



The Correlation between Body Mass Index and Albumin Level with Sputum Conversion in AFB-Positive Pulmonary TB Patients in Primary Health Center in Medan, Indonesia

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Abstract. Tuberculosis (TB) remains a major public issue in Indonesia including in North Sumatra province. Despite reported good efficacy of TB treatment in the region, the success of treatment depends on many factors including nutritional status. This study aims to determine the relationship between Body Mass Index and Albumin level with sputum conversion in AFB-positive pulmonary TB patients. The study was done in two primary health centres in Medan between October and November 2018. A total of 39 newly diagnosed TB patients with confirmed AFB-positive were included in the study. Participants received TB treatment according to the national guidelines. The proportion of participants with below normal, normal and above normal BMI status were 13 (33.3%), 21 (53.9%) and 5 (12.8%), respectively. Level of albumin was determined as normal in 25 participants (64.1%), and the remaining as low. Normal BMI status was significantly associated with increased albumin level ($P < 0.05$). At 2 months follow-up, the sputum conversion was observed in 24 individuals (61.5%), and the conversion was significantly associated with normal BMI and/or normal albumin level ($P < 0.05$). We concluded that nutritional status is an important factor in the success of TB treatment.

Keyword: Tuberculosis, Body Mass Index, Albumin, Sputum Conversion, Indonesia

Abstrak. Tuberkulosis (TB) tetap menjadi masalah publik utama di Indonesia termasuk di provinsi Sumatera Utara. Meskipun dilaporkan kemanjuran pengobatan TB yang baik di wilayah tersebut, keberhasilan pengobatan tergantung pada banyak faktor termasuk status gizi. Penelitian ini bertujuan untuk mengetahui hubungan antara Indeks Massa Tubuh dan kadar Albumin dengan konversi dahak pada pasien TB paru positif-AFB. Penelitian ini dilakukan di dua pusat kesehatan primer di Medan antara bulan Oktober dan November 2018. Sebanyak 39 pasien TB yang baru didiagnosis dengan positif AFB positif dimasukkan dalam penelitian ini. Peserta menerima pengobatan TB sesuai dengan pedoman nasional. Proporsi peserta dengan status BMI di bawah normal, normal dan di atas normal adalah 13 (33,3%), 21 (53,9%), dan 5 (12,8%), masing-masing. Tingkat albumin ditentukan secara normal pada 25 peserta (64,1%), dan sisanya rendah. Status BMI normal secara signifikan dikaitkan dengan peningkatan kadar albumin ($P < 0,05$). Pada 2 bulan follow-up, konversi sputum diamati pada 24 orang (61,5%), dan konversi

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secara signifikan terkait dengan BMI normal dan / atau tingkat albumin normal ($P < 0,05$). Kami menyimpulkan bahwa status gizi adalah faktor penting dalam keberhasilan pengobatan TB.

Kata Kunci: Tuberkulosis, Indeks Massa Tubuh, Albumin, Konversi Sputum, Indonesia

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1 Introduction

Tuberculosis (TB) is a lungs disease cause by Mycobacterium tuberculosis bacillus (Kemenkes, 2014). The source of transmission is from AFB-positive pulmonary TB patients. When coughing or sneezing, the patients spread germs in the air through sputum (droplet nuclei). One cough produces around 3000 sputum splash. Thus, TB is included in 10 deadly diseases in the world. According to the data from North Sumatera provincial health office in 2016, the new cases of TB reached 23,097 numbers with 5,714 death rates. Medan is the biggest TB infected area compared to other places in North Sumatera. Since 2010, TB cases in Medan experiences a continuous increase. In 2010, there were approximately 1,425 new cases, with 38,615 Case Detection Rate (CDR). However, there were 1,425 cure rate in the same year.

