

Original Research**Tuberculosis Case Finding And Diabetes Mellitus Screening In Vulnerable Populations Budi Luhur Nursing Home Jambi****Rd. Halim¹, Helmi Suryani Nasution^{2*}**^{1,2} Faculty of Medicine and Health Science Universitas Jambi, Indonesia**ABSTRACT**

Background: Indonesia was ranked third in 2018 for tuberculosis (TB) incidence among other countries in the world. Indonesia is also facing non-communicable diseases (NCDs) and re-emerging disease. One of the NCDs problems in Indonesia is diabetes mellitus. These two diseases are interrelated. The prevalence of TB and diabetes mellitus in the elderly is much higher than in the other age groups. The purpose of this study was to determine the proportion of TB and diabetes mellitus and risk factors associated with each of these diseases in the elderly.

Methods: The research was conducted at the Budi Luhur Nursing Home. The number population and sample is 70 people. The research design was cross-sectional. Univariate analysis was shown in the distribution of frequencies and proportions and bivariate analysis was performed using a chi-square test.

Results: The proportion of TB was 2.4% while the proportion of diabetes mellitus was 14.6%. History of diabetes mellitus was associated with diabetes mellitus (p -value=0.015 and POR 7.11 (95% CI 1.543 - 32.764)). Age, gender, nutritional status, stress, physical activity, and history of TB were not associated with diabetes mellitus.

Conclusion: : It is recommended to conduct other studies with a better design and to consider a research method that is suitable for the elderly.

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diabetes mellitus, elderly; nursing home; tuberculosis

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INTRODUCTION

Tuberculosis is one of Indonesia's major public health issues (TB). Based on WHO estimates, the incidence of TB in Indonesia in 2018 was 845,000 cases. Indonesia is now ranked third in the world as a result of this incident (World Health Organization (WHO), 2019). Based on the results of the 2014 TB Prevalence Survey in Indonesia, the prevalence of TB at the age of 55-64 years and ≥ 65 years is 1.4-2.1 times compared to the total national TB prevalence, namely 1,030 per 100,000 population for the 55-64 year age group and 1,582 per 100,000. population for the age group ≥ 65 years (Kementerian Kesehatan, 2015). According to the 2018 Basic Health Research

Data (Riskesdas), the prevalence of diabetes mellitus (DM) in Indonesia is 10.9 percent based on blood sugar tests (95 %CI 10.5-11.2 %).

When disaggregated by age, the older a person is, the higher the prevalence. The prevalence at age 55-64 years is 19.6% (95% CI 18.6 - 20.7), 65-74 years is 19.6% (95% CI 18.1 - 21.3), and ≥ 75 year 17.0% (95% CI 15.0 - 19.2) (Riset Kesehatan Dasar (RISKESDAS), 2019). The prevalence of diabetes mellitus in tuberculosis patients ranges from 1.9 percent to 45 percent, with a global prevalence of 16 percent (IQR 9.0 % -25.3 %). Meanwhile, the prevalence of tuberculosis (TB) among diabetic patients ranges from 0.38 to 14%, with a national median prevalence of 4.1 percent (IQR 1.8 %-6.2 %) (Workneh, Bjune, & Yimer, 2017). Thus, screening TB in DM patients can be an effort to increase TB case detection. And vice versa, DM screening in TB patients can increase DM case finding.

The Budi Luhur Nursing Home is the only nursing home in Jambi Province. The number of residents in the nursing home is 70 people. There is one elderly person who has had TB treatment and has been declared cured. There is a possibility of TB transmission to other residents of the nursing home. Several studies regarding the prevalence of DM in TB patients have been conducted (Kubiak et al., 2019; Munseri, Kimambo, & Pallangyo, 2019; Sharma, Khanal, Jha, Pyakurel, & Gurung, 2019; Tenaye, Mengiste, Baraki, & Mulu, 2019) likewise several studies on the prevalence/incidence of TB among DM patients (Mave et al., 2017; Ugarte-Gil et al., 2020).

