Original Article

The Differences of Blood Sugar Levels Among Smoker and Non-Smoker Farmers: Data Analysis of the Integrated non-Communicable Disease Post (NCD) in Pakusari Public Health Centre of Jember Regency, Indonesia

Wiwin Handayani, BNS
Undergraduate Nursing Program, Faculty of Nursing, Jember University, Jember, Indonesia

Tantut Susanto, RN, MN, PHN., Ph.D
Department of Community, Family & Geriatric Nursing, Faculty of Nursing, Jember University, Jember, Indonesia

Hanny Rasni, RN, MN
Department of Community, Family & Geriatric Nursing, Faculty of Nursing, Jember University, Jember, Indonesia

Mokhlas Kholidi, BSN, RN
Community Health Nurses, Pakusari Public Health Center, Department of Health of Jember Regency, Indonesia

Correspondence: Tantut Susanto. Department of Community, Family & Geriatric Nursing, Faculty of Nursing, Jember University, Jember, Indonesia E-mail: tantut_s.psik@unej.ac.id

Abstract

Background: Farmers have to check their health status, including blood sugar levels. Diabetes mellitus is most commonly assessed using the fasting plasma glucose test.
Aim: The objective of this study was to analyze the differences in blood sugar levels of smoker farmers and non-smoker farmers in the Posbindu report of Pakusari Health Center Jember.
Material and Method: This study was a survey analysis, that used a cohort retrospective study design, which used secondary data. The population was all of the participants of Posbindu PTM at Pakusari health center Jember within inclusion criteria and who do not have any exclusion criteria with a number sample of 111 farmers. The data were analyzed from secondary data in the form of identity, smoking behavior, and the blood sugar level. The data of smoking behavior was used to perform smoking habits among farmers and their relationship with blood sugar level. The Chi-square test was used to answer the research questions.
Results: The result showed that were no significant difference in blood sugar levels between smoker farmers and non-smoker farmers (X^2=2.705; p-value >0.05 =1.000) but the analytical test used Mann Whitney Test get result significant relationship between age and smoking behavior (p-value = 0.026) and then this study shows there is significant relationship between gender and smoking behavior (p-value = 0.001).
Conclusions: This study shows there is no difference in blood sugar levels between smoker farmers and non-smoker farmers. Therefore, it is necessary to further identify the factors that affect blood sugar levels in farmers.

Key Words: Blood sugar levels, smoking, not smoking, farmers

Introduction

The prevalence of Non Communicable Disease (NCD) in the world is 73% (WHO, 2018). Diabetes Mellitus (DM) is a metabolic endocrine disease caused by increasing of blood sugar levels in the body (Sari, Darlan and Prasetya, 2018). The prevalence of DM in Indonesia is 30.4% (Kemenkes RI, 2016). The increase in blood sugar levels is caused by several factors such as lack of physical activity, stress and smoking behaviour (Sandrelly, Karim and Nurchayati, 2017).

Smoking is confirmed to be one of the risk factors for increasing blood sugar levels in

the body (Roux et al., 2017). Indonesia becomes a country with the largest cigarette consumption in the world after China and India (Kemenkes RI, 2018). The prevalence of smokers in rural areas is 37.7% (Nurida, Levani and Hakam, 2019). A report from The Institute National de Prevention et d'Education pour la Sante (INPES) shows that the prevalence of active smokers in France is 17% in farmer groups (Roux et al., 2017).

Active smokers have a 26% risk factor of metabolic syndrome (Sun, Liu and Ning, 2012). The nicotine can cause insulin resistance because it can interfere the release of insulin (Dwi Ario, 2014). Insulin resistance will trigger hyperglycaemia. Indonesia implements several strategies to overcome the problem of NCD, it is the Integrated Non-Communicable Disease Development Post (Posbindu PTM) which is carried out at every village (WHO, 2015). The Posbindu PTM carries out activities such as health screening for smoking behavior, measuring body weight, checking blood sugar levels, counseling (Kemenkes RI, 2012). In 2015, the achievement of Posbindu PTM in Indonesia was 8.6% (Andayasari and Opitasari, 2019). The report of Posbindu PTM at the Pakusari Public Health Centre showed a fluctuating results.

In 2019, the participants of Posbindu PTM at the Pakusari Public Health Centre was 1.344 participants. The incidence of DM during 2019 was 62.4% and it increased every month. 8.5% of them were categorized as DM in January then in February increased to 18.3% and continued to increase rapidly to 32.3% in March. Therefore, identification is needed related to the difference of blood sugar levels among smoker farmers and non-smoker farmers at the Pakusari Public Health Centre of Jember regency.