Sputum conversion is a strong predictor and the beginning of success in TB therapy. It is determined by the discovery of mycobacteria in sputum culture taken on the second month of treatment. Sputum conversion on TB cases is formed in the end of first month (60 – 80%), the end of second month (95%), while 9% do not convert (Tabrani, 2007). The success factors in intensive phase of treatment is patients' life and work, the access to health service, food supply and behaviors (the obedience in medicine consumption, alcohol consumption, smoking habit and nutritional status) (Lonnroth, 2011).

One of the most efficient and economical measurement to describe nutritional status is Body Mass Index (BMI). The research from Tama et al (2016) shows that AFB-positive pulmonary TB patients with BMI < 18.5 kg/m² possess higher cumulative probability of conversion failure compared to those patients with BMI > 18.5 kg/m². The speed of sputum conversion (hazard rate) on patients with BMI < 18.5 kg/m² is lower compared too patients with BMI > 18.5 kg/m². Sputum conversion will take longer time if the increase of patients' body weight at the end of intensive phase is < 1 kg. Therefore, TB patients with low BMI at the beginning of treatment should be monitored for their nutritional improvement. This nutritional improvement must be the focus of attention during treatment, considering the increase of body weight in the last intensive phase is a vital contribution to the success of sputum conversion.

Albumin is one of the indicators of nutritional status, both at the beginning of malnutrition case or during improvement (Sridevi, 2015). To TB patients, albumin in serum will experience a significant decline, assumedly because nutrition factors (low food supply, anorexia, catabolism increase), enteropathy and acute phase of protein reaction (Prastowo et al, 2016). The decline of

total protein and albumin are oftenly caused by the decrease of appetite, malnutrition and malabsorption of TB patients (Memon, 2014). According to the research by Simbolon et al (2016), it is found that there are 69.76% TB patients with albumin content < 3.5 g/dL, and the rest 30.24% possess albumin $\geq 3,5$ g/dL. This result indicates that there more patients with albumin $<3,5$ g/dL, which is caused by chronic inflammation, where albumin production decrease while albumin damage keep increasing until a situation called hypoalbuminemia or the deficiency of albumin in blood (Martina, 2012).

2 Research Method

The research was conducted in quantitative method using the correlation study design and cross sectional approach. The research took place in Amplas and Teladan health center medan since October 01, 2018 until November 30, 2018. The population of this research is the new TB patients with AFB-positive pulmonary at Teladan and Puskesmas health center Medan. Samples are all AFB-positive pulmonary patients who meet all the inclusive and exclusive criteria. Inclusive criteria include patients < 16 years old; diagnosed as the new AFB-positive pulmonary patients; New TB patients with regular treatment at Teladan and Amplas health center; Patients agree to participate in the research and fill the informed consent. The exclusive criteria include pregnant women; new TB patients followed by DM or HIV; TB category II. Total samples are 39 patients.

The sputum examination on patients was conducted in the laboratory of Amplas and Teladan health center by Ziehl Neelsen method. The sputum collection was done three times, and marked with patients' names. Anti-Tuberculosis medicine used were Rifampicin, INH, Pirazinamide, Streptomycin, Ethambutol with the dosage adjusted to patients' weight (Kemenkes, 2014). The AFB-positive

3 Results

3.1 Characteristics of Respondents

From 39 respondents, there were 22 males (56.41%) and 17 females (43.59%). Their ages range from 18 – 70 years old with average 43.23 ± 15.45 . There were 28 TB patients at productive age (16 – 55 years old). Respondents data based on education background were divided into 27 High School graduates (69.23%) and 28 working people (71.79%).

Table 1 Characteristics of Respondents

Characteristics	n	%	Average ± SD
Gender:			
Male	22	56.41	
Female	17	43.59	
Age:			43.23±15.45
16 – 35 years old	13	33.33	
36 - 55 years old	15	38.46	
56 – 75 years old	11	28.21	
Education:			
Elementary	4	10.26	
Junior High School	7	17.95	
Senior High School	27	69.23	
University	1	2.56	
Work Status:			
Working	34	87.18	
Not Working	5	12.82	

3.2 Body Mass Indeks (BMI)

The Body Mass Index of respondents was ranging between 15.14 – 32.19 with average 20.82 ±4.05. From the table, it is seen that from 39 respondents, there were 13 patients (33.33%) with BMI < 18.5 kg/m² (skinny), 21 patients (53.85%) with BMI < 18,5 – 25 kg/m² (normal) and 5 patients (12.82%) with BMI > 25 kg/m² (fat). This result produced the average BMI of most respondents were > 18,5- 25 kg/m² (normal).