Bi-directional studies regarding the prevalence of DM among TB patients and TB patients among DM patients have also been widely carried out (McMurry et al., 2019; Prakash et al., 2013; Workneh et al., 2017; Zheng, Hu, & Gao, 2017). However, research on TB and DM in the elderly population has not been widely carried out. One of the studies ever been conducted was by Lin et al. in Taiwan. The results of the study stated that the prevalence of TB was 3.89 per 1,000 people which subsequently increased to 6-7 times in elderly DM patients (Lin et al., 2015). From the references acquired, research on TB and DM in the elderly has never been carried out in Indonesia, especially in Jambi Province. It is necessary to know the magnitude of the problem of TB and DM in one of the vulnerable populations (elderly) along with the risk factors for the occurrence of these two diseases.

TB transmission in the population can be monitored and morbidity and mortality rates of DM minimized by determining the magnitude of the issue and risk factors.

MATERIALS AND METHOD

This research is a quantitative study with a cross-sectional study design. The research was carried out at the Budi Luhur Nursing Home in Jambi. The duration of the study was 8 months, from April to November 2020. The independent variables for tuberculosis were age, sex, diabetes mellitus, smoking, nutritional status, and history of TB while the independent variables for diabetes mellitus were age, sex, tuberculosis, nutritional status, physical activity, depression, and family history. The population and sample of the study were all residents of the Budi Luhur Nursing Home totaling 70 people. The elderly residents of the Budi Luhur Nursing Home who could be invited to speak and who were able to sign the informed consent document were the inclusion criteria of sample.

The exclusion criteria of sample were the elderly who had seriously ill or senile so that examination/measurement and/or interviews could not be carried out. Data on age,

gender, clinical symptoms of TB, smoking, history of TB, and family history were collected through interviews using a questionnaire. To establish a TB diagnosis, this study used a molecular rapid test while a diagnosis of DM is carried out by checking blood sugar using a glucometer. Anthropometric measurements were carried out using measurements of weight and height. The Depression Anxiety Stress Scale (DASS) was used to assess depression, and the International Physical Activity Questionnaire-Short Form (IPAQ-SF) was used to assess physical activity.

The data is processed using EpiData and SPSS. Data analysis included univariate and bivariate analyzes. The results of the univariate analysis are shown in the distribution of frequencies and proportions. A chi-square test was performed for bivariate analysis. Before the implementation of the study, this research had obtained prior permission from the Health Office of Jambi Municipality.

RESULTS

The characteristics of respondents and the association between independent and dependent variables can be seen respectively in table 1 and table 2. The following table (table 1) is a description of the characteristics of the respondents in this study.

Table 1. Characteristics of Respondents (n=41)

Variables	Frequency	Percentage
Age		
60 – 69 years old	14	34,2%
70 – 79 years old	14	34,2%
≥ 80 years old	13	31,7%
Sex		
Male	21	51,2%
Female	20	48,8%
Smoking		
Yes	10	24,3%
Quit smoking	14	34,2%
Never smoked	17	41,5%
Nutritional status		
Underweight	5	12,2%
Normal	23	56,1%
Overweight/obese	13	31,7%
Stress		
Normal	34	85,0%
Mild/moderate /heavy /very heavy	6	15,0%
Physical activity		
Heavy	1	2,4%
Moderate	13	31,7%
Mild	27	65,9%
History of diabetes mellitus		
Yes	6	14,6%
No/missing	35	85,4%
History of tuberculosis		
Yes	2	4,9%
No	39	95,1%

Variables	Frequency	Percentage
Diabetes mellitus		
Yes	6	14,6%
No	35	85,4%
Tuberculosis		
Yes	1	2,4%
No	40	97,6%

Based on table 1, it is obtained that the percentage of DM in the elderly at the nursing home is 14.6% (6 people). The percentage of TB in the elderly is 2.4% (1 person) and the percentage of TB is 2.4% (1 person). The respondents' average age was 74 years, with a range of 60-79 years. Most of the respondents were male with a total number of 21 people (51.2%). There were 17 people (41.5%) who said that they had never smoked, and 23 respondents (56.1%) with a nutritional status was normal, 35 people (85.4%) experienced normal stress levels, and 27 people (65.9%) had low physical activity.

Based on family history affected by DM there were as many as 35 people (85.4%) who stated that there was never a history of DM or the answer in the questionnaire was not filled (missing). Meanwhile, based on the history of TB, only 2 people (4.9%) stated that they had been a TB patient. The risk factors for DM according to the bivariate analysis can be seen in table 2. Meanwhile, the results of the bivariate analysis for TB cannot be presented because only 1 elderly person was confirmed with TB. As a result, the calculation of the p-value and the measurement of association cannot be obtained.

