



## ORIGINAL RESEARCH

# FACTOR ASSOCIATED WITH UNDERWEIGHT AMONG PEOPLE WITH TUBERCULOSIS

*Faktor yang Berhubungan dengan Underweight Pada Orang dengan Tuberkulosis*

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### ABSTRACT

**Background:** The relationship between Tuberculosis (TB) and nutritional status is a significant one. Patients with TB who are underweight face a higher risk of death. **Purpose:** This research aims to analyze the factors related to the occurrence of being underweight among TB patients at the Public Health Center (PHC) in Perak Timur, Surabaya. **Method:** This was an analytical observational study and used a cross-sectional design. The sample for this research was 41 respondents, who were TB patients and were undergoing treatment at the PHC in Perak Timur, Surabaya. Data collection was done from March 2020 to June 2020. Primary data was collected by conducting interviews using a questionnaire. Data analysis was performed using a chi-square test. **Results:** The results indicated that, out of the 41 respondents, there were 21 respondents who were underweight (51.22%). Descriptively, underweight TB patients were more likely to be in the intensive phase of treatment (90%), have a low income (56.76%), have a low education status (65.38%), and be unemployed (59.38%), with PR=0.43 and 95% CI=0.76–9.38. The results of this research indicated a link between the treatment phase and TB patients being underweight ( $p=0.01$ ; PR=2.33; 95% CI=1.43–3.79), the level of education attained by underweight TB patients ( $p=0.04$ ; PR=0.41; 95% CI=0.17–0.99), and the income of underweight TB patients ( $p=0.04$ ; PR=0.43; 95% CI=0.30–0.63). The results of this research indicated that there was a correlation between the work status and TB patients being underweight ( $p=0.07$ ; PR=2.67; 95% CI=0.76–9.38). **Conclusion:** The treatment phase, education level and income are significantly related to TB patients being underweight.

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## ABSTRAK

**Latar Belakang:** Hubungan antara Tuberkulosis (TB) dan status gizi bersifat dua arah, underweight pada penderita tuberkulosis dapat mengakibatkan hasil pengobatan yang buruk hingga kematian. **Tujuan:** Penelitian ini bertujuan untuk menganalisis faktor yang berhubungan dengan kejadian underweight pada penderita TB di Pusat kesehatan masyarakat (Puskesmas) Perak Timur Kota Surabaya. **Metode:** Studi yang digunakan pada penelitian ini merupakan studi analitik observasional dengan desain cross sectional. sampel pada penelitian ini yaitu sebagian dari penderita TB yang menjalani pengobatan di Puskesmas Perak Timur Kota Surabaya sebanyak 41 responden. Pengambilan data dilakukan pada bulan Maret hingga Juni tahun 2020. Pengumpulan data primer dilakukan dengan wawancara menggunakan kuesioner. Analisis data pada penelitian ini menggunakan uji Chi-square. **Hasil:** Penelitian ini menunjukkan bahwa dari 41 responden, terdapat 21 responden mengalami underweight (51,22%). Secara deskriptif, underweight pada penderita tuberkulosis lebih banyak pada fase pengobatan intensif (90%), memiliki penghasilan rendah (56,76%), memiliki tingkat pendidikan rendah (65,38%) dan tidak bekerja (59,38%). Hasil penelitian ini menunjukkan adanya hubungan yang signifikan antara fase pengobatan dengan underweight pada penderita TB ( $p=0,01$ ;  $PR=2,33$ ; 95%  $CI = 1,43-3,79$ ), tingkat pendidikan dengan underweight pada penderita TB ( $p=0,04$ ;  $PR=0,41$ ; 95%  $CI=0,17-0,99$ ), dan pendapatan dengan underweight pada penderita TB ( $p=0,04$ ;  $PR=0,43$ ; 95%  $CI = 0,30-0,63$ ). Hasil penelitian ini menunjukkan tidak adanya hubungan antara status pekerjaan dengan status gizi kurang pada penderita TB ( $p=0,07$ ;  $PR=2,67$ ; 95%  $CI=0,76-9,38$ ). **Kesimpulan:** Fase pengobatan, tingkat pendidikan, dan pendapatan memiliki hubungan signifikan dengan kejadian underweight pada penderita TB.

