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# Overview of Nutritional Fulfillment in Dm-TB Patients At the Gorontalo City Health Center

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**ABSTRACT**

Diabetes Mellitus (DM) and Tuberculosis (TB) are interrelated diseases and can worsen patients' health conditions. DM-TB patients are at risk of impaired nutritional fulfillment due to increased energy needs, decreased appetite, and metabolic disorders of the body. Adequate nutritional fulfillment is important to support the healing process, increase immunity, and help control blood sugar levels. This study aims to find out the picture of nutritional fulfillment in DM-TB patients at the Gorontalo City Health Center. The research uses a quantitative method with a descriptive design. The research was carried out in 6 Gorontalo City Health Centers, namely Dungingi Health Center, Central City, West City, Sipatana, North City, and South City from December 29, 2025 to January 26, 2026. The study sample was DM-TB patients selected using total sampling techniques. Data collection was conducted using the Semi Quantitative Food Frequency Questionnaire (SQ-FFQ) to assess nutritional fulfillment based on energy intake, carbohydrates, proteins, fats, and micronutrients. The data were analyzed univariately and presented in frequency distributions. The results of the study showed that most of the respondents had not yet optimal nutritional fulfillment. The conclusion of this study is that the fulfillment of nutrition in DM-TB patients at the Gorontalo City Health Center still needs to be improved through nutrition education and proper dietary assistance.

## INTRODUCTION

Nutritional fulfillment is an important factor in the management of patients with Diabetes Mellitus (DM) and Tuberculosis (TB) comorbidities. These two diseases affect each other DM increases susceptibility to TB infection through immune system disorders, while TB can worsen blood sugar control in DM patients (Robert, 2022). Poor nutritional conditions in DM-TB patients, such as lack of energy, protein, and micronutrients, can weaken the body's defenses, slow down the TB healing process, and increase the risk of complications and treatment failure (Mustofa et al., 2022). Various studies show that DM-TB patients tend to have lower nutritional status than TB or DM patients alone, so the fulfillment of adequate nutrition is a key factor in increasing treatment effectiveness, maintaining stable blood sugar levels, and supporting patient recovery (Girishbhai et al., 2025).

Diabetes Mellitus (DM) with Tuberculosis (TB) is a comorbidity condition in which a person suffers from Diabetes Mellitus (DM) as well as Tuberculosis (TB) at the same time. These two diseases affect each other DM increasing the risk of TB, while TB can worsen blood sugar level control in DM patients (Jeon & Murray, 2022).

According to information from the World Health Organization (WHO) in 2021, DM with TB is now one of the main causes of global death, which is very worrying. Based on a report from the World Health Organization (WHO), in 2021, there were 10.7 million cases of pulmonary TB worldwide, with around 1.6 million people dying from this disease. Meanwhile, in the same year, the number of adults experiencing DM reached 537 million. Of all DM cases, about 15% also have Pulmonary TB, which indicates more than 1.6 million individuals have dual health problems of DM-Pulmonary TB worldwide. Some of the countries with the highest number of DM cases with TB are India, China, Indonesia, the Philippines, and Pakistan, which when added contribute more than 50% of the total cases of Pulmonary DM-TB in the world (WHO, 2024).

The prevalence of DM with TB in Indonesia in 2024 will increase, this will have a major effect on tuberculosis (TB) cases. People with DM have a 2–3 times higher risk of developing TB than people who do not have DM. Based on data from the Indonesian Health Insurance in 2021, the prevalence of diabetes mellitus (DM) comorbidities in pulmonary tuberculosis patients nationally was recorded at around 4.2% of all pulmonary TB cases (Prasiska et al., 2024).

According to data from the Gorontalo Provincial Health Office, in 2025, the prevalence of DM with disabled TB will reach 257 cases. Based on data obtained from the Gorontalo City Health Center from several health centers, namely the Dungingi Health Center with a total of 20 cases, followed by the Central City Health Center with 14 cases, the North City Health Center with 10 cases, the Sipatana Health Center and the West City Health Center with 12 cases and the lowest is the South City Health Center with 8 cases, with a total of 76 cases diagnosed with DM with TB complications (Gorontalo Provincial Health Office, 2025).

The discovery of data at the Gorontalo City Health Office regarding patients with TB-DM (Tuberculosis and Diabetes Mellitus) at the Gorontalo City Health Office shows that there is a pattern that requires special attention. According to the 2024 report, the total number of TB-DM patients reached 103 individuals, with the majority aged between 18 and 59 years old as many as 81 people, and the rest aged 60 years and above as many as 22 people. In 2025 (January to August), there will be 66 patients, consisting of 45 patients in the age group of 18-59 years and 21 patients aged 60 years and above. Although this data indicates a decrease in the number of patients, the productive age group is still the most affected group (Gorontalo City Health Office, 2025).

