

## Research Article

## Relationship Between Time Term of Diabetes Mellitus, Age, And History of Lung TB Contact on The Event of Lung TB in Diabetes Mellitus Patients

Chyntia Destiany<sup>1</sup>, Andi Zulkifli<sup>1</sup> and Ridwan M.Thaha<sup>2</sup><sup>1</sup>Department of Epidemiology, Public Health Faculty, Hasanuddin University Indonesia<sup>2</sup>Department of Health Promotion, Public Health Faculty, Hasanuddin University Indonesia

\*Corresponding Author

Chyntia Destiany

**Abstract:** One of the goals of SDG's is a good health system where one of its goals is to end the epidemic of pulmonary tuberculosis (TB) called the "The End TB" program (WHO, 2016). But efforts to end the epidemic of pulmonary TB were exacerbated by the incidence of tuberculosis with diabetes mellitus (TB-DM). Diabetes Mellitus results in a weakened immune system so that sufferers are 3 times more likely to suffer active TB (Director General of Disease Control and Environmental Health, 2015). This type of research was observational analytic with case control design carried out in five health centers in Makassar City. With a sample of 90 people (45 cases and 45 controls), interviewed with a questionnaire. The case is patients with pulmonary tuberculosis smear (+) with a history of DM and control are patients with pulmonary TB smear (-) with a history of DM. Bivariate and multivariate data analysis was used to analyze potential risk factors for the incidence of pulmonary TB. Analysis of data using the 12th application. The results showed that significant risk factors for the incidence of pulmonary TB were a history of TB contact (OR = 8.894 CI 95%: 2,871-30,254) and duration of suffering from DM (OR = 12,363 95% CI: 4,134-38,084) while age is not a significant risk factor (OR = 1.681 95% CI: 0.549-5.3347). Efforts to control pulmonary TB are advised not only to focus on curative aspects but also through promotive and preventive efforts, especially to prevent people with DM from having risk factors such as TB contact history and duration of suffering from diabetes.

**Keywords:** Risk Factors, Lung Tuberculosis, Diabetes Mellitus, Case Control.

### INTRODUCTION

*Sustainable Development Goals* (SDG's) are the latest goals and indicators that are universally enforced that will frame every agenda and political policy until 2030. One of the goals (goals) of SDG's is a good health system where one of its goals is to end the pulmonary tuberculosis epidemic (TB) called the "The End TB" program (WHO, 2016). But efforts to end the epidemic of pulmonary TB were exacerbated by the incidence of tuberculosis with diabetes mellitus (TB-DM). Diabetes Mellitus results in a weakened immune system so that sufferers are 3 times more likely to suffer from active TB (General Director of Disease Control and Environmental Health, 2015).

TB-DM comorbidity is a double burden that has significant implications for public health. Because, the interaction between TB and DM causes treatment management at risk of failure compared to treatment in

non-DM cases or vice versa (Wang *et al.*, 2013). Diabetes Mellitus damages the innate and adaptive immune response so that it accelerates the proliferation of tuberculosis thereby increasing the risk of developing pulmonary tuberculosis (Narasimhan *et al.*, 2013).

Based on the *Global Report Tuberculosis report 2015*, it is estimated that TB cases are 10.4 million cases worldwide and the number of deaths due to TB is 1.4 million cases. In 2000-2015 the death rate from TB decreased by 22% but tuberculosis was still among the 10 highest causes of death in the world (WHO, 2016).

In Indonesia in 2015 the number of tuberculosis cases found was 330,729 cases, the number increased in 2016 as many as 351,893 cases (Health Ministry RI, 2017). The number of notifications of all tuberculosis cases in 2017 shows that South Sulawesi is

Quick Response Code



Journal homepage:

<http://www.easpublisher.com/easjpid/>

Article History

Received: 10.07.2019

Accepted: 15.07.2019

Published: 28.07.2019

Copyright © 2019: This is an open-access article distributed under the terms of the Creative Commons Attribution license which permits unrestricted use, distribution, and reproduction in any medium for non commercial use (NonCommercial, or CC-BY-NC) provided the original author and source are credited.

included in the top 10 highest tuberculosis case notification numbers with 197 cases per 100,000 population (Health Ministry RI, 2018). The number of notifications of all tuberculosis cases in 2017 shows that South Sulawesi is included in the top 10 highest tuberculosis case notification numbers with 197 cases per 100,000 population (( General Director of Disease Control and Environmental Health, 2017).