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## INTRODUCTION

Tuberculosis (TB) is an infectious disease caused by mycobacterium tuberculosis that can transmit through droplets. Most of these bacteria attack the lungs and other organs. TB can occur when the immune system weakens. TB has become a global health concern. The prevalence of TB in the world was estimated at around 132 per 100,000 population. In terms of the number of TB sufferers, Indonesia was in the top three countries, with the most number of TB patients, which was around 8% of all TB patients in the world (World Health Organization, 2019).

In 2017, the national TB incidence rate was 319 cases per 100,000 population, moreover, in 2018, there was a decrease in the TB incidence rate to 316 cases per 100,000 population. The East

Java province had the second largest number of TB cases in Indonesia. The total number of TB cases in the East Java province in 2018 was 54,863 cases (Ministry of Health RI, 2019). The highest number of TB cases in the East Java province was found in Surabaya city. Based on data obtained from the health profile of Surabaya from 2015 to 2017, there had been an increase in the number of patients with pulmonary TB for three consecutive years (Surabaya City Health Office, 2018).

The prevalence of underweight TB patients in Ethiopia was 39.70% (Dargie, Tesfaye, & Worku, 2016); in Taiwan, this prevalence was 35.50% (Yen et al., 2016); and in Indonesia, the prevalence ranged from 42.40% to 61.10% (Kurnia, Masruroh, & Melizza, 2020; Kusumaningroh, Susilowati, & Wulandari, 2018; Putri, Munir, & Christianto, 2016). Nutritional status and TB are

closely interrelated. The relationship between pulmonary TB and nutritional status is a catch-22 situation. Patients diagnosed with TB lose weight, and being underweight is a risk factor for getting TB. A study conducted among TB patients in India revealed that poor nutritional status can lead to an increase in disease severity and can also increase the risk of death (Kant, Gupta, & Ahluwalia, 2015). Poor nutritional status increases the risk of pulmonary TB. Conversely, pulmonary TB leads to a poor nutritional status because the course of the disease affects endurance (Putri, Munir, & Christianto, 2016).

The results of a research conducted in Brazil mentioned that factors connected to the high prevalence of malnutrition status are gender, age, and smoking history (Francisco, Assumpção, Borim, & Malta, 2019). Another research conducted in Odisha (India) revealed that nutritional status was significantly affected by the socioeconomic status (Bera, Das, & Behera, 2019). The nutritional status of patients is known to play an important role in the treatment of pulmonary TB. Patients with good nutritional status have better treatment responses; in contrast, patients with poor nutritional status risk obtaining poor or recurring treatment (Martin & Sabina, 2019). This research aims to analyze the factors linked to TB patients being underweight at the PHC of Perak Timur in Surabaya.

## METHODS

This was an analytical research and employed a cross-sectional design approach. The population for this research was all patients who had TB and were undergoing treatment at the PHC of Perak Timur, Surabaya city were 77 people. The inclusion criteria was TB patients  $\geq 15$  years. The sample size calculation was performed by using the simple random sampling calculation formula to obtain a total sample of 41 people. The research subjects were selected at random by providing numbers to all of the members of the population. Subsequently, a random selection of numbers was done according to the sample size determined. The data used in this research was primary data collected through interviews using a questionnaire. The location of this research was the PHC of Perak Timur in Surabaya city. Data collection was done from March 2020 to June 2020.

The independent variables studied in this research were the treatment phase and the socioeconomic factors (education, occupation, and income); the dependent variable was the

occurrence of being underweight. The treatment phase was divided into two categories: intensive phase (if a respondent received TB treatment  $\leq 2$  months); and continuance phase (if the respondent was taking treatment for over 2 months). Education was grouped into two categories: low education (if the respondent did not go to school and if the respondent went to elementary school and junior high school); and high education (if the respondent studied at a high school equivalent level or in university). The job variable was divided into two categories: employed and unemployed. The income variable was divided into two categories: low-income category (if a respondent earned an income below the UMK (minimum wage) of Surabaya city); and high income (if a respondent had an income above the UMK of Surabaya city). TB patients who were underweight were those who had a BMI less than 18.50.