Patients suffering from TB as well as DM, it is important to regulate the food intake they have. Food or diet regulation is the main foundation in DM-TB therapy, as food has a direct relationship with variations in glucose levels in the blood. However, in the implementation of food arrangements for DM, there are still major challenges (Ministry of Health of the Republic of Indonesia, 2021)

The application of a proper diet in the treatment of patients suffering from DM-TB, with the aim of maintaining blood glucose levels in balance, improving nutritional status, and aiding the healing process of damaged lung tissue, nutritional therapy for DM-TB patients should include increased energy and protein intake, restriction of simple sugars, as well as the selection of complex carbohydrate sources with a low glycemic index (Health Organization, 2021). Research (He et al., 2019) in Xinjiang, China, shows that the implementation of a diet that is adjusted to energy needs (30–35 kcal/kgBB/day) and high protein intake (1.5–2 g/kgBB/day) is able to reduce blood glucose levels, Similar results were also found by (Adi Brando & Etty, 2024) stating that a diet program equipped with regular nutrition education can improve dietary order, improve nutritional conditions, and accelerate the clinical healing process for TB patients who have comorbidities with DM.

Nutritional disorders also have an impact on the effectiveness of TB treatment, characterized by a slower response to therapy, a higher risk of treatment failure, and a longer duration of the disease. This condition not only reduces the quality of life of patients, but also increases the economic and social burden, especially for patients with limited access to nutritious food. Therefore, the fulfillment of optimal nutrition is a crucial aspect in the management of DM-TB patients, both to support the effectiveness of therapy, improve clinical conditions, and improve the quality of life of patients.

Based on data from Riskedes, the prevalence of Diabetes Mellitus has increased, from 6.9% in 2013 to 8.5% in 2018. The results of the analysis of blood sugar levels showed that among the population over 15 years old in urban areas, the prevalence reached 5.7% and the prevalence of IGT (Impaired Glucose Tolerance) for the same age group in urban areas was 10.2%. In addition, there is also a low rate of fruit and vegetable consumption which reached 93.6%, and the percentage of alcohol consumption in the past month was 4.6%. In addition to Diabetes Mellitus, Tuberculosis (TB) is also one of the diseases commonly encountered in the community (Lona et al., 2023).

According to (Indah Fitriani & Achmad, 2023) Tuberculosis (TB) remains a major challenge in public health due to its rapid spread and can lead to serious complications, especially in individuals who also suffer from other diseases such as Diabetes Mellitus (DM). TB infection increases energy and nutrient requirements due to the presence of inflammatory processes and increased metabolism in the body. On the other hand, often the patient's appetite is reduced, there are difficulties in absorbing nutrients, and the use of TB drugs (OAT) can also affect how the body absorbs nutrients.

Tuberculosis patients who also suffer from Diabetes Mellitus need to regulate blood sugar levels properly. It is important to note that the use of Rifampicin can decrease the effectiveness of oral diabetes medications, such as sulfonyl urea, so the dosage of diabetes medications should be increased. In patients with diabetes mellitus, complications of diabetic retinopathy often appear, therefore it is necessary to be careful in administering etambutol, as it can worsen the condition (Chairul Anam & Eko Sudarmo, 2025).

Based on the results of interviews and initial observations conducted by researchers at the Gorontalo City Health Center on October 7, 2025, the researcher obtained an overview of the conditions of nutritional fulfillment in DM-TB patients. From the results of initial data collection, it is known that some patients still experience obstacles in maintaining a diet that is in accordance with the condition of the disease they suffer. From interviews conducted with 3 respondents suffering from Diabetes Mellitus with Pulmonary Tuberculosis, it is known that most patients still do not fully understand the importance of dietary regulation in supporting the healing process. Some respondents admitted that they still eat high-carbohydrate foods and rarely pay attention to the balance of protein,

vegetables, and fruit intake. One of the respondents even said that his appetite decreased due to the effects of TB medication, so he often missed meals and only ate once or twice a day. The results of the researchers' observations in the field also showed that some patients had a weak-looking body condition and weight loss, which may be related to the lack of balanced nutritional intake. On the other hand, there are also patients who have tried to follow nutrition education from health workers by starting to reduce sugar consumption and increase their intake of vegetables and fruits, even though the implementation has not been consistent. Some patients claim to focus more on medical treatment than paying attention to the importance of nutritional fulfillment as part of the healing process.

Based on the description above, the researcher is interested in researching more about the Picture of Nutritional Fulfillment in DM-TB Patients at the Gorontalo City Health Center.