Table 2 Sample Distribution Based on BMI

Characteristics	N	%	Average ± SD
Body Mass Index (kg/m ²)			20.82 ± 4.05
Skinny (< 18,5 kg/m ²)	13	33.33	
Normal (>18,5-25kg/m ²)	21	53.85	
Fat (> 25 kg/m ²)	5	12.82	
Total	39	100.00	

3.3 Albumin Level

The albumin level in respondents was ranging between 3.10 g/dL – 4.50 g/dL with average 3.73 ± 0.39. From the table, it is seen that from 39 respondents, there were 25 patients (64.10%) possess albumin ≥ 3,5 g/dL and 14 patients (35.90%) possess < 3,5 g/dL. This result shows that there were more respondents with albumin ≥ 3.5 g/dL.

Table 3 Sample Distribution Based on Albumin Content

Characteristics	n	%	Average ± SD
Albumin content (g/dL)			3.73 ± 0.39
≥ 3.5 g/dL	25	64.10	
< 3.5 g/dL	14	35.90	
Total	39	100.00	

3.4 AFB-positive pulmonary Sputum Conversion Results

From the 39 respondents with AFB-positive pulmonary TB diagnoses, 24 patients (61.54%) experienced the sputum conversion at the end of intensive phase treatment, and 15 patients (38.46%) did not experience sputum conversion. This result shows that there were more respondents experience the AFB-positive pulmonary sputum conversion at the end of intensive phase treatment.

Table 4 AFB-positive pulmonary Sputum Conversion Results

Characteristics	n	%
Conversion	24	61.54
Non-Conversion	15	38.46
Total	39	100.00

3.5 The Correlations Between BMI and Sputum Conversion

From the cross-test results (Table 5), it is notable that from 24 new TB patients, only 4 experiences sputum conversion (16.67%) with BMI skinny, 16 patients (66.67%) with BMI fat. From 15 patients, 9 did not experience sputum conversion with BMI skinny, 5 patients (33.33%) with BMI normal and 1 patient (6.67%) with BMI fat. From chi square test result, it is seen that p value at 0.02 means that there was significant correlations between Body Mass Index with sputum conversion.

Table 5 The Cross Tabulation of BMI and Sputum Conversion

Sputum Conversion	Body Mass Index (n/%)						Total	p value	
	Skiny	Normal	Fat	Conversion	Non-Conversion	Total			
Conversion	4	16	4	16.67	66.67	16.67	24	61.54	0.020
Non Conversion	9	5	1	60.00	33.33	6.67	15	38.46	
Total	11	21	5	33.33	53.85	12.82	39	100.00	

3.6 The Correlations Between Albumin Level and Sputum Conversion

From the cross tabulation (Table 6), it is notable that from 24 new TB patients, there were 20 experienced AFB-positive pulmonary sputum conversion (83.33%) with albumin level $\geq 3,5$ g/dL and 4 patients (16.67%) with albumin level $<3,5$ g/dL. From 15 patients, there were 5 patients (33.33%) did not possess albumin $\geq 3,5$ g/dL and 10 patients (66.67%) possess albumin $< 3,5$ g/dL. According to the chi square test results, p value was 0.020, which means that there were significant correlations between albumin level and sputum conversion.