Data analysis was done using univariate and bivariate analysis. Frequency distribution was employed in univariate analysis; a chi-square test was employed in bivariate analysis to determine whether there was a relationship between the dependent and the independent variables. This relationship was observed through the p value obtained: The results of the chi-square test indicated a p-value less than 0.05, which meant there was a relationship between these variables. This research has received the ethical approval from the Health Research Ethical Clearance Commission at the Faculty of Dental Medicine in Universitas Airlangga. This study bears the certificate number 178/HRECC.FODM/III/2020.

## RESULTS

The data in Table 1 indicates that most of the TB patients were male (51.22%), they were in the age group of 46–55 years (36.83%), were married (53.66%), and were undergoing the continuance treatment phase (75.61%). In terms of the socioeconomic conditions of the respondents, most of them had low education (63.41%), were unemployed (78.05%), and had an income below the UMK of Surabaya city (90.24%). Most of the TB patients had a BMI value less than 18.50 and were underweight (51.22%).

The data in Table 2 indicates a p value=0.01 ( $p < 0.05$ ), indicating a relationship between the two variables. With regard to the income variable analysis (with the occurrence of being underweight calculated using the chi-square test), the results indicated that  $p = 0.04$  ( $p < 0.05$ ), which meant that

there was a relationship between the two variables. Based on the analysis of the work status variable (with the occurrence of being underweight calculated using the chi-square test), the results indicated that  $p=0.07$  ( $p>0.05$ ), which meant that there was no relationship between the two variables. Additionally, the results of the analysis of the education level variable (with the occurrence of being underweight calculated using the chi-square test) indicated that the  $p$ -value=0.04 ( $p<0.05$ ), suggesting a relationship between the two variables.

## DISCUSSION

Assessing a person's nutritional status is one way of fulfilling the nutritional needs of the body. A nutritional status assessment can be performed by using various methods to obtain data that can help identify the population (or individual) at risk of being underweight or overweight. A nutritional status assessment can be classified into a direct and an indirect assessment. Direct assessment includes anthropometry, biochemistry, clinical, and biophysical assessments. Indirect assessment includes conducting surveys of food consumption, measuring vital statistics, and considering the ecological factors. A simple tool that can be used to measure the nutritional status of adults, especially those focusing on weight loss, is measuring the BMI. BMI is a tool or a simple technique to monitor the nutritional status of adults, and this tool particularly helps underweight and overweight individuals (Suhaimi, 2019).

The nutritional status plays an important role in determining a person's health level. Nutritional status, in addition to directly affecting the immune system, also plays a role in the healing of diseases, including healing patients suffering from TB. Being underweight is a condition of nutritional deficiency, when a person's BMI is under  $18.50 \text{ kg/m}^2$ . A person may be underweight because of an imbalance between food availability and the body's nutritional needs. TB patients are often underweight, and this may affect the body's immunity and ability to seek effective TB treatment. Several studies have reported TB patients to be underweight. Patients who are malnourished need more time to heal and are at a greater risk of secondary infection. The result of this study revealed a relationship between nutritional deficiency and inadequate TB treatment. Treatment inadequacy affects adaptive immune responses that are carried out by white blood cells (Sinha et al., 2019).

The results of this study indicated that 51.22% of the respondents were underweight. These findings were in line with a research conducted in Ethiopia by Gashaw et al (2019). These similarities could probably have occurred because of a similar nature of quality of care provided. Another research conducted in Taipei (Taiwan) by Yen et al (2016) revealed that nutritional deficiencies in TB patients were less compared to nutritional deficiencies of respondents included in this study. This difference could be attributed to the diet, lifestyle, socioeconomic conditions, and the time period of data collection.

Most of the TB patients in this research were males. This finding was supported by a previous study conducted in the Sehat Terpadu Hospital in Bogor, which suggested that 64.30% of the TB patients were males (Wulandari, 2015). The high incidence of disease infections in men was because men and women respond differently to the same illness. Behavioral and biological differences between men and women can lead to differences in disease prevalence, developmental rates, and treatment outcomes (Carrero, Hecking, Chesnaye, & Jager, 2018).

