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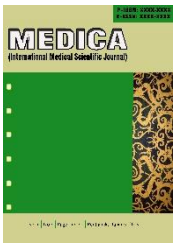

The Relationship Between Anti-Tuberculosis Drug Therapy and Uric Acid and Creatinine Levels in Tuberculosis Patients in Kayong Utara District

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Abstract

Pulmonary tuberculosis (TB) is a chronic infectious disease caused by Mycobacterium tuberculosis. TB treatment involves five essential drugs: isoniazid, streptomycin, ethambutol, rifampicin, and pyrazinamide. Among these, pyrazinamide and ethambutol are known to potentially increase uric acid and creatinine levels as side effects. This study aimed to examine the relationship between anti-TB drug (OAT) therapy and levels of uric acid and creatinine in TB patients in Kayong Utara District. Using a cross-sectional design and purposive sampling, data were collected from 31 TB patients across three community health centers with the highest TB incidence. Results showed that 54.8% of patients had elevated uric acid levels, while 45.2% had normal levels. For creatinine, 93.5% had normal levels, and 6.5% had elevated levels. Chi-square analysis indicated a significant association between OAT therapy and uric acid levels ($p = 0.045$), but no significant relationship was found with creatinine levels ($p = 1.000$). These findings suggest that OAT therapy may affect uric acid levels in TB patients, highlighting the need for monitoring during treatment.

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1. INTRODUCTION

Tuberculosis (TB) is a chronic infectious disease caused by the bacterium Mycobacterium tuberculosis. This bacterium can be observed under a microscope, characterized by its rod shape and acid-fast property, hence often referred to as Acid-Fast Bacillus (AFB). Tuberculosis is a long-standing disease caused by a pathogenic bacterium that has not been adequately managed (Kementerian Kesehatan Republik Indonesia, 2019). In 2022, there were approximately 10.6 million cases of tuberculosis worldwide. Indonesia ranked second after India, with 9.2% of global cases (Kementerian Kesehatan Republik Indonesia, 2023). According to the Health Department of West Kalimantan Province (2022), there were 9,514 confirmed TB cases, or around 15.13% (Dinas Kesehatan Provinsi Kalimantan Barat, 2022). Based on the Tuberculosis Information System (SITB) data for Kayong Utara District in 2023, there were 193 confirmed TB-positive patients who were required to undergo Anti-Tuberculosis Drug (OAT) therapy (Dinas Kesehatan Provinsi Kalimantan Barat, 2022).

The Directly Observed Treatment Shortcourse (DOTS) strategy is aimed at reducing the morbidity and mortality rates of tuberculosis and preventing drug resistance. The national tuberculosis control program, recommended by the World Health Organization (WHO), has been implemented in Indonesia since 1959. There are five types of drugs used in the treatment, namely Isoniazid, Streptomycin, Ethambutol, Rifampicin, and Pyrazinamide. OAT therapy plays an essential role in TB treatment efforts. TB treatment, which follows the Multidrug regimen over an extended period, often leads to various side effects (Nafila et al., 2017). In fact, TB patients can complete their treatment without significant side effects, but some may experience side effects that interfere with their daily activities (Kementerian Kesehatan Republik Indonesia, 2020). Common OAT side effects include loss of appetite, nausea, stomach pain, joint pain, tingling or burning sensations in the feet, skin itching and redness, jaundice, hearing loss, and liver dysfunction (Nafila et al., 2017). Additionally, other side effects include nephrotoxicity, which is toxic or destructive to kidney cells.

