritional status and the incidence of pulmonary TB in the area covered by the Puskesmas Martapura 1, Banjar District, South Kalimantan, with a p-value of 0.006 and an Odds Ratio (OR) of 6.417.

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