The risk of pulmonary tuberculosis smear (+) in people with diabetes mellitus tends to increase with increasing age. Systematic results of the review show that 22 studies reported that older age increases the risk of tuberculosis in people with diabetes mellitus (Workneh *et al.*, 2017). The results of the study are similar to a retrospective study in Brazil conducted by Gil-Santana *et al.* ( 2016) namely tuberculosis patients with a history of diabetes mellitus on average older than non-diabetic tuberculosis patients. Research by Syed Azhar Syed Sulaiman, *et al.* (2013) namely tuberculosis patients with a history of diabetes mellitus on average older than non-diabetic tuberculosis patients. Research.

History Contact with patients is considered a risk factor for the development of tuberculosis in patients with diabetes mellitus where frequent exposure or contact can cause transmission of tuberculosis (Workneh, Bjune and Yimer, 2017). Research conducted by (Webb *et al.*, 2009), showed that there was a significant relationship between the incidence of smear (+) pulmonary tuberculosis in patients with diabetes mellitus with a history of contact with tuberculosis ( $p = 0.0011$ ). People with diabetes mellitus are considered to have a risk of 3.61 times affected by tuberculosis if they have a history of contact with tuberculosis (Dewi *et al.*, 2017). Mycobacterium tuberculosis bacteria have very small particles, are aerobic in nature, are able to survive long in dry sputum, and are easily excreted through droplets through coughing, sneezing or while talking. So that frequent contact with tuberculosis sufferers has a high risk of infection (Butiop, Kandou and Palendeng, 2015).

Research conducted at the Surabaya pulmonary hospital showed that patients with diabetes mellitus with a disease duration of  $\geq 6$  months had a risk of 24,347 times with tuberculosis (Juwatiningsih, 2013). These results are in line with the research conducted by Amare *et al.* (2013) ie patients who have diabetes mellitus over 10 years have a higher proportion of tuberculosis than those who have a shorter duration of disease. The research added by Ababa also showed that patients who had diabetes more than 10 years had a risk of 8.95 times exposed to tuberculosis compared to those who had tuberculosis less than 5 years (95% CI; 2.1-30.3) (Tiroro, 2015).

Research conducted by Wijayanto (2013) reported that the duration of diabetes mellitus had a strong association with the occurrence of TB infection

in DM patients (OR 23.136 95% CI 4.6-11). Increased and uncontrolled glucose levels for a long time are considered as factors that increase the associated risk (Amare *et al.*, 2013). The purpose of this study was to determine the risk associated with the incidence of pulmonary TB in DM patients in Makassar City.

## METHODOLOGY

### Research Design

This study was an analytic observational study with a case control design (case control study). The study was conducted in 5 working areas of the Kassi Health Center, Bara-Baraya Health Center, Jongaya Health Center, Kaluku Bodoa Health Center and Mamajang Health Center, Makassar City, South Sulawesi Province.

### Population and Sample

The population in this study were patients aged  $\geq 15$  years who were diagnosed with or not suffering from AFB (+) pulmonary disease with a history of DM recorded in the TB register of the Kassi Health Center, Bara-Baraya Health Center, Jongaya Health Center, Kaluku Bodoa Health Center and Mamajang Health Center. The sample in this study consisted of a case group and a control group with a total of 90 samples (45 cases and 45 controls). Cases are all sufferers of pulmonary TB with AFB (+) with a history of DM and recorded in the TB register in the health center in 2018. Control is all patients with pulmonary TB with AFB (-) with a history of DM and recorded in the TB register of Community Health Centre (puskesmas) in the same period. Sampling in the case and control groups was carried out using non-probability sampling techniques, namely purposive sampling.

### Data collection

Data collection is done by collecting and interviewing. The types of data collected are primary data and secondary data. The primary data collection uses research instruments in the questionnaire used in interviews with respondents. Secondary data were obtained from the TB Health Department list, registering TB health centers in 2018.

The research questionnaire consisted of 10 parts, namely sections A to J. Sections A to C were used to obtain secondary data that provided information regarding the time of interview, location identity and identity of the respondent (including: category of respondent, name, gender, employment status, marital status, cellphone number, BTA examination result and BTA examination date), while section D to J is a question that provides information related to risk factors (variables studied).