Most of the TB patients in this research were elderly (from 46 to 55 years). This finding was supported by a previous study on TB patients, which revealed that most of the TB patients were in the age group of 46–55 years (Hutama et al., 2019). Increased chances of suffering from TB could also be due to age; the greater the age, the higher the risk of TB transmission. Old age is associated with a poor immune response (Dewanty, Haryanti, & Kurniawan, 2016).

Most of the TB patients in this research were already married. This data was in accordance with a previous research conducted by Hadifah, Amri Manik, Zulhaida, & Wilya (2017) at the PHC in Pidie district, Aceh province. The results indicated that 80% of the respondents were married.

Most of the TB patients had a low income. Thus, these people were unable to meet the nutritional needs. In fact, TB treatment requires having a balanced meal to aid the healing process. TB patients who had a low income tended to be underweight compared to those who had a high income. People who had a low income were 0.43 times more likely to be underweight compared to respondents who had a high income. A previous study conducted in Medan (Indonesia) revealed results that were in agreement with the results of this study. There was a significant relationship

between income and TB patients being underweight (Sari, Sarumpaet, & Siregar, 2017).

**Table 1**  
Distribution of Characteristics of TB Patients

Variable	n	%
<b>Sex</b>		
Female	20	48.78
Male	21	51.22
<b>Age (Years)</b>		
15-25	8	19.51
26-35	6	14.63
36-45	7	17.07
46-55	11	26.83
>55	9	21.95
<b>Marital Status</b>		
Non Married	19	46.34
Married	22	53.66
<b>Treatment Phase</b>		
Intensive	10	24.39
Continuance	31	75.61
<b>Educational Level</b>		
Low	26	63.41
High	15	36.59
<b>Occupational Status</b>		
Unemployed	32	78.05
Employed	9	21.95
<b>Income</b>		
Low	37	90.24
High	4	9.76
<b>Underweight</b>		
Yes	21	51.22
No	20	48.78
Total	41	100.00

**Table 2**  
Chi-Square Test Results for the Treatment the Relationship between the Socio-economic Factors and The Incidence of being Underweight

Variable	Underweight				Total		p	PR (95% CI)
	Yes		No					
	n	%	n	%	n	%		
<b>Treatment Phase</b>								
Intensive	9	90.00	1	10.00	10	24.39	0.01	2.33 (1.43–3.79)
Continuance	12	38.71	19	61.29	31	75.61		
<b>Income</b>								
Low	21	56.76	16	43.24	37	90.24	0.04	0.43 (0.30–0.63)
High	0	0.00	4	100.00	4	9.76		
<b>Educational Level</b>								
Low	17	65.38	9	34.62	26	63.41	0.04	0.41 (0.17–0.99)
High	4	26.67	11	73.33	15	36.59		
<b>Occupational status</b>								
Unemployed	19	59.38	13	40.63	32	78.05	0.07	2.67 (0.76–9.38)
Employed	2	22.22	7	77.78	9	21.95		
Total	21	51.22	20	48.78	41	100.00		

Families who had a low per capita income were 2.70 times more likely to suffer malnutrition (Sarkar, Baidya, & Bhattacharya, 2018). When a person with low income suffers from TB, it adds to their financial burden. This can result in the person consuming less food and facing the risk of malnourishment and, thus, being underweight (Mokti, Isa, Manaf, Hayati, & Rahim, 2020). The food purchasing power (in this case, nutritious food) is affected by family income. Determining the variety and type of food to be purchased depends on the size of the income. Low income is a factor related to an individual's poor nutritional status (Afifah, 2019).

Education is another basic need to attain good nutrition. The level of education is related to the selection of nutritious foods, ease of access to information, and receiving information about healthy nutrition. Low education level is significantly related to being underweight. People with a low educational status were 0.41 times more likely to suffer from being underweight compared to a person with a high educational status. In most cases, an individual who has low education is underweight, while someone who has attained a high level of education has a normal weight. A previous study conducted by Gupta et al (2018) (whose findings were in line with the results of this study) revealed that a low level of education presented a significant risk for being underweight; 94% of the people who were underweight were in junior high school and below. Another study conducted by Dodor (2008) in Ghana indicated that there was a significant relationship between education and being underweight.