A study by Purnasari, Manggau, & Kasim, (2018) showed that prolonged use of streptomycin (more than 31 days) and gentamicin therapy led to an increase in creatinine levels. Streptomycin interferes with the exchange of metabolic waste products in the renal tubules, causing substances that should be excreted to be reabsorbed into the bloodstream, resulting in hyperuricemia (Wibowo et al., 2023). Moreover, the pyrazinamide component of OAT can produce an active metabolite, pyrazinoic acid, which inhibits uric acid secretion and causes elevated uric acid levels (hyperuricemia) (Ningsih et al., 2022). Hyperuricemia occurs when excess uric acid accumulates in the blood, often causing pain in one joint at a time, typically in the big toe (Madyaningrum et al., 2020). Uric acid is the final product of purine metabolism, catalyzed by xanthine oxidase. A study by Nuraeni et al. (2018) showed that 71.4% of TB patients on OAT therapy experienced elevated uric acid levels. Elevated uric acid levels in the blood can indicate kidney dysfunction. The kidneys, being the organs responsible for excretion, are vulnerable to side effects from drugs. Therefore, hyperuricemia is a sign of kidney damage. Kidney dysfunction can be assessed, in part, by measuring creatinine levels. Elevated creatinine levels indicate kidney dysfunction, as creatinine is not properly filtered by the kidneys.

Kayong Utara District consists of five subdistricts with 11 community health centers (puskesmas) in each subdistrict capable of diagnosing tuberculosis through various tests, such as microscopic AFB examination, molecular rapid test (TCM), and tuberculin skin tests (Mantoux) for children. Health workers in each health center also conduct case-finding strategies both inside and outside the healthcare facilities, such as distributing

sputum sample containers in schools, posyandu (integrated service posts), and posbindu (village health posts). TB treatment services in Kayong Utara District health centers include Intensive Phase (Initial), Continuation Phase, Medication Adherence Monitoring (PMO), and Contact Tracing for TB patients. Based on SITB data at the district level, three health centers have the highest number of TB cases: Teluk Melano Health Center, Teluk Batang Health Center, and Sungai Paduan Health Center. Several TB patients have reported experiencing side effects, such as tingling cramps and joint pain in the knees, toes, and wrists, which are symptoms of increased uric acid levels. The aim of this study is to determine the relationship between Anti-Tuberculosis Drug (OAT) therapy and uric acid levels as well as creatinine levels in tuberculosis patients in Kayong Utara District.

2. METHOD

This study employed an analytical observational approach with a cross-sectional design, aimed at examining the relationship between Anti-Tuberculosis Drug (OAT) therapy and serum uric acid and creatinine levels in TB patients in Kayong Utara District.

The study population consisted of all tuberculosis patients undergoing OAT therapy registered in the Tuberculosis Information System (SIT) between June and July 2024, totaling 47 individuals. A purposive sampling technique was applied to select participants who met specific inclusion criteria: patients actively receiving OAT in either the initial (intensive) or continuation phase of therapy, aged ≥12 years, and who gave informed consent. Exclusion criteria included patients with known chronic kidney disease, mental health disorders, those who discontinued therapy, were deceased, transferred out, or refused participation. A total of 31 patients met the inclusion criteria and were included in the final analysis.

Primary data included laboratory measurements of uric acid and creatinine levels, taken via venous blood samples and analyzed using standardized clinical chemistry methods. In addition, structured questionnaires were used to gather sociodemographic data (age, sex, education), physical activity level, and dietary patterns (e.g., purine-rich food intake). Data collection was conducted by trained health personnel at the participating health centers (Teluk Melano, Teluk Batang, and Sungai Paduan). Secondary data were obtained from the SIT database to verify patient records, treatment phases, and TB incidence at the selected health centers.

Data were processed and analyzed using SPSS. Descriptive (univariate) analysis was conducted to present the frequency distribution of sociodemographic characteristics and biochemical parameters. Bivariate analysis was performed using the Chi-square test to assess the relationship between OAT therapy phase and uric acid and creatinine levels. A significance level of $p < 0.05$ was used to determine statistical significance.