## RESEARCH METHODS

Research This will be held at the Gorontalo City Health Center on December 29, 2025 – January 26, 2026. Types of quantitative research The research design used in this study is quantitative research with a descriptive type. Descriptive research is a research conducted with the main purpose of making an overview of the state of something (Scott, 2021). The data collection method in this study uses Semi Quantitative Food Frequency Questionnaire (SQ-FFQ) to assess the patient's nutritional fulfillment based on energy, carbohydrates, proteins, fats, and micronutrients. with a sample of 76 respondents. The types of research instruments can be in the form of food frequency questionnaire (FFQ) is used to measure the frequency and type of food consumption that DM-TB patients consume in a given period.

## RESEARCH RESULTS

Table 1. Characteristics of Respondents by Age

| Age (Years) | Quantity | Percentage (%) |
|---|---|---|
| 12-16 (Early teens) | 1 | 1,3 |
| 17-25 (Late teens) | 6 | 7,9 |
| 26-35 (Early adult) | 8 | 10,5 |
| 36-45 (Late adulthood | 10 | 13,2 |
| 46-55 (early seniors) | 19 | 25,0 |
| 56-65 (late seniors) | **20** | **26,3** |
| >65 (Manula) | 12 | 15,8 |
| **Total** | **76** | **100** |

Based on the table above, the characteristics of respondents based on age are known that out of a total of 76 DM-TB patients, the age distribution of respondents is dominated by the elderly group. The final elderly group with an age range of 56-65 years is the category with the largest number of patients, reaching 20 people or 26.3% of the total study population. If combined with the initial elderly group aged 46-55 years as many as 19 people or 25.0%, it is clear that more than half of the total patients are in the age range over 45 years.

Table 2. Characteristics of Respondents by Gender

| Gender | Quantity | Percentage (%) |
|---|---|---|
| Male | 37 | 48,7 |
| Women | **39** | **51,3** |
| **Total** | **76** | **100** |

Based on the table above, the characteristics of respondents based on gender show that most of the respondents are female, namely 39 respondents (51.3%), while male respondents amount to 37 respondents (48.7%).

Table 3. Characteristics of Respondents Based on Last Educator

| Final Education | Quantity | Percentage (%) |
|---|---|---|
| Elementary / Equivalent | 17 | 22,4 |
| Junior High School / Equivalent | **35** | **46,1** |
| High School/ Equivalent | 20 | 26,3 |
| College | 4 | 5,3 |
| **Total** | **76** | **100** |

Based on the table above, the characteristics of respondents based on their last education Most of the respondents have a junior high school education / equivalent, which is as many as 35 respondents (46.1%). Respondents with high school education/equivalent amounted to 20 respondents (26.3%), followed by respondents

with elementary education/equivalent as many as 17 respondents (22.4%) and respondents with higher education amounted to 4 respondents (5.3%).

Table 4. Characteristics of Respondents Based on Employment Status

| Jobs | Quantity | Percentage (%) |
|---|---|---|
| Not working | 2 | 2,6 |
| IRT | **29** | **38,2** |
| Self-employed | 19 | 25,0 |
| Labor | 9 | 11,8 |
| ASN | 3 | 3,9 |
| Private | 5 | 6,6 |
| Merchant | 2 | 2,6 |
| Students | 3 | 3,9 |
| Students | 2 | 2,6 |
| Retirees | 1 | 1,3 |
| Farmer | 1 | 1,3 |
| **Total** | **76** | **100** |

Based on the table above, data on respondent characteristics based on employment status was obtained The majority of DM-TB patients in 6 Gorontalo City Health Centers were housewives (IRT) as many as 29 respondents (38.2%), followed by self-employed as many as 19 respondents (25.0%) and workers as many as 9 respondents (11.8%). Other respondents were spread across the private category (6.7%), civil servants and students (3.9% each), to the smallest percentage in the retired and farmer groups (1.3% each).

Table 5. Characteristics of Respondents Based on Marital Status

| Marital Status | Quantity | Percentage (%) |
|---|---|---|
| Unmarried | 14 | 18,4 |
| Married | **62** | **81,6** |
| **Total** | **76** | **100** |

Based on the table above, showing marital status, most of the respondents were married as many as 62 people (81.6%), while respondents with unmarried status amounted to 14 people (18.4%).

Table 6. Characteristics of respondents based on length of DM

| Long Suffering from DM | Quantity | Percentage (%) |
|---|---|---|
| 12 Months | 15 | 19,7 |
| 18 Months | 13 | 17,1 |
| 24 Months | **24** | **31,6** |
| 36 Months | 8 | 10,5 |
| 42 Months | 4 | 5,3 |
| 48 Months | 7 | 9,2 |
| 54 Months | 1 | 1,3 |
| 60 Months | 4 | 5,3 |
| **Total** | **76** | **100** |

Based on the table above, data on the distribution of DM-TB patients according to the length of time they have had DM shows that the largest proportion of respondents have had the disease for 24 months, which is 24 people (31.6%). In contrast, the lowest percentage was found in respondents who had DM for 54 months, which was only 1 person (1.3%). The other long-suffering groups were spread over durations of 12 months (19.7%), 18 months (17.1%) and 36 months (10.5%), while the rest were in the range of 42 to 60 months with a smaller percentage accumulation.