Table 2. Bivariate Analysis of Risk Factors for Diabetes Mellitus (n=41)

Variables	Diabetes Mellitus (n=6)	Not diabetes mellitus (n=35)	P-value	POR	95% CI
Age			0,060	0,239	0,054-1,063
60 – 69 years old	4 (28,6%)	10 (71,4%)			
70 – 79 years old	2 (14,3%)	12 (85,7%)			
≥ 80 years old	0 (0,0%)	13 (100,0%)			
Sex			0,948	1,059	0,187-5,985
Male	3 (14,3%)	18 (85,7%)			
Female	3 (15,0%)	17 (85,0%)			
Nutritional status			0,821	1,115	0,434-2,865
Underweight	1 (20,0%)	4 (80,0%)			
Normal	3 (13,0%)	20 (19,6%)			
Overweight/obese	2 (15,4%)	11 (84,6%)			
Stress			0,194	3,75	0,511– 27,498
Normal	4 (11,8%)	30 (88,2%)			
Mild/moderate /heavy /very heavy	2 (0%)	4 (5,1%)			
Physical activity			0,337	0,343	0,039-3,042
Heavy	0 (0%)	1 (100%)			
Moderate	5 (18,5%)	22 (81,5%)			
Mild	1 (7,7%)	12 (9,23%)			
History of diabetes mellitus			0,015	7,111	1,543 – 32,764
Yes	4 (44,5%)	5 (55,6%)			
No	2 (3,2%)	30 (93,8%)			
History of tuberculosis*					
Yes	2 (100%)	0 (0%)			
No	4 (12,3%)	35 (89,7%)			

POR cannot be calculated because there is one cell with an empty value. From table 2, it is known that the significant variable for DM is a history of DM with a p-value of 0.015 and a Prevalence Odds Ratio (POR) of 7.11 (95% CI 1.543 - 32.764). The variables of age, sex, nutritional status, stress level, physical activity, and history of TB were not associated with the incidence of DM. The POR of the TB variable cannot be calculated because there is one cell whose value is zero, namely the presence of a history of TB in respondents who do not have DM.

DISCUSSION

Age was not statistically related to DM. This may be because the prevalence of diabetes among the elderly does not vary. This is different from other studies with respondents are the general population. The elderly tend to be at higher risk of developing diabetes than most age ranges of the general population. In this study, it can be seen that the older the elderly, the smaller the proportion of elderly affected by DM. This finding is consistent with studies on the elderly in China. The study states that age is negatively correlated with DM (LIANG et al., 2020).

According to the findings of this study, Sex did not have an association with the prevalence of diabetes in the elderly. This research supports the findings of Trisnawati et al. (2012), who found no association between sex and DM (Trisnawati & Setyorogo, 2013). In outpatients at the Internal Medicine Department of Dr. H. Sowondo Hospital in Kendal, Rahayu (2011) found no association between sex and the incidence of diabetes (Rahayu, Utomo, & Setiawan, 2012). These findings are also consistent with the Iranian study. Gender is not a major risk factor for diabetes, according to this report. However, modifiable risk factors for men and women, such as low education and general adiposity in men and central adiposity in women, are linked to the development of diabetes mellitus (Derakhshan et al., 2014).

There is no association between sex and DM is because the percentage of sex between men and women is almost the same for the incidence of DM. From the results of Riskesdas 2018, it is known that there is no difference in the prevalence of DM based on sex. The prevalence of DM in men and women is estimated to be 1.1 % based on these findings (Riset Kesehatan Dasar (RISKESDAS), 2019). According to the findings of a systematic study and meta-analysis, the prevalence of DM is about the same in men and women (Hilawe, Yatsuya, Kawaguchi, & Aoyama, 2013). The findings of this research show that physical exercise has no statistical relationship with the occurrence of diabetes.

There would be a rise in insulin sensitivity, a reduction in glycosylated hemoglobin (A1C), and an increase in peak oxygen intake (VO₂peak) as a result of physical exercise, both of which will help to reduce diabetes (Amanat, Ghahri, Dianatinasab, Fararouei, & Dianatinasab, 2020). According to research conducted in a nursing home by Rachmawati(2018) and Isnaini(2018), there is no association between physical activity and diabetes (Isnaini & Ratnasari, 2018; Rachmawati, 2018). This is probably due to the inaccuracy of respondents' answers. Several studies have shown that the elderly population's response quality is hampered by natural consequences of the aging process (Kutschar & Weichbold, 2019). Like physical activity, in this study, stress was not statistically related to DM. This may be related to the previous explanation regarding the accuracy of the information provided by elderly respondents. In theory, stress is associated with DM through hormonal mechanisms.