3. RESULTS AND DISCUSSION

The sample for this study on uric acid and serum creatinine levels was taken from three health centers with the highest number of TB patients, namely Teluk Melano Health Center, Teluk Batang Health Center, and Sungai Paduan Health Center. A total of 31 TB patients receiving Anti-Tuberculosis Drug (OAT) therapy from June 2024 to July 2024 participated in the study. The total population for this research was 47 individuals; however, only 31 respondents met the inclusion criteria for the study. There were 16 individuals who were excluded from the study, including 1 person with mental health issues, 4 people who discontinued their medication, 3 people who passed away, 1 person who transferred to a different healthcare facility, 6 people residing outside the service area

of the first-level healthcare facility, and 1 person who refused to participate as a respondent.

The study used serum samples from TB patients undergoing OAT therapy, and their consent was obtained for the use of these samples to examine uric acid and creatinine levels in the serum. The data was processed based on treatment stage, age, gender, physical activity level, consumption of purine-rich foods, education level, and comorbidities. Among the 31 respondents, the highest uric acid level measured was 15.8 mg/dl, and the lowest was 3.2 mg/dl, with an average uric acid level of 7.8 mg/dl. For creatinine levels, the highest value was 2.4 mg/dl, and the lowest was 0.5 mg/dl, with an average creatinine level of 0.9 mg/dl.

Table 1. Characteristic of respondents

Criteria	**Frequency**	**Percentage**
Age Group		
Adolescents (12-25 years)	2	6.5%
Adults (26-45 years)	13	41.9%
Elderly (46-65 years)	9	32.2%
Seniors (>65 years)	7	19.4%
Total Age Group	31	100%
Gender		
Female	8	25.8%
Male	23	74.2%
Total Gender	31	100%
Physical Activity		
Light	8	25.8%
Moderate	8	29%
Heavy	15	45.2%
Total Physical Activity	31	100%
Consumption of High Purine Foods		
Never	0	0%
Rarely (<3 times/week)	11	35.5%
Often (>3 times/week)	20	64.5%
Total Consumption of High Purine	31	100%
Education Level		
Elementary School (SD)	26	83.9%
Junior High School (SMP)	0	0%
Senior High School (SMA)	4	12.9%
Bachelor's Degree (S-1)	1	3.2%
Total Education Level	31	100%
Comorbidities		
Diabetes Mellitus	5	16.1%
No Comorbidity	26	83.9%
Total Comorbidities	31	100%

Table 1 shows that the research involving 31 tuberculosis (TB) patients in Kayong Utara District, the majority of patients were in the adult age group (26-45 years), accounting for 41.9% of the total respondents. In contrast, the adolescent group (12-25 years) only accounted for 6.5%. In terms of gender, the majority were male (74.2%). Regarding physical activity, most respondents engaged in heavy physical activity,

reaching 45.2%. Additionally, most respondents frequently consumed purine-rich foods, more than 3 times a week (64.5%). In terms of education, the majority of respondents had only completed elementary school (83.9%), with very few reaching higher education levels. Regarding comorbidities, most respondents did not have any underlying diseases (83.9%), while diabetes mellitus was the most common comorbidity found (16.1%). This data provides an overview of the respondent characteristics, which will help in understanding the factors that may influence their health, particularly related to the anti-tuberculosis drug (OAT) therapy they are receiving.

Table 2. Respondent Distribution Based on Uric Acid and Creatinine Levels in Tuberculosis Patients in Kayong Utara Regency

Criteria	Initial OAT Phase	Continuation OAT Phase
Uric Acid		
Normal	1 (12.5%)	13 (56.5%)
Abnormal	7 (87.5%)	10 (43.5%)
Total	8 (100%)	23 (100%)
Creatinine		
Normal	8 (25.8%)	21 (67.7%)
Abnormal	0 (0%)	2 (6.5%)
Total	8 (25.8%)	23 (74.2%)

Table 2 shows that most patients (87.5%) had abnormal uric acid levels in the initial phase of OAT treatment. In the continuation phase, the proportion of patients with normal uric acid levels increased significantly compared to the initial phase, indicating an improvement or adaptation of the body to treatment. All patients in the early phase had normal creatinine levels, indicating unimpaired renal function at the start of therapy. There was a slight increase in the number of patients with abnormal creatinine levels in the follow-up phase, which may indicate long-term side effects of OAT on renal function.