Table 7. Characteristics of respondents based on length of time of TB

| Long Suffering from TB | Quantity | Percentage (%) |
|---|---|---|
| 1 Month | 7 | 9,2 |
| 2 Months | 10 | 13,2 |
| 3 Months | **23** | **30,3** |
| 4 Months | 16 | 21,1 |
| 5 Months | 8 | 10,5 |
| 6 Months | 8 | 10,5 |

| | | |
|---|---|---|
| 7 Months | 2 | 2,6 |
| 8 Months | 1 | 1,3 |
| 9 Months | 1 | 1,3 |
| **Total** | **76** | **100** |

Based on the table above, the distribution of respondents according to the length of time they had Tuberculosis (TB) showed that most of the respondents had suffered from the disease for 3 months, namely 23 people (30.3%). The second largest group was respondents who suffered for 4 months as many as 16 people (21.1%), followed by the 2-month group of 10 people (13.2%). The duration of suffering was found the least in the 8 months and 9 months categories, which each amounted to only 1 person (1.3%).

Table 8. Characteristics Based on Type of Treatment of DM Respoden

| Types of DM Treatment | Quantity | Percentage (%) |
|---|---|---|
| Oral | **50** | **65,8** |
| Insulin | 26 | 34,2 |
| **Total** | **76** | **100** |

Based on the table above, the majority of respondents used oral treatment (oral drugs) as many as 50 people (65.8%). Meanwhile, respondents who used insulin therapy amounted to 26 people (34.2%) out of a total of 76 respondents

Table 9. Characteristics Based on Nutritional Fulfillment in DM-TB Patients

| Nutritional Fulfillment | Quantity | Percentage (%) |
|---|---|---|
| Good diet | 20 | 26,3 |
| Diet is adequate | 7 | 9,2 |
| Poor diet | **49** | **64,5** |
| **Total** | **76** | **100** |

Based on the table above, the characteristics of DM-TB patients in 6 Gorontalo City Health Centers in 2025, based on nutritional fulfillment, shows that out of a total of 76 respondents, most of them have a poor diet, namely 49 respondents (64.5%). Furthermore, respondents with a good diet amounted to 20 respondents (26.3%), while respondents with a moderate diet were the least number, namely 7 respondents (9.2%).

The data shows that the majority of DM-TB patients in 6 Gorontalo City Health Centers still have poor nutritional fulfillment. This condition illustrates that DM-TB patients have not fully implemented a diet that is in accordance with nutritional needs, even though the fulfillment of good nutrition is very important in helping the treatment process, increasing immunity, and accelerating recovery in DM-TB patients.

## DISCUSSION

### Overview of Nutritional Fulfillment in DM-TB Patients

The majority of DM-TB patients in 6 Gorontalo City Health Centers in 2025 showed nutritional fulfillment in the category of poor diet, namely 49 respondents (64.5%), while respondents with a good diet were 20 respondents (26.3%), and respondents with a sufficient diet were 7 respondents (9.2%). This data shows that most patients are not able to meet their nutritional needs optimally, both in terms of the amount of food intake, the quality of the type of food consumed, and the regularity of the daily eating schedule. Poor diet in DM-TB patients can reflect low dietary variation, an imbalance of macro and micronutrients, and a lack of proper dietary regulation according to the needs of the disease. This condition is an important concern because patients with DM-TB have more complex metabolic needs than patients with one disease alone.

DM patients need a controlled carbohydrate intake to maintain stable blood glucose levels, while TB patients need higher energy and protein intake to support the immune system and the healing process of tissues damaged by infection. If the diet is not managed properly, the balance between needs and nutrient intake will be disrupted, which can worsen glycemic control, increase the risk of malnutrition, and slow down the patient's overall clinical recovery process. The high number of patients with poor diets in this study shows that most of the respondents still experience obstacles in meeting their appropriate nutritional needs while undergoing DM-TB treatment.

A total of 49 respondents (64.5%) who were in the category of poor diet indicated that the patient may not be able to implement the diet according to the principles of the DM-TB diet. This condition can be influenced by various factors, such as decreased appetite due to TB infection, side effects of anti-tuberculosis drugs in the form of nausea and vomiting, economic limitations, unhealthy eating habits, and lack of patient knowledge about the importance of nutritional fulfillment during treatment. In active TB patients, systemic symptoms such as prolonged fever, fatigue, weight loss, and gastrointestinal disorders are often found that cause food intake to decrease. If these

conditions occur at the same time as DM, then dietary regulation becomes more difficult because the patient has to limit the consumption of certain foods to keep blood sugar levels stable. As a result, patients are at risk of energy and protein deficits that can worsen nutritional status and slow down the healing process.