Table 6 Cross Tabulation of Albumin Level and Sputum Conversion

Sputum Conversion	Albumin Level (n/%)				Total	p value	
	≥ 3.5 g/dL	< 3.5 g/Dl					
Conversion	20	83.33	4	16.67	24	61.54	0.002
Non Conversion	5	33.33	10	66.67	15	38.46	
Total	25	64.10	14	35.90	39	100.00	

3.7 The Correlations Between Body Mass Index and Albumin Level

From the cross-test result (Table 7), it is seen that from 13 new TB patients with BMI skinny, there were 2 patients (15.38%) with albumin level $\geq 3,5$ g/dL and 11 patients (84.62%) with albumin level $< 3,5$ g/dL. From 21 new TB patients with BMI normal, there were 18 patients (85.71%) with albumin level $\geq 3,5$ g/dL and 3 patients (14.29%) with albumin level $< 3,5$ g/dL. From 5 new TB patients with BMI fat, there were 5 patients (100%) possess albumin level $\geq 3,5$ g/dL. From this person correlation test, p value was 0.001, showing that there were significant correlations between Body Mass Index with albumin level. This concludes that if Body Mass Index increases, the albumin level will follow.

Table 7 Cross Tabulation of BMI and Albumin Level

BMI	Albumin Level, (n/%)				Total	p value	
	≥ 3.5 g/dL	< 3.5 g/dL					
Skinny	2	(15.38)	11	(84.62)	13	(33.33)	0.001
Normal	18	(65.71)	3	(14.29)	21	(53.85)	
Fat	5	(100.00)	0	(0)	5	(12.82)	
Total	25	(64.10)	14	(35.90)	39	(100.00)	

4 Discussion

4.1 Characteristics of Respondents

The amount of new TB patients at Medan Health Center consists of 22 males (56.41%) and 17 females (43.59%). This shows that there are more male TB patients. This result is in line with the research of Puspita et al (2016) who found 48 males (67.60%) out of 71 new patients at Lungs Polyclinic, Arifin Achmad General Hospital Pekanbaru. In addition, the data from the Ministry of Health shows that the cases of TB happen more to males, totally reaching 48 people or 67.60%. While the data from Ministry of Health in 2013 shows that TB cases happen more often to male because of the different social interaction between males and females, smoking habit, alcohol consumption until the decline of immune system and exposed to TB bacteria, causing the emergence of syndromes and finally positive for TB.

The majority of new TB patients at Medan health center are at productive ages (16 – 55 years old or 71.79%). This result is in accordance with the study by Puspita et al (2016) who stated that TB patients are mostly at their productive ages. The National Ministry of Health in 2007 also stated in the national guidance of Tuberculosis prevention that 75% individuals in productive age (15 - 50 years old) are infected by Tuberculosis bacteria. One of the affecting

factors is because they spend more time outdoor for work and social interaction, so the risk of contracting with TB sufferers is higher.

The majority of new TB patients at Medan health centre are high school graduates, reaching 27 number of patients or 69.23%. This study is in accordance with Puspita et al (2016) who found that the distribution of TB patients at Lungs Polyclinic, Arifin Achmad General Hospital Pekanbaru based on education level was mostly the high school graduates (35 patients or 49.3%). Afterwards, from the research by Andhika at West Bandung in 2012, it is found that 25 patients or 59.5% were High School graduates. However, this study was contradicting with Notoatmojo's theory (2007) who stated that education impacted the reception of health information. Through education, an individual is able to better understand his illness. Education level holds an important role in public health. Higher education level allows higher ability to receive information about health.

The amounts of working patients are 35 people (87.18%) and the non-working patients are 5 people (12.82%). This result indicates that the majority new TB patients at Medan health center are workers. This is possible considering their workplaces are vulnerable to TB transmission. Some occupations allow high risk of TB transmission and growth, for example the factory workers. The research of Tama et al (2016) also shows that majority of new AFB-positive pulmonary TB patients are workers, reaching 79 number of patients or 65.8%. The research of Putri et al (2016) conducted at Arifin Achmad General Hospital Pekanbaru on January – September 2015 shows that there are 75% TB patients are workers. In accordance to Haryono's study (2012) who stated that one of the affecting factors of mycobacterium tuberculosis exposure is because the frequent human interaction which impacts on the transmission level. The other possibility is that the workers demonstrate higher mobility than the non-workers, causing higher exposure to TB bacteria. The smoking habit and work risk from air pollutants from the outdoor, especially from the industrial sectors also increase the risk of infection.