### Data Analysis

Data were analyzed quantitatively using STATA 12. Univariate analysis was performed to describe the frequency distribution of each variable, both the dependent variable and the independent

variable by describing the characteristics of the respondents, sociodemographic characteristics and research variables. Bivariate analysis was conducted to

determine the relationship between the independent variables and the dependent variable.

**RESULTS**

**Table 1. Distribution of Respondents Based on Socio demographic Characteristics in Makassar City**

Characteristics	Case		Control	
	(n = 45)		(n = 45)	
	n	%	n	%
1. Age Group (Year)				
15-24	0	0,00	1	2,22
25-34	0	0,00	4	8,89
35-44	7	15,56	5	11,11
45-54	17	37,38	16	35,56
55-64	15	33,33	13	28,89
65-74	5	11,11	5	11,11
75-84	1	2,22	1	2,22
2. Sex				
Male	28	62,22	31	68,89
Female	17	37,78	14	31,11
3. Last Education				
Have no Education	3	6,67	0	0,00
Did not Graduate from Elementary School	4	8,89	0	0,00
Graduated from Elementary School	8	17,78	9	20,00
Junior School	5	11,11	8	17,78
High School	17	37,78	17	37,78
Higher Education	8	17,78	11	24,44
4. Marital Status				
Married	44	97,78	42	93,33
Not Maaried	1	2,22	3	6,67
5. Occupation				
Jobless	24	53,33	25	55,56
Civil Servant/Army/Police Officer	1	2,22	3	6,67
Privat Employees	5	11,11	5	11,11
Entrepreneur	15	33,33	10	22,22
Fishermen	0	0,00	2	4,44

Based on table 1. it can be seen that the age group, the highest number of respondents was in the age group of 45-54 years, cases (37.78%) and controls (35.56). According to male respondent sex, the highest number of respondents was in the case group (62.22%) and in the control group (68.89%). Based on marital status, more respondents were married, both in the case

group (97.78%) and the control group (93.33%). For the last education, most of the respondents had high school / equivalent education in the case group (37.78%) and controls (37.78%). Furthermore, based on the characteristics of the work, most of them do not work. in the case group (53.33%) and control (55.56%).

**Table 2. Distribution of Respondents Based on Research Variables in Makassar City**

Characteristics	Cases		Control	
	(n = 45)		(n = 45)	
	n	%	n	%
1. Age				
<46 Years Old	8	17,78	12	26,67
≥46 Years Old	37	82,22	33	73,33
2. Contact History				
Have	26	57,78	6	13,33
No	19	42,22	39	86,67
3. Duration of Suffering DM				
<5 tahun	9	20,00	34	75,56
≥5 tahun	36	80,00	11	24,44

Based on table 2, it can be seen that the respondents aged ≥46 years were mostly found in the

case group (82.22%) compared to the control group (73.33%). The proportion of respondents who had the

most TB contact history was found in the case group (57.78%) compared to the control group (13.33%). For the old variable suffering from DM the proportion of

respondents  $\geq 5$  years was the most in the case group (80.00%) compared to the control group (24.44%).

**Table 3. Large Independent Variable Risk Distribution Against the incidence of pulmonary TB in people with DM in the city of Makassar**

Independent Variable	Lungs TB Cases				Total	
	Kasus		Kontrol		OR	CI 95%
	n=45	%	n=45	%		
<b>Age</b>						
<46 Years Old	8	17,78	12	26,67	1,681	0,549-5,347
$\geq 46$ Years Old	37	82,22	33	73,33		
<b>Contact History</b>						
Have	26	57,78	6	13,33	2,736	1,070-7,064
No	19	42,22	39	86,67		
<b>Duration of Suffering DM</b>						
<5 tahun	9	20,00	34	75,56	12,363	4,134-38,084
$\geq 5$ tahun	36	80,00	11	24,44		

Based on table 3, it can be seen that the age variable obtained the value of Odds Ratio (OR) = 1.681 (95% CI: 0.549-5,347) with a lower limit and upper limit (LL-UL) value including 1. This means that age is a risk factor which was not statistically significant for the incidence of pulmonary TB in DM patients. The results of the study for TB contact history variables were OR = 8.894 (95% CI: 2,871-30,254) with lower limit and upper limit (LL-UL) values that did not include the value 1. This means that TB contact history is a risk factor (OR = 8.894) which was statistically significant for the incidence of pulmonary TB. So it can be concluded that DM patients with a history of contact with TB patients are at risk of developing pulmonary TB at 8,894 times compared to DM patients who have no history of contact with TB patients.