Table 3. Chi-Square Test of Uric Acid Level and OAT Therapy in Tuberculosis Patients in Kayong Utara Regency

Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	4.644a	1	0.031	
Continuity Correction	3.037	1	0.081	
Likelihood Ratio	5.164	1	0.023	
Fisher's Exact Test			0.045	0.038
Linear-by-Linear Association	4.495	1	0.034	
N of Valid Cases	31			

Note: 2 cells (50.0%) have expected count less than 5. The minimum expected count is 3.61.

Table 3 shows that the significance value for uric acid levels was 0.045, which is less than the p-value threshold of 0.05. This indicates a significant relationship between OAT therapy and uric acid levels in tuberculosis patients.

DISCUSSION

The research conducted on tuberculosis (TB) patients at three public health centers in Kayong Utara Regency involved 31 respondents. Among them, 8 were in the initial phase of OAT therapy and 23 were in the advanced phase. The study found that 17

patients had abnormal uric acid levels. This result is consistent with the research conducted by Ulfah (2021), which stated that TB patients undergoing OAT experienced an increase in uric acid levels. The increase in uric acid is one of the side effects of certain anti-tuberculosis drugs (OAT), including Rifampicin and Streptomycin. Rifampicin forms antibody complexes in the blood vessels of the kidneys, which can lead to damage and inflammation in the glomerular capillary walls. The accumulation of these antibody complexes in blood vessels results in narrowing of the vessels and ischemia in the tubules, leading to tubular necrosis and reduced kidney function. Similarly, Streptomycin causes nephrotoxic effects when aminoglycosides enter the renal cortex and proximal tubules, binding with lysosomes and forming myeloid bodies/secondary lysosomes, which leads to cell death and decreased kidney function (Singh, Ganguli, & Prakash, 2003). Additionally, Pyrazinamide and Ethambutol, two anti-TB drugs, have been reported to cause hyperuricemia. Pyrazinamide is a potent urate retention agent, causing a more than 80% reduction in renal uric acid clearance at a therapeutic dose of 300 mg daily. The metabolite pyrazinoic acid is oxidized by xanthine oxidase and is thought to be responsible for the hyperuricemia effect (Pham et al., 2014).

Regarding creatinine levels, only 2 patients in the advanced phase of OAT therapy had abnormal creatinine levels. This finding is similar to the study by Jumria (2023), which found that only a few of respondents experienced an increase in creatinine levels. The medications used in the advanced phase of OAT therapy, such as Rifampicin and Isoniazid, have been implicated in this increase. In Kayong Utara Regency, the majority of TB patients were in the adult age group, with 13 respondents in this category. According to the Indonesian Ministry of Health (2023), the highest number of TB cases globally occurs in the productive age group, particularly those aged 25-34 (Kementerian Kesehatan Republik Indonesia, 2023). In Indonesia, the most TB cases occur in the 45-55 age group, which is typically the working age. As people age, kidney function tends to decline. After the age of 40, the body starts losing nephrons, which play a crucial role in filtering the blood in the kidneys. Therefore, if kidney function declines, uric acid and creatinine levels in the blood increase (Singh, Ganguli, & Prakash, 2003).

In terms of gender, there were more male TB patients (74.2%) compared to female patients (25.8%). This finding is consistent with the research by Wibowo et al. (2023), which also showed a higher prevalence of TB in males. This may be related to estrogen hormone levels. Estrogen helps excrete uric acid through urine, and men, who have lower estrogen levels, are less efficient at excreting uric acid. This leads to a higher risk of elevated uric acid levels in men (Handayani, 2017). The level of physical activity also affects uric acid and creatinine levels. The study found that most respondents had a high level of physical activity. Physical activity produces lactic acid, which can temporarily decrease the excretion of uric acid. However, the effect is temporary, and lactic acid levels typically return to normal within a few hours (Natania, & Malinti, 2020). Similarly, creatinine levels can be affected by the intensity of physical activity, as excessive physical activity can reduce renal plasma flow and decrease glomerular filtration rate. The increase in creatinine levels can be caused by excessive physical activity. This is consistent with the findings of Harison (2019), which showed that only 20.9% of TB patients on OAT experienced an increase in creatinine levels.