Meanwhile, there were 7 respondents (9.2%) who were in the category of adequate diet. This group showed that patients had begun to pay attention to their diet and the fulfillment of their nutritional needs, but were not fully optimal. Patients with a sufficient diet may have been able to manage their eating schedule and start choosing healthier foods, but the amount and quality of nutrient intake consumed still does not meet the body's needs optimally. This condition still needs to be considered because DM-TB patients need adequate energy, protein, vitamins, and minerals to maintain the body's condition and support the effectiveness of treatment. As many as 20 respondents (26.3%) were in the category of good diet. This shows that some patients have been able to implement a diet that suits the needs of their disease. Patients with a good diet tend to be better able to manage a regular meal schedule, choose foods with a balanced nutritional composition, and comply with dietary recommendations provided by health professionals. A good diet is very important in DM-TB patients because it can help maintain nutritional status, increase immunity, speed up the TB healing process, and help maintain stable blood glucose levels. Patients who have a good diet generally also have a higher awareness of the importance of nutrition in supporting treatment success.

The results of this study are in line with research conducted by Prasetya, Fitriani, and Widianti (2021) which reported that the nutritional status of DM-TB patients is still in the poor category based on anthropometric indicators, which shows an imbalance between increased energy requirements due to chronic inflammatory processes and inadequate food intake. The study explained that active TB patients often experience decreased appetite, fatigue, and weight loss which has an impact on low nutritional status. When these conditions are accompanied by DM, metabolic disorders become more complex because patients must maintain stable blood sugar levels while meeting the increased energy and protein needs due to TB infection.

In line with the findings of Patel et al. (2024), patients with TB-DM coinfection have a higher prevalence of malnutrition than patients who only suffer from TB or DM. Malnutrition in patients with TB-DM is characterized by high HbA1c levels, low albumin levels, and vitamin D deficiency which indicates metabolic disorders and deficiencies in essential nutrients. This condition is exacerbated if the patient has a poor diet, where irregular food intake, limited meal portions, and lack of food variety cause the body to not get enough energy, protein, and micronutrients to repair body tissues, maintain immune function, and support the healing process of disease.

Thus, poor diet in DM-TB patients is not only a supporting problem, but also an important factor that affects the nutritional status and overall health condition of the patient. Therefore, interventions in DM-TB patients do not only focus on medical treatment, but also need to involve a comprehensive nutrition approach through nutrition education, diet monitoring, dietary assistance, and regular monitoring of nutritional status. These efforts are expected to help improve the nutritional status of patients, improve glycemic control, strengthen the immune system, and support the success of DM-TB treatment optimally.

## CONCLUSION

Based on the results of the study on the description of nutritional fulfillment in DM-TB patients in 6 Gorontalo City Health Centers located in Gorontalo City with a total of 76 respondents, it can be concluded that:

The characteristics of the respondents showed that most of them were in the age group of 56-65 years old (26.3%), female (51.3%), educated in junior high school (46.1%), and the majority worked as housewives (38.2%).

The level of nutritional fulfillment of DM-TB patients is mostly in the poor category (64.5%), followed by the good category (26.3%), and there are still patients in the adequate category (9.2%).

In general, the nutritional fulfillment of DM-TB patients is in the poor category, but there are still some patients who have not met their nutritional needs optimally. This condition shows that attention to diet and nutrition education still needs to be increased, especially considering the importance of nutrition in controlling blood sugar levels and the TB healing process.

## ADVICE

Improving nutrition education and counseling on a regular basis for DM-TB patients, both through individual and group counseling.

Optimize the role of health workers in monitoring the nutritional status and dietary adherence of patients.

Develop a special nutrition assistance program for patients with the category of nutrient fulfillment.

Pay more attention to the diet according to the recommendations of health workers, especially in regulating the amount, type, and schedule of meals.

Raising awareness of the importance of balanced nutrition to speed up the healing process and prevent complications.

It can conduct follow-up research with larger sample counts and broader variables, such as the relationship between nutrient fulfillment levels and blood sugar levels or TB treatment success.

Using analytical methods to find out the factors that affect nutritional fulfillment in DM-TB patients.

## REFERENCES


Adi Brando Sagala, Etty (2024). Status Of Patients With Pulmonary Tuberculosis : A Systematic. 6(3), 1161–1172.

Aleid & Zenteno-Cuevas (2024). Association Between Diabetes Mellitus – Tuberculosis And The Generation Of Drug Resistance. 1–24.

Ali Khomsan (2022). Food and Nutrition.