The results of the analysis of the old variable suffering from DM obtained OR = 12,363 (95% CI: 4,134-38,084) with a lower limit and upper limit (LL-UL) value does not cover the value 1. This means that the duration of DM is a risk factor (OR = 12,363) which was statistically significant for the incidence of pulmonary TB. In conclusion, DM patients who suffer from disease for a period of  $\geq 5$  years are at risk of developing pulmonary TB at 12,363 times compared to those with long-term DM who suffer from <5 years of disease.

## DISCUSSION

The results of bivariate analysis in this study found that the contact history of TB and prolonged suffering from diabetes risked the incidence of pulmonary TB in the city of Makassar. Whereas age is not at risk for the incidence of pulmonary TB in Makassar City. This can happen because the proportion of young age and old age in the case group and the control group is almost the same. In addition, respondents are DM patients who are generally affected by older people.

The results of this study are in line with research in Manado by Ismail, Ali and Loho, (2013) and Utomo, HS and Margawati, (2016) which shows that age and incidence of AFB (+) pulmonary TB in patients with DM do not have a significant relationship. But it is different from research Wang *et al.*, (2013) which shows that people with DM > 50 years have a risk of developing pulmonary TB at 13.2 times compared to people with DM <50 years. Study conducted by Harso *et al.*, (2017) also shows that age has an influence on the incidence of TB-DM.

TB contact history in DM patients who have a risk of 8,894 times exposed to pulmonary TB compared to DM patients who do not have a home TB contact history. Based on the results of the interviews obtained, respondents had been  $\geq 6$  months at home / had lived at home with TB patients (100%). This is in accordance with the theory which states that the contact history of family members who live at home  $\geq 3$  months has a risk for the occurrence of pulmonary TB, especially excessive contact (Notoatmodjo, 2003).

The rate of transmission of TB in the family / household sphere is quite high. Patients with pulmonary TB with AFB (+) on average can transmit 2-3 people in their homes, besides the risk of transmission in households with TB patients more than one person is 4 times compared to households with only one TB sufferer. The presence of TB patients in one house increases the duration of contact frequency with tuberculosis germs which is an important factor in tuberculosis pathogenesis (Fitriani, 2013).

In the etiology of tuberculosis, mycobacterium tuberculosis is very small, aerobic, can survive long in dry sputum, other excreta and can easily be excreted through inhalation of sputum grains through coughing, sneezing or speech (droplet infection). So that frequent contact with active tuberculosis sufferers will cause infection or exposure to healthy people (Butiop, Kandou and Palendeng, 2015). Some studies show the



same results with this study, namely a cross sectional study conducted by Webb *et al.*, (2009) showed that DM patients who had a TB contact history had a significant relationship to the incidence of pulmonary TB ( $p = 0.0011$ ). besides the research carried out by Wijayanto, (2013) showed that the history of household contact in DM patients increased the risk of developing TB by 3.2 times compared with DM patients who did not have a TB contact history. Research conducted in Eastern Ethiopia shows that the household contact history of DM patients has a risk of 9.4 times TB exposure compared to people with DM who do not have a TB contact history (Amare *et al.*, 2013).

Long suffering from Diabetes Mellitus (DM)  $\geq 5$  years provides a risk of 12,268 times exposed to pulmonary tuberculosis AFB (+) compared to respondents who have long suffered from diabetes  $<5$  years. The results of this study are in line with the cross sectional study by Amare *et al.*, (2013) which shows that the duration of suffering from 6-10 years of DM is 3.84 times the risk of pulmonary TB, even if the duration of suffering  $> 10$  years is the risk of developing pulmonary TB, which is increasing by 9.92 times. The case control study at Lung Hospital Surabaya also showed that patients with diabetes mellitus with a disease duration of  $\geq 6$  months had a risk of 24,347 times the occurrence of pulmonary tuberculosis (Juwatiningsih, 2013). A retrospective study in Ethiopia also showed that the duration of diabetes mellitus  $\geq 5$  years increased the risk of 5 times having pulmonary tuberculosis smear (+) compared to the duration of diabetes  $<5$  years (Tiroro, 2015).