Regarding diet, 20 respondents (64.5%) frequently consumed purine-rich foods, while 11 (35.5%) consumed them less often. The levels of uric acid in the blood can be influenced by foods high in purines. The body produces around 85% of purine, with only 15% coming from food. If dietary purine intake exceeds this 15%, purine levels accumulate, leading to an increase in uric acid levels (Direktoral Jenderal Pelayanan

Kesehatan, 2022). Regarding education, the majority of respondents (83.9%) had completed only primary school. According to a study by Muhammad et al. (2019), higher education levels can indirectly affect a person's health. Tuberculosis and diabetes mellitus (DM) are among the top ten causes of death in countries with lower-middle incomes (Mihardjal et al., 2015). Among the 31 respondents in this study, five (16.1%) had a history of DM.

4. CONCLUSION

Based on the findings, this study concludes that there is a significant relationship between OAT (anti-tuberculosis drug) therapy and increased uric acid levels in TB patients, while no significant association was found with serum creatinine levels. The elevated uric acid levels are potentially linked to the side effects of drugs such as Rifampicin and Pyrazinamide. Although abnormal creatinine levels were uncommon, factors such as age, gender, physical activity, diet, education level, and comorbidities—particularly diabetes mellitus—were identified as contributing factors influencing kidney function. These results underscore the importance of regular monitoring of uric acid and renal function in TB patients undergoing OAT therapy to ensure early detection and management of potential side effects.

REFERENCES

Dinas Kesehatan Provinsi Kalimantan Barat. (2022). *LAKIP Final 2022*. Pontianak: Dinas Kesehatan Provinsi Kalimantan Barat. Retrieved from: https://datacloud.kalbarprov.go.id/index.php/s/MJDRt6g3PeE3SGF#pdfviewer

Direktoral Jenderal Pelayanan Kesehatan. (2022). *Pengaruh Makanan Mengandung Purin Dengan Asam Urat.* Jakarta: Kementerian Kesehatan Republik Indonesia.

Harison, M. F. (2019). Gambaran Kadar Ureum dan Kreatinin pada Penderita Tuberkulosis Paru yang Mendapat Terapi Obat Anti Tuberkolosis (OAT) di RS. Khusus Paru di RS. Khusus Paru Provinsi Sumatera Selatan Tahun 2019. *Diploma Thesis*. Politeknik Kesehatan Palembang.

Handayani, T. L. (2017). Faktor Dominan Peningkatan Kadar Asam Urat Pada Arthritis di Wilayah Kerja Puskesmas di Kabupaten Jember. *Jurnal Riset Kesehatan Nasional*, 1(2), 95-101.

Jumria, J. (2023). Gambaran Kadar Kreatinin Pada Pasien Tuberkulosis Paru Dengan Pengobatan OAT Kategori 1 Di Puskesmas Temindung Dan Puskesmas Remaja Tahun 2022. *Diploma Thesis*. Jurusan Teknologi Laboratorium Medik, Politeknik Kesehatan Kementerian Kesehatan Kalimantan Timur.

Kementerian Kesehatan Republik Indonesia. (2019). *Pedoman Nasional Pelayanan Kedokteran Tata Laksana Tuberkulosis*. Jakarta: Kementerian Kesehatan Republik Indonesia

Kementerian Kesehatan Republik Indonesia. (2020). *Pedoman Nasional Pelayanan Kedokteran Tata Laksana Tuberkulosis*. Jakarta: Kementerian Kesehatan Republik Indonesia

Kementerian Kesehatan Republik Indonesia. (2023). *Laporan Program Penanggulangan Tuberkulosis Tahun 2022*. Jakarta: Kementerian Kesehatan Republik Indonesia

Madyaningrum, E., Kusumaningrum, F., Wardani, R. K., Susilaningrum, A. R., & Ramdhani, A. (2020). *Buku Saku Kader: Pengontrolan Asam Urat di Masyarakat*. Yogyakarta: Fakultas Kedokteran, Kesehatan Masyarakat dan Keperawatan (FK-KMK) UGM.