4.2 Body Mass Index

The results of cross tabulation shows that the majority of 39 TB patients from Medan health center possess BMI 18.5 – 25 kg/m², reaching 21 people or 53.85%. This result is in accordance with the study of Puspita et al (2016) who found that the nutritional status of TB patients based on the BMI index at Lungs Polyclinic Arifin Achmad General Hospital Pekanbaru shows 33 patients (46.5%) with normal status, 31 patients (43.7%) were underweight, 4 patients (5.6%) were overweight and 3 patients (4.2%) were obese. The study from Suliyanti about the description about nutritional status and protein consumption rate of TB patients at Medan Johor health center in 2013 shows that there were 51.7% patients had normal nutritional status. The research of Wokas et al (2015) also found there more patients with BMI > 18.5 – 25 at RSUP Prof. Dr. R. D. Kandou General Hospital, reaching 48.5% in total.

4.3 Albumin Level

The result of this study shows that from 39 patients, there were 25 patients (64.10%) possessed albumin level $\geq 3,5$ g/dL and 14 patients (35.90%) possessed albumin level $< 3,5$ g/dL. This result shows that there are more patients at Medan health center possess albumin level $\geq 3,5$ g/dL. This result is in accordance with the study from Wokas et al (2015) who found that there were more TB patients possessed albumin level $\geq 3,5$ g/dL. However, in contrast the study from Simbolon et al (2016) found that there were more TB patients possessed albumin level $< 3,5$ g/dL. The differences of this results is caused by the difference of sample numbers or the possibility that patients had had albumin level $\geq 3,5$ g/dL at the early stage of TB infection.

4.4 Sputum Conversion

From the study result, it is found that majority of new AFB-positive pulmonary TB patients at Amplas and Teladan Health Center Medan experienced sputum conversion after two months. From 39 patients, there were 24 people (61.54%) experienced the transformation of AFB-positive pulmonary to AFB-negative pulmonary, while there were 15 people (38.46%) did not experience sputum conversion. This result indicated that there were more patients experience sputum conversion after to months, reaching 61.54%. It is in accordance with the study from Aliyah et al (2016) who found that there were 55 subjects (62.5%) AFB-positive pulmonary sputum conversion in intensive phase experienced the sputum conversion, while 33 subjects (37.5%) did not convert. The research from Tama et al (2016) showed the cumulative probability of conversion failure (survival rate) of new TB patients were at 17% and 9.2% patients experienced the conversion failure. Moreover, the study from Intiyati et al (2012) showed the healing rate of AFB-positive pulmonary TB patients according to the sputum examination was reaching 27 patients (57%), while AFB-negative pulmonary TB patients 20 patients (43%).

The conversion number is one indicator to measure the development and the success of TB prevention. This indicator is used to quickly obtain the treatment results and to monitor the medicine consumption (Depkes RI, 2007). To measure the success of TB treatment, the examination of sputum was done at the end of treatment. The conversion occurred as the effect of medicine, which is the success predictor of TB medication (PPTI, 2010). Although there were more conversion success in this research, the result is not compatible with the conversion target by WHO, which is 85%. The cure process is different on each patient depending on the body response to medication.

The good response was determined by the transformation of sputum conversion after 30 days of adequate treatment, but bad responses happen when sputum conversion occurred more than 30 days (Khairil et al, 2017). There were a few factors causing the failure of sputum conversion at intensive phase: the lack of supervision at intensive phase, the poor obedience on medicine

consumption, the incompatible dose of medicine, comorbidities and the resistance towards double medication (Liu, 2008).