Alfariki. (2020). Child Nutrition and Stunting. Smallaprio Publishers. Https://Books.Google.Co.Id/Books?Id=E9kzeaaaqbaj

Alpian & Alfarizi (2022). Type 2 (Two) Diabetes Mellitus and Its Treatment: A Review of the Literature. Journal Of Public Health And Medical Studies, 1(1), 13–23.

Alvi Ratna Yuliana. (2023). Prevention of TB Transmission through the Implementation of Bu Titik Outbreak (Prevent the Risk of Transmission. 6(1), 77–87.

Ambarwati, Luluk Cahyanti, Johanna Tomasoa, Iwan., Dwi Nopriyanto, Icca Narayani Pramudaningsih, Sony Wahyu Tri Cahyono, Rusmiyati, Diana Tri Lestari. (2024). Type 2 Diabetes Mellitus: Disease Concept and Management. Publisher Qiara Media. Https://Books.Google.Co.Id/Books?Id=Fpv7eaaaqbaj

Ardiansyah. (2023). Data Collection Techniques and Educational Scientific Research Instruments on Qualitative and Quantitative Approaches. Journal of Ihsan : Journal of Islamic Education, 1(2), 1–9. Https://Doi.Org/10.61104/Ihsan.V1i2.57

Arfiza Ridwan. (2021). Pulmonary Tuberculosis and Its Prevention: A Literature Review of Lung Tuberculosis and Its Prevention: Literature Review. xii(1), 27–32.

Bhelqis (2024). Skin Manifestations in Patients with Diabetes Mellitus: A Systematic Review. Journal of Educational, Psychological and Health Research, 5(3), 851–861.

Bisht, Dahiya, Ghosh, S. M. (2023). The Cause – Effect Relation Of Tuberculosis On Incidence Of Diabetes Mellitus. June, 1–15. Https://Doi.Org/10.3389/Fcimb.2023.1134036

Chairul Anam, Eko Sudarmo (2025). Characteristics of Tuberculosis Patients with Type 2 Diabetes Mellitus at Dr. H. Chasan Boesoirie Hospital, Ternate City Chairul. Journal of Medicine, 12(2), 436–444.

Dera Rahmi Gusti Fauzia. (2020). Nursing Care for Nutritional Fulfillment Disorders in Type II Diabetes Mellitus Patients in the Women's Non-Surgical Irna Room of Dr. M. Djamil Padang Hospital in 2020. Health Polytechnic of the Ministry of Health of Padang. (Scientific Paper).

Rosalin Yuniarti Maruf, Ningrum Wahyuni, Ekawaty Suryani Mastari. (2024). Type 2 Diabetes Mellitus. Publisher Adab. Https://Books.Google.Co.Id/Books?Id=Irhieqaaqbaj

Erida, Astuti. (2024). Bookchapter Diabetes Melitus. 1(3048–0973), 7.

Evi Martalinda Harefa (2023). Monograph of Risk Factors for the Occurrence of Type 2 Diabetes Mellitus. Uwais is inspired by Indonesia. Https://Books.Google.Co.Id/Books?Id=Ur3leaaaqbaj

Genton, Germert & Soeters (2022). Basic Concepts In Nutrition : Nutritional Requirements For Health At Rest And On Exercise , Adult Subjects. 163–166. Https://Doi.Org/10.1016/J.Eclnm.2008.04.001

Girishbhai, Baral, Jacob, Malakapogu, Saravu & Sekhar (2025). Journal Of Clinical Tuberculosis And Other Mycobacterial Diseases Nutritional Status In Patients With Tuberculosis And Diabetes Mellitus : A Comparative Observational Study. Journal Of Clinical Tuberculosis And Other Mycobacterial Diseases, 35(March 2024), 100428. Https://Doi.Org/10.1016/J.Jctube.2024.100428

Hardinsyah. (2022). Sufficiency of Energy, Protein, Fat and Carbohydrates. May.

Indah Fitriani, Achmad (2023). The Relationship between Diet and Glucose Levels in the Elderly with Type 2 Diabetes Mellitus. Guidelines for Nutrition Services in Tuberculosis Patients, 149–156.

Jeon & Murray (2022). Diabetes Mellitus Increases The Risk Of Active Tuberculosis : A Systematic Review Of 13 Observational Studies. 5(7). Https://Doi.Org/10.1371/Journal.Pmed.0050152

Juliana, Soleha, Yunianto, Ismunandar, Study. (2024). Diagnostic Approach Based on Manifestations, Clinical Examination and Management in Pulmonary Tuberculosis. 14 (September), 1851–1857.

Kinoshita, Yamamoto, Nakamura & Saito (2026). Age-related decline, comorbidities, and nutritional vulnerability among older adults with chronic infectious diseases. Geriatric Medicine and Health Research, 18(1), 45–56.