The nutritional status of most of the TB patients improved as long as they were undergoing TB treatment. An increase in BMI could be due to a lowering of infection. The treatment phase was significantly related to being underweight; people in the intensive treatment phase were 2.33 times more likely to suffer from being underweight compared to people who were in the continuance treatment phase. These findings were in line with a study conducted by Kusumaningroh, Susilowati, & Wulandari (2018) in Surakarta (Indonesia), which suggested that there was a significant relationship between the treatment phase and TB patients being underweight. It was also observed that patients who had inadequate nutrition were more commonly found in the initial treatment phase; some respondents having a normal nutritional status were found in the advanced treatment phase. Some other studies conducted in India have

revealed that the duration of treatment had a significant link with the patients' nutritional status (Sarkar, Baidya, & Bhattacharya, 2018). These findings were in line with a study conducted by Dodor (2008) in Ghana with 570 adult pulmonary TB patients. The results indicated that the average BMI at the time of performing the initial diagnosis was 18.70 kg/m<sup>2</sup>. After undergoing an intensive phase of treatment for two months, the average BMI of the patients increased to 19.50 kg/m<sup>2</sup>. At the end of the intensive phase, 60% of the patients attained a normal nutritional status.

The results of the relation test between occupation and underweight status of TB patients indicated that there was no relationship. Patients faced the same risk of malnourishment, regardless of whether they were employed or unemployed. A previous study conducted in India suggested that there was no significant relationship between the occupational status and a person being underweight (Sarkar, Baidya, & Bhattacharya, 2018). Other research studies have produced similar findings as this research and have indicated that there is no significant relationship between the occupational status and the incidence of being underweight (Dargie, Tesfaye, & Worku, 2016). A previous study conducted in Nepal revealed a different result from this research and suggested that the occupational status and the frequency with which food was being supplied were significantly linked to the calorie supply in TB patients. The results also indicated that one third of the TB patients in their early phases of treatment suffered from being underweight. Moreover, the amount of calories, frequency of food consumption, type of TB, and previous nutritional status were significantly related to the current nutritional status of TB patients. The results also suggested that the occupational status was related to the poor nutrition status in TB patients (Gurung, Bhatt, Karmacharya, & Yadav, 2018). Unemployed TB patients were 1,286 more likely to have a poor nutritional status. This could be due to the fact that an increased level of activity at home causes them need to consume more food, but it is not supported by sufficient food availability (Kurnia, Masrurroh, & Melizza, 2020). Adult TB patients were estimated to lose approximately 3–4 months of their working time, resulting in a yearly loss of 20–30% of their domestic income. This phenomenon may result in these individuals reducing their consumption of high-quality food (Kusnanto, Pradanie, & Karima, 2016). Another study conducted by Noviyani (2015) revealed that working tends to improve social relationships and

influences working individuals' personal knowledge compared to people who are unemployed. This makes it easier for employed people to receive information regarding proper nutritional needs. This study revealed that the occupational status was not the main factor affecting individual nutritional status. Other factors related to nutritional status include marriage status, monthly income, and avoiding specific food items.

The results of this study indicated several factors related to nutritional status, which can be used as a predictor to prevent the state of being underweight. In this way, nutritional improvement efforts can be made to increase the success of TB control programs. People with a poor nutritional status usually experience treatment failures compared to patients who have a good nutritional status (Samuel et al., 2016).

#### Research Limitation

There were time limitations in data collection, so only a small number of respondents' data was collected.

#### CONCLUSION

The majority of the TB patients in this research were underweight. The condition of being underweight and having TB is significantly related to the treatment phase, education level, and income. It is recommended for the PHC of Perak Timur to regularly monitor the BMI so that the patients who are severely underweight can be provided with nutritional counseling and receive supplementary feeding.

#### CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

#### AUTHOR CONTRIBUTION

All authors actively participated in this study and were responsible for content writing, preparing and writing the first draft, selecting the research design, performing data analysis, and revising this article. WWF wrote the first draft, was involved in the preparation phase, selected the research design, worked on the software, was involved in data analysis, and the revision of this article. DPA was responsible for translating, editing and revising this article.

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