The failure factors of AFB-positive pulmonary TB patients at the end of intensive phase in this research did not reach 85% as targeted by the government was caused by the positivity level of sputum at the beginning of medication, low BMI, and albumin level < 3.5 g/dL. From 15 new TB patients with no sputum conversion at the end of intensive phase, there were 8 patients with AFB-positive pulmonary (2+), 3 patients with AFB-positive pulmonary (3) and 4 patients with AFB-positive pulmonary (1+). This research shows the majority of patients with high positivity level did not experience sputum conversion. The result was in accordance to the study from Tama et al (2016) who stated that the higher the sputum positivity at the beginning of medication, the higher the cumulative possibility of conversion failure (survival rate). Patients with 3+ sputum positivity level possess the highest survival rate, followed by 2+, 1+ and scanty (1-9 stems).

The majority of new TB patients with no sputum conversion in this study possessed BMI $< 18,5$ kg/m². The conversion failure occurred to skinny BMI was caused by the malabsorption of anti-tuberculosis medicine. The low nutritional status affected the decline of medicine concentration in blood plasma and increased the function of kidney for waste disposal. As the results, the medication was not effective that it increased the risk of medication failure, even worse, it might increase the risk of recurrence (Bento et al, 2010 in Tama et al, 2016). The last factor of conversion failure was the new TB patients with albumin level < 3.5 g/dL. The decline of albumin level caused the declining bonds between albumin and anti-tuberculosis medicine, which at the end affected the healing process (Ascenzi et al, 2010 in Wijaya, 2015).

4.5 The Correlation Between Body Mass Index and Albumin Level

From Pearson correlation test, it was found that p value = $0.001 < p=0,05$, which indicates the positive and significant correlation between Body Mass Index and albumin level. This result proved that every time BMI increased, albumin level followed. This is in accordance with the research from Wokas et al (2015) who found that albumin level increased along with BMI, making it obvious that BMI and albumin are affecting each other.

Furthermore, the research from Simbolon et al (2016) also found the close connection of BMI and albumin level on TB patients, where the decline of BMI affected the albumin level. The increase of food supply will increase the albumin level (Prastowo et al, 2016). This result is in accordance with the theory stating albumin is the highest protein in blood plasma. When infections occur and cause the decline of blood plasma, the injury or stress caused the increase of metabolism necessity to repair the damaged tissues and to neutralized the free radical inside the body. The decline of protein value and albumin level were mostly caused by the decreased appetite, malnutrition and malabsorption on TB patients (Memon, 2014).

4.6 The Correlation Between BMI and Sputum Conversion

According to the study result, there were 16 out of 24 TB patients (66.67%) with BMI > 18,5 – 25 kg/m² experienced sputum conversion, while 9 out of 15 patients (60%) with BMI < 18,5 kg/m² did not experience sputum conversion. This result obviously shows that new TB patients with BMI < 18,5 kg/m² mostly did not experience sputum conversion. While in contrast new TB patients with BMI > 18,5 – 25 kg/m² experienced it. This indicates that one of the most affecting factors in the success of sputum conversion is the patients' nutritional status when they were first diagnosed with TB. This study result is in accordance to the research of Tama et al (2016) who stated that AFB-positive pulmonary TB patients with BMI < 18,5 require longer time to reach the conversion and risk failure for 1.32 – 8.86 times compared to the patients with BMI > 18.5.

The study results from Dillon, 1195 in Intiyati et al (2012) stated that the malnutrition will cause the obstruction of antibody and lymphocyte production, and finally, delay in the healing process. This result is in accordance to the study from Amaliah (2012) who found that TB patients with low nutritional status will have 3.5 times higher failure risk compared to those with normal nutritional status. Moreover, the study from Khariroh (2006) shows that TB patients with skinny status had 8.861 times higher failure risk of conversion compared to those with normal status, while the very skinny patients had 30.918 higher risk compared to those with normal status.