The direct impact of stress hormones on raising blood sugar levels and the indirect effect of stress on food and exercise habits are both linked to the effect of stress on blood sugar control in people with diabetes (Marcovecchio & Chiarelli, 2012). The findings revealed that the DM had a significant association with the occurrence of DM. According to Isnaini (2018), there is an association between a family history of diabetes and the prevalence of diabetes in people over 45 years old (Isnaini & Ratnasari, 2018). Based on twin studies in Europe, Australia, and the United States, it suggests that genetic causes, in addition to environmental factors, play a part in the development of type 2 diabetes. Genetic factors have a moderate to high contribution to the incidence of DM. Heritability values can reach 72% (Avery & Duncan, 2019).

The risk of developing type 2 DM increases 2-4 times in people who have a father, mother, or both diabetes. Several studies have also shown that someone with a diabetic mother is more likely to get diabetes than people who have a diabetic father. This is influenced by both genetic and environmental causes, such as mitochondrial DNA defects and the intrauterine environment (K Papazafiropoulou, Papanas, Melidonis, & Maltezos, 2017). People who have DM family members are also at risk of developing DM in old age. According to experts, a person's chance of having diabetes is increased whether either or both parents have the disease ("Diagnosis and classification of diabetes mellitus," 2012). Respondents with a family history of diabetes but no symptoms may be attributed to early disease prevention actions.

According to the findings of this report, 84.6% of respondents have a normal nutritional status and do not have diabetes. Meanwhile, the respondents who had diabetes were 15.4%. Nutritional status shows no statistically significant relationship with DM. These findings support Kurniawaty's (2016) study, which found that obesity is not a factor in the development of type 2 diabetes (Evi & Yanita, 2016). This is in contrast to the findings of Trisnawati and Setyorogo (2012), who found that there is a significant association between diabetes and obesity (Trisnawati & Setyorogo, 2013).

Body mass index (BMI) is currently used to determine anthropometric characteristics in adults categorized as underweight, normal, overweight, and obese. BMI is a measure of a person's weight and is used to predict the occurrence of a variety of health conditions, including diabetes (Nuttall, 2015). The risk of developing type 2 DM is 4 times greater for obese people than those with normal nutritional status. This is because, in obese people, there is insulin resistance (Soelistijo et al., 2015). However, according to the findings of a 2007 Basic Health Research study, central obesity measured by waist circumference was found to be a greater risk factor for diabetes than general obesity measured by BMI (Soetiarto, Roselinda, & Suhardi, 2011). BMI does not affect lipid profiles, according to research in Pakistan, so the measurement and treatment of abnormal blood lipids need not be dependent on body weight or patient BMI (Hussain, Ali, Kaleem, & Yasmeen, 2019).

According to the results, the proportion of DM patients among TB patients was 100%, while the proportion of TB patients among DM patients was 33%. This finding is consistent with previous research, which found that the proportion of TB patients among DM patients is higher than the proportion of DM patients among TB patients (Workneh et al., 2017). There is no association between the history of TB and DM is probably because in this study not many elderly people with TB. This is because the prevalence of tuberculosis is low, and the number of TB cases obtained from this study is not representative enough to show a connection between tuberculosis and diabetes mellitus. In principle, individuals with DM are three times more likely to acquire

tuberculosis (Restrepo, 2016). TB can cause sugar intolerance disorders and the emergence of new-onset of DM (Yorke et al., 2017).

CONCLUSION

The proportion of TB in the elderly at Budi Luhur Nursing Home in Jambi was 2.4% while the proportion of DM was 14.6%. History of TB associated with DM with a p-value of 0.015 and POR 7.11 (95% CI 1.543 - 32.764). Meanwhile, the variables of age, gender, nutritional status, stress level, physical activity, and history of TB were not associated with the incidence of DM. To determine the proportion and risk factors for TB and DM in the elderly, similar studies with a better design are needed. In addition, it is necessary to consider a research method that is suitable for the elderly so that more valid data can be obtained.

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