Kundarti, Titisari & Andrianto (2024). Textbook of Pathophysiology in Midwifery Cases. Unisma Press. Https://Books.Google.Co.Id/Books?Id=Atfteaaaqbaj

Kurniawan & Agustini. (2021). Health and Nursing Research Methodology. Library House.

Kusumawaty, Achmad, Ginting, Yunike, Liana, Indriyani, Martiningsih, Solehudin, & Lalla (2022). Nursing Research Methodology. In Upt. Unsoed Printing and Publishing (September issue). Pt Global Technology Executive.

Laksono (2022). Determinants Of Complication Events In Diabetes Mellitus. 10(1), 68–78.

Lona, Zendrato, Wulan & Yoan, P. (2023). Education On Fulfilling Nutritional Needs In Diabetes And Tuberculosis Patients. 6(2), 163–168.

Mashuri (2025). Journal of Intelligent Sifa Education. 14, 26–39.

Mochammad (2025). Long suffering from diabetes mellitus with an increased risk of erectile dysfunction. Journal of Community Medicine, 13(01).

Moewardi (2023). Factors Affecting Complications in Diabetes Mellitus Patients at Dr. Moewardi factor affecting complications in diabetes mellitus patients in. 20(1), 27–35.
Hope you are right. Arifin Hidayat, Shinta Arini Ayu, Triana Arisdiani, Netti, Retno Ayu Yuliastuti, Yuly Abdi Zainurridha, Treesia Sujana, Anida, & Dia Amalindah. (2024). Medical Surgical Nursing Textbook (Cardiovascular, Hematology, Respiratory, Innervation). Https://Books.Google.Co.Id/Books?Id=R2ujeqaaqbaj
Muhamad Afifuddin Nur (2024). Scientific. 2, 163–175.
Mustofa, Purwono (2022). The Application of Foot Gymnastics to Blood Glucose Levels in Diabetes Mellitus Patients in the Working Area of the Purwosari Health Center, North Metro District in 2021. Journal of Young Scholars, 2, 78–86.
Nidia Suriani, Risnita (2023). The concept of population and sampling as well as participant selection was reviewed. Ihsan: Journal of Islamic Education, 1, 24–36.
Nopitasari (2021). Received: January 2021; Accepted: April 2021; Published: June 2021. 4(1), 17–27.
Novi Malisa, Fitriani Agustina, Yasin Wahyurianto, Dewi Siti Oktavianti, Susilawati, Karim, Muhaimin, Caraka, Alfiansyah, & Hakim, (2022). Manual of Nursing Medicine Volume I. Masterpiece Citra Utama Group. Https://Books.Google.Co.Id/Books?Id=R-Ateaaaqbaj
Pantaria, Hapsari & Isfandiari (2024). Socioeconomic and nutritional relationship with tuberculosis risk in people with type 2 DM. August, 185–194. Https://Doi.Org/10.20473/Jbe.V5i2.2017.185-194
Perkeni. (2021). Guidelines for the Management and Prevention of Type 2 Diabetes Mellitus in Adults in Indonesia. In Perkeni (Indonesian Endocrinology Association).
Rafiqul & Sim (2021). Education And Food Consumption Patterns : Quasi-Experimental Evidence From Indonesia Education And Food Consumption Patterns : Quasi-Experimental Evidence From Indonesia. 1–22.
Rasyid & Heryawan (2023). Classification of tuberculosis disease (TB) of human lung organs based on thorax X-ray images using the Convolutional Neural Network (CNN) method. Indonesian Journal of Health Information Management (JMIKI), 11(1), 35–44. Https://Doi.Org/10.33560/Jmiki.V11i1.484
Ridzuan Mohd, Ridzuan (2021). Sciencedirect Sciencedirect A Review On Data Cleansing Methods For Big Data A Review On Data Cleansing Methods For Big Data. Procedia Computer Science, 161, 731–738. Https://Doi.Org/10.1016/J.Procs.2019.11.177
Robert (2022). Interaction Of Nutritional Status And Diabetes On Active And Latent Tuberculosis : A Cross-Sectional Analysis. 1–9.
Ruiz-Rosso, Moreno Del-Pino-Casado, Palomino-Moral (2024). Factors Influencing Nutritional Status In Hospitalized Individuals Aged 70 And Above.
Said, Sari & Lauchan (2024). The relationship between stress levels and eating disorders with. 5, 12755–12765.
Salsabela, Suryadinata, Farisa, & Arya (2021). Overview of Nutritional Status in Tuberculosis Patients at Hasan Sadikin Central General Hospital Bandung Tuberculosis Patients' Nutritional Status In. August. Https://Doi.Org/10.24198/Jsk.V2i2.11257
Sary,Sulastri (2024). Nutrition And Genetic : What Is Relationship With. 15(Juni), 85–95.
Senjaya, Sriati & Maulana (2022). Family support for Odha who has an open status in Garut Regency. Journal of Scientific Horizons, 2(3), 1003–1010.
Setia & Kartika (2024). Taboo culture and eating style with food diversity and nutritional status of toddlers in the Dayak tribe. 3(September), 147–155.
Sinclair, Abdelhafiz & Rodríguez-Mañas (2020). Diabetes and frailty in older people: Implications for management. Diabetes Research and Clinical Practice, 162, 108–115.
Subhaktiyasa (2024). Quantitative and qualitative research methodology approach. Scientific Journal of the Education Profession, 9(4), 2721–2731.
Sugiyono. (2016). Educational Research Methods (Quantitative Approach, Qualitative and R&D. Cv.Afabeta.
Sulung & Muspawi (2024). Understanding research data sources: primary, secondary, and tertiary. Journal of Edu Research Indonesian Institute For Corporate Learning And Studies (IICLS) Page, 5(3), 110–116. Https://Doi.Org/10.1163/9789004263925_015
Sumiyati (2022). The Effect of Diabetes Mellitus on the Eyes. Journal of Optical Optics, 2(2), 1–9. Https://Doi.Org/10.54363/Jmo.V2i2.36
Suntama. (2023). Application of Basic Principles of Scientific Research Ethics. Journal of Tambusai Education, 7(3), 27876–27881.
Susanti, Maulida, Rizqi, Dewi & Barokah (2024). The relationship between age, sex and diet and risk of diabetes mellitus in Air Hitam Village. 5(September), 7484–7491.
Sutomo & Purwanto (2023). The Effect of Consumption of Star Fruit Leaf Tisane on Changes in Blood Sugar Levels in Patients with Type 2 Diabetes Mellitus. Journal of Nursing, 146–148.
Tang, Huang, Shi, Wang, Zhang, Xue, A., … & Miao, S. (2021). Effect Of Exclusive Enteral Nutrition On The Disease Process, Nutrition Status, And Gastrointestinal Microbiota For Chinese Children With Crohn's Disease. Journal Of Parenteral And Enteral Nutrition, 45(4), 826–838.
Tomastola, Rambi & Brangmanise, S. (2021). Nutritional Interventions To Improve Intake And Nutritional Status