The longer the duration of the patient with the condition of hyperglycemia, the higher the risk of complications, the higher the susceptibility to other diseases (Erick, 2012). Research of Almasdy *et al.*, (2015) shows patients who have a history of DM more than one year and length of stay of more than 10 days are susceptible to complications with diabetic ulcers and pulmonary TB.

## CONCLUSION

In this study it can be concluded that the contact history of TB and duration of suffering from DM are risk factors while age is not a significant risk factor for the incidence of pulmonary TB in DM patients in Makassar City. Efforts to control pulmonary TB are advised not only to focus on curative aspects but also through promotive and preventive efforts, especially to prevent people with DM from having risk factors such as TB contact history and duration of suffering from diabetes.

## REFERENCES

1. Almasdy, D. *et al.* (2015). 'Evaluasi Penggunaan Obat Antidiabetik pada Pasien Diabetes Mellitus Tipe-2 di Suatu Rumah Sakit Pemerintah Kota Padang Sumatera Barat', *Jurnal Sains Farmasi &*

- Klinis*, 02(01), pp. 104–110.
2. Amare, H. *et al.* (2013). 'Smear positive pulmonary tuberculosis among diabetic patients at the Dessie referral hospital, Northeast', *Infectious Diseases of poverty*, 2(6), pp. 1–8. doi: 10.1186/2049-9957-2-6.
3. Butiop, H. M. L., Kandou, G. D., & Palendeng, H. M. F. (2015). 'Hubungan Kontak Serumah, Luas Ventilasi, dan Suhu Ruangan dengan Kejadian Tuberkulosis Paru di Desa Wori', *Jurnal Kedokteran Komunitas dan Tropik*, 3(4a), pp. 241–248.
4. Dewi, D. P. R. *et al.* (2017). 'Risk factors of pulmonary tuberculosis among diabetes mellitus patients in Denpasar City', *Public Health and Preventive Medicine Archive*, 5(1), pp. 24–29.
5. South Sulawesi Provincial Health Office. (2017). *Profil Kesehatan Sulawesi Selatan*.
6. Dirjen Pengendalian Penyakit dan Penyehatan Lingkungan. (2015). 'Petunjuk Teknis Penemuan Pasien TB-DM Di Fasilitas Kesehatan Rujukan Tingkat Lanjut', *Kementerian Kesehatan RI*, pp. 1–39. doi: 10.3406/arch.1977.1322.
7. Erick. (2012). *Hubungan Antara Konsumsi Alkohol Dengan Prevalensi Tuberkulosis Paru Pada Pasien Diabetes Mellitus Tipe 2 Di Rumah Sakit Cipto Mangunkusumo Tahun 2010*. Universitas Indonesia. doi: 10.1002/tox.22101.
8. Fitriani, E. (2013). 'FAKTOR RISIKO YANG BERHUBUNGAN DENGAN KEJADIAN TUBERKULOSIS PARU (Studi Kasus di Puskesmas Ketanggungan Kabupaten Brebes Tahun 2012)', *Unnes Journal of Public Health*, 2(1), pp. 2–5. doi: 10.15294/UJPH.V2I1.3034.
9. Gil-Santana, L. *et al.* (2016) 'Diabetes is associated with worse clinical presentation in tuberculosis patients from Brazil: A retrospective cohort study', *PLoS ONE*, 11(1), pp. 1–14. doi: 10.1371/journal.pone.0146876.
10. Harso, A. D. *et al.* (2017) 'Perbedaan Faktor Sosiodemografi dan Status Gizi Pasien Tuberkulosis dengan dan Tanpa Diabetes Berdasarkan Registri Tuberkulosis-Diabetes Melitus 2014', *Media Penelitian dan Pengembangan Kesehatan*, 27(2), pp. 65–70.
11. Ismail, M. R., Ali, H. R., & Loho, E. (2013). 'Gambaran Foto Toraks pada Penderita Dewasa dengan Diagnosis Klinis Diabetes Mellitus yang disertai Tuberkulosis Paru di Bagian/SMF Radiologi FK UNSRAT BLU RSUP PROF. Dr. R. D. Kandou Manado Periode 1 Januari 2011 – 31 Desember 2011', *Journal E-Clinic Unsrat*, 1(3), pp. 1689–1699. doi: 10.1017/CBO9781107415324.004.
12. Juwatiningsih, E. S. (2013). *Faktor Yang Mempengaruhi Terjadinya Tuberkulosis Paru Pada Pasien Diabetes Mellitus Di Rumah Sakit Paru Surabaya*. Universitas Airlangga.
13. Health Ministry RI. (2017). *Profil Kesehatan Indonesia Tahun 2016*. doi: 10.1111/evo.12990.
14. Health Ministry RI. (2018). *Profil Kesehatan*