Natania, N., & Malinti, E. (2020). Hubungan Aktivitas Fisik Dengan Kadar Asam Urat Di RW 13 Kampung Mokla, Kecamatan Parongpong. *Klabat Journal of Nursing*, 2(2), 17-24. https://doi.org/10.37771/kjn.v2i2.488

Mihardjal, L., Lolong, D. B., & Ghani, L. (2015). Prevalensi Diabetes Melitus Pada Tuberkulosis. *Indonesian Journal of Health Ecology,* 14(4), 350-358.

Muhammad, E. Y. (2019). Hubungan tingkat pendidikan terhadap kejadian tuberkulosis paru. Jurnal Ilmiah Kesehatan Sandi Husada, 8(2), 288-291. Retrieved from: https://jurnalsandihusada.polsaka.ac.id/JIKSH/article/view/173

Nafila, N., Haqiqi, R. N., & Wahyunita, S. (2017). Kadar asam urat pada pasien tuberkulosis dengan terapi obat anti tuberkulosis (OAT) di Puskesmas Cempaka Maret 2017. *Jurnal Ilmiah Manuntung: Sains Farmasi Dan Kesehatan,* 3(2), 173-177. Retrieved from: https://jurnal.stiksam.ac.id/index.php/jim/article/view/124

Ningsih, A. S. W., Ramadhan, A. M., & Rahmawati, D. Proceeding of Mulawarman Pharmaceuticals Conferences, *15*, 231–241. https://doi.org/10.25026/mpc.v15i1.647

Nuraeni, V., Kurniawan, E., & Atfal, B. (2018). Profil Kadar Asam Urat Terhadap Penderita Tuberkulosis Yang Sudah Mengkonsumsi Obat Anti Tuberkulosis (OAT) Pirazinamid dan Etambuthol Tahun 2018. *Media of Medical Laboratory Science*, 2(2), 58-63.

Pham, A. Q., Doan, A., & Andersen, M. (2014). Pyrazinamide-induced hyperuricemia. *Pharmacovigilance Forum*, 39(10), 695–715. Retrieved from: https://pubmed.ncbi.nlm.nih.gov/25336865/

Purnasari, C., Manggau, M. A., & Kasim, H. (2018). Studi Pengaruh Dosis Dan Lama Penggunaan Terapi Aminoglikosida Terhadap Fungsi Ginjal. *Majalah Farmasi Dan Farmakologi*, 22(3), 76–80. https://doi.org/10.20956/mff.v22i3.5807

Singh, N. P., Ganguli, A., & Prakash, A. (2003). Drug-induced kidney diseases. *The Journal of the Association of Physicians of India,* 51, 970–979. Retrieved from: https://pubmed.ncbi.nlm.nih.gov/14719587/

Ulfah, U. (2021). Tuberkulosis Gambaran Kadar Asam Urat Pada Penderita Tuberkulosis Paru Yang Mengkonsumsi Obat Anti Tuberkulosis (OAT). *Jurnal Kesehatan Rajawali*, 11(2), 40-45. https://doi.org/10.54350/jkr.v11i2.108

Wibowo, W., Mulia, Y. S., Sunarno, S., Su'udi, A., Putranto, R. H., Kusumawati, K., & Renitia, G. I. (2023). Analisis Kadar Ureum, Creatinin, Dan Asam Urat Pada Oat Tb-Paru*. Jurnal Riset Kesehatan Poltekkes Depkes Bandung*, 15(2), 442-449. https://doi.org/10.34011/juriskesbdg.v15i2.2222