From the chi square results, it was found that p value was $0,020 < (p= 0,05)$, which means there was correlation between Body Mass Index and sputum conversion on TB patients at Teladan and Amplas Health Center Medan. This result is in accordance to the study from Intiyani et al (2012) who found that there was correlation between BMI and the cure of patients at Lungs Polyclinic of Sidoarjo General Hospital. In line with Tama et al (2016) who stated that patients' nutritional status was the predictor of sputum conversion. Patients with good nutritional status will be able to develop their immune response and speed up the healing process, while patients with bad nutritional status, will risk the healing failure (Isselbacher, et al. 1999).

4.7 The Correlation Between Albumin Level and Sputum Conversion

From the cross tabulation, it was found that 20 out of 25 patients (80%) possessed albumin level $\geq 3,5$ g/dL and 5 patients (20%) did not experience conversion. While 4 out of 14 patients (28.57%) possessed albumin level < 3,5 g/dL and 10 patients (71.43%) did not experience conversion. This result shows that the majority of TB patients with albumin level $\geq 3,5$ g/dL will experience sputum conversion while those with albumin level < 3,5 g/dL mostly will not experience it. This result is in accordance to the study from Khairil et al (2017) who found that the majority (54.20%) of TB patients at the TB public service at dr. Zainoel Abidin General Hospital Banda Aceh with declining albumin experienced poor clinical healing. Furthermore, the study from Kulsum et al (2017) found that the failure risk factor of conversion was the low

albumin level. Albumin level as the protective factor will minimize the failure of sputum conversion. Albumin is the media of medicine transportation like riphampycin, which is TB therapy medicine. Albumin is also plasma protein and TB medicine is bound to plasma protein. Anti-TB medicine is metabolized in liver and excreted with bilirubin by bile (mercer et al, 2007).

From the chi square statistical test, it is known that p value was 0.002, which means there is significant correlation between albumin and sputum conversion. This result is supported by the research from Matos and Lemos (2006) who stated that albumin gave significant impacts to sputum conversion, making it vital to repair the nutritional status on TB patients during the medication. Sputum conversion on TB patients was influenced by C-Reaktif Protein (CRP) and albumin level (Aceh Province Health Profile, 2012). The study from Kulsum et al (2017) found that albumin in blood acted as the protective factor to decrease the failure of sputum conversion. Furthermore, the study from Khairil et al (2017) found that the albumin level affected the clinical healing at TB public service at dr. Zainoel Abidin General Hospital Banda Aceh. Riphampycin as TB medicine was strongly bound to albumin. Riphampycin isoniazid was another TB medicine which strongly bound to albumin. This strong-bonds aim to the increase the antimicrobial effects of anti-TB medicine to the decline of inflammatory cytokines and speed healing (Lassen et al, 2006). The decline of albumin will cause the decline of albumin bonds with anti-TB medicine causing the speed in TB healing (Ascenzi et al, 2010 in Wijaya, 2015).

5 Conclusion

1. Characteristics of respondents at Medan Health Center: Majority of respondents were males (22 people, 56.41%), in productive ages (16 – 55 years old) (28 people, 71.79%), were High School graduates (27 people, 69.23%) and were workers (34 people, 87.18%).
2. Majority of AFB-positive pulmonary TB patients at Medan health center are with BMI > 18,5- 25 kg/m² (normal) (21 people, 53.85%).
3. Majority of AFB-positive pulmonary TB patients at Medan health center possessed albumin level $\geq 3,5$ g/dL (25 people, 64.10%).
4. Majority of AFB-positive pulmonary TB patients at Medan health center experienced sputum conversion at the end of intensive phase medication (24 people, 61.54%).
5. There was significant correlation between Body Mass Index and albumin level on AFB-positive pulmonary TB patients at Medan health center.
6. There was significant correlation between Body Mass Index and sputum conversion on AFB-positive pulmonary TB patients at Medan health center.
7. There was significant correlation between albumin level and sputum conversion on AFB-positive pulmonary TB patients at Medan health center.

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