- Indonesia Tahun 2017. doi: 10.1002/qj.
15. Narasimhan *et al.* (2013). 'Risk factors for tuberculosis', *Pulmonary Medicine*, 2013. doi: 10.1155/2013/828939.
  16. Notoatmodjo, S. (2003). *Pendidikan dan Perilaku Kesehatan*. Jakarta: PT. Rineka Cipta.
  17. Sulaiman, S. A. S., Khan, H. A., & Mutallif, A. R. (2013). 'Impact of diabetes mellitus on treatment outcomes of patients with active tuberculosis in an endemic area', *The American Journal of the Medical Sciences*, 345(4), pp. 321–325. Available at: [http://erj.ersjournals.com/content/42/Suppl\\_57/P4453.full.pdf+html?sid=929221e5-aa83-4ee8-bb96-abea1294a3e9%0Ahttp://ovidsp.ovid.com/ovidweb.cgi?T=JS&PAGE=reference&D=emed11&NEWS=N&AN=71843977](http://erj.ersjournals.com/content/42/Suppl_57/P4453.full.pdf+html?sid=929221e5-aa83-4ee8-bb96-abea1294a3e9%0Ahttp://ovidsp.ovid.com/ovidweb.cgi?T=JS&PAGE=reference&D=emed11&NEWS=N&AN=71843977).
  18. Tiroro, S. (2015). *The Magnitude And Associated Factors of Tuberculosis Among Diabetic Patients at Tikur Anbessa Specialized Teaching Hospital in Addis Ababa, Ethiopia*. Addis Ababa University.
  19. Utomo, R., HS, K. H. N., & Margawati, A. (2016). 'Hubungan Antara Status Diabetes Melitus Tipe 2 Dengan Status Tuberkulosis Paru Lesi Luas', *Jurnal Kedokteran Diponegoro*, 5(4), pp. 1535–1544.
  20. Wang, Q. *et al.* (2013). 'Prevalence of Type 2 Diabetes among Newly Detected Pulmonary Tuberculosis Patients in China: A Community Based Cohort Study', *PLoS ONE*. Edited by J. A. Caylà, 8(12), p. e82660. doi: 10.1371/journal.pone.0082660.
  21. Webb, E. *et al.* (2009). 'High prevalence of Mycobacterium tuberculosis infection and disease in children and adolescents with type 1 diabetes mellitus', *INT J TUBERC LUNG DIS*, 13(7), pp. 868–874. doi: 10.2310/JIM.0b013e31826803c1.
  22. WHO. (2016a). *Global Tuberculosis Report*.
  23. WHO. (2016b). *World Health Statistics 2016: Monitoring Health For The SDGs*. doi: 10.1017/CBO9781107415324.004.
  24. Wijayanto, A. (2013). 'Faktor Terjadinya Tuberkulosis Paru Pada Pasien Diabetes Mellitus Tipe 2 (Factors associated to Pulmonary Tuberculosis among Type 2 Diabetes Mellitus Patients)'. Available at: <http://jurnalrespirologi.org/wp-content/uploads/2015/08/JRI-Jan-2015-35-1-1-11.pdf>.
  25. Workneh, M. H., Bjune, G. A., & Yimer, S. A. (2017). 'Prevalence and associated factors of tuberculosis and diabetes mellitus comorbidity: A systematic review', *PLoS ONE*, 12(4), pp. 1–26. doi: 10.1371/journal.pone.0175925.