Of Patients With Diabetes Mellitus Complications Pulmonary Tuberculosis Multi Drugs Resistance Mycobacterium Tuberculosis Germs In Manado City Nutritional Interventions To Improve Intake And Nutritional Status Of Pat. 36–48.

Trifa & Purwanti (2024). The Relationship of Diabetic Neuropathy with Sleep Quality in Patients with Diabetes Mellitus in the Working Area of the Bendosari Sukoharjo Health Center. Holistic Journal of Health, 18(5), 567–576. Https://Doi.Org/10.33024/Hjk.V18i5.371

Wahyuni, Dhiemitra, Dewi & Hariawan (2023). The Correlation Between Diet Quality And Blood Glucose Levels In Type 2 Diabetes Mellitus Patients In Yogyakarta Municipality. 7(2), 252–260. Https://Doi.Org/10.20473/Amnt.V7i2sp.2023.25

Who. (2024). Global Tuberculosis Report 2024.

Widyaiswara (2022). The implementation of personal branding Smart Asn is a manifestation of being proud to serve in North Maluku Province. Journal of Scientific Research, 1(2), 297–303.

Wijayakusuma (2022). Diabetes-Free Like Bleeding. Self-Reliance. Https://Books.Google.Co.Id/Books?Id=Onivkw-Chxyc

Wisconsin, Wisconsin (2024). The Influence of Working Conditions and Organizational Changes on Work Behavior at Pt . Pos Indonesia Kcu Manado The Influence Of Working Conditions And Organizational Changes On Employee Work Behavior At . Pt . Pos Indonesia Kcu Manado Emba Journal Vol . 12 No. Emba Journal, 12(1), 1096–1105.

Scott, D. (2021). The Effect of Pulmonary TB Disease Education on the Acceptance Attitude of Family Members Suffering from Pulmonary TB at the Tb Dots (Directly Observed Treatment Short-Course) Polyclinic of Gmim Pancaran Kasih Manado Hospital.

Yastirin (2022). Identification Of Nutritional Status In Pre-Adolescent Group In The Integrated Islamic Elementary School Al Firdaus Purwodadi Pintam Ayu Yastirin 1) ; Rosmala Kurnia Dewi 2).

Yusra, Zalmadani & Seventr (2024). The Relationship Between Family Socio-Economic Status And Nutritional Status Of School-Age Children At State Elementary School 14 According to the Global Nutrition Report on . 3–6.

Zulfirman (2022). Journal of Research, Education and Implementation of Outdoor Learning Methods in. Journal Homepage, 3(2), 147–153.