The objective of this study was to analyze the difference of blood sugar levels among smoker farmers and non-smoker farmers at the Pakusari Public Health Centre of Jember regency. The answer question 'Does there a difference of blood sugar levels among smoker farmers and non-smoker farmers at the Pakusari Public Health Centre of Jember regency?' was sought and the hypothesis of the research was determined as follows.

H_0: There is no difference in blood sugar levels between smoker farmers and non-smoker farmers

H_1: There are difference in blood sugar levels between smoker farmers and non-smoker farmers

Methods - Design and participants: This study used a retrospective cohort study to analyze the difference of blood sugar levels among smoker farmers and non-smoker farmers. This study used secondary data of Posbindu PTM at Pakusari Public Health Centre. This study's inclusion criteria were the participants of Posbindu PTM aged more than 15 years old, less than 64 years old and worked as farmers. Meanwhile, the exclusion criteria were:

1. The participants who had not complete data of smoking behavior and blood sugar levels for 3 months;

2. The participants who did not had complete data of smoking behavior;

3. The participants who did not had complete data of blood sugar levels. The data in this study was 345 data of farmers who were registered at Posbindu PTM of Pakusari Public Health Centre Jember regency from January to March 2020. The data screening process in this study (Figure 1) identified 345 data, of which 122 participants did not had complete data of smoking behaviour and blood sugar levels for 3 months, 93 participants aged more than 64 years old, 16 participants did not have complete data of smoking behaviour and blood sugar levels for 3 months and 3 participants did not have complete data of smoking behaviour. Therefore, this study's final data was 111 participants.

Instruments: A card for health risk factor of NCD (KMS) questionnaire was used in this study (see in Appendix 1). This questionnaire consisted of participants characteristics including age, gender, education, marital status, religion, physical activity, consumption of fruit and vegetables, smoking behaviour and random blood sugar data. The assessment of physical activity in KMS questionnaire carried out by health workers with the requirements if participants lack of physical activity (not enough) 3 times/week or lack of 150 minutes and sufficient of physical activity (enough) if carried out for 3 to 5 times/week or more than 150 minutes/week. Meanwhile, the assessment of fruit and vegetables consumption was "less than 5 portions" if lack of 300-400 gram in fruit and vegetables consumption and "more than 5 portions" if more than 300-400 gram of fruit and vegetables consumption.

Data collection: The data were collected through surveys of KMS Posbindu PTM. Firstly, the head of Pakusari Public Health Centre received an explanation regarding the aims and objectives of the study. The researchers coordinated with the person in charge of Posbindu PTM programs at Pakusari Public Health Centre of Jember regency and processed the data obtained so that it could be analysed and a conclusion was drawn.

Ethical consideration: The study was approved by the Ethical Committee Review Board of Indonesia of the Faculty of Dentistry, University of Jember No.978/UN25.8/KEPK/DL/2020.

Data analyses: All data were analysed using the IBM statistical Package for Social Sciences software program, version 23.0. Statistic descriptive was used to determine participants characteristics with median and percentile 25-75 (for numeric data) and percentage (for categorical data). Chi square

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test and Mann-Whitney test were used to analyse the difference between independent variable and dependent variable. A *p*-value <0.05 was considered statistically significant.

Research Flow: The research screening can be seen in the chart below.

Results

Characteristics of participants (Table 1) showed that the median age of participants were 50 (42-57) years, with 79.3% of participants of female and 20.7% of the male participants.

The majority of participants were 49.5% of educated elementary school and all of them were Muslim and married. While, the participants had sufficient physical activity 70.3% and most of them consumed less than 5 servings of fruit and vegetables per day (71.2%).

The participants characteristics in this research were comprised of age, gender, education, religion, physical activity and consumption of fruit and vegetables as it would be presented on the table 1 below.

The blood sugar levels among farmers were identified in normal categories or not hyperglycaemia. That condition may be caused by several factors as presented in Table 2.

Table 2 shows that female farmers in this study more than not hyperglycaemic. Based on age also shows that more farmers are not hyperglycaemic. The results of statistical analysis showed that there was no significant relationship between age and blood sugar levels (p= 0.259), while gender and blood sugar levels also showed no significant relationship (p-value= 0.486; p > 0.05).

The results of this analysis also show that there is no relationship between physical activity and blood sugar levels (p = 0.206) and then this analysis shows that there is relationship between consumption of fruit and vegetables with blood sugar levels p-value 0.013 (p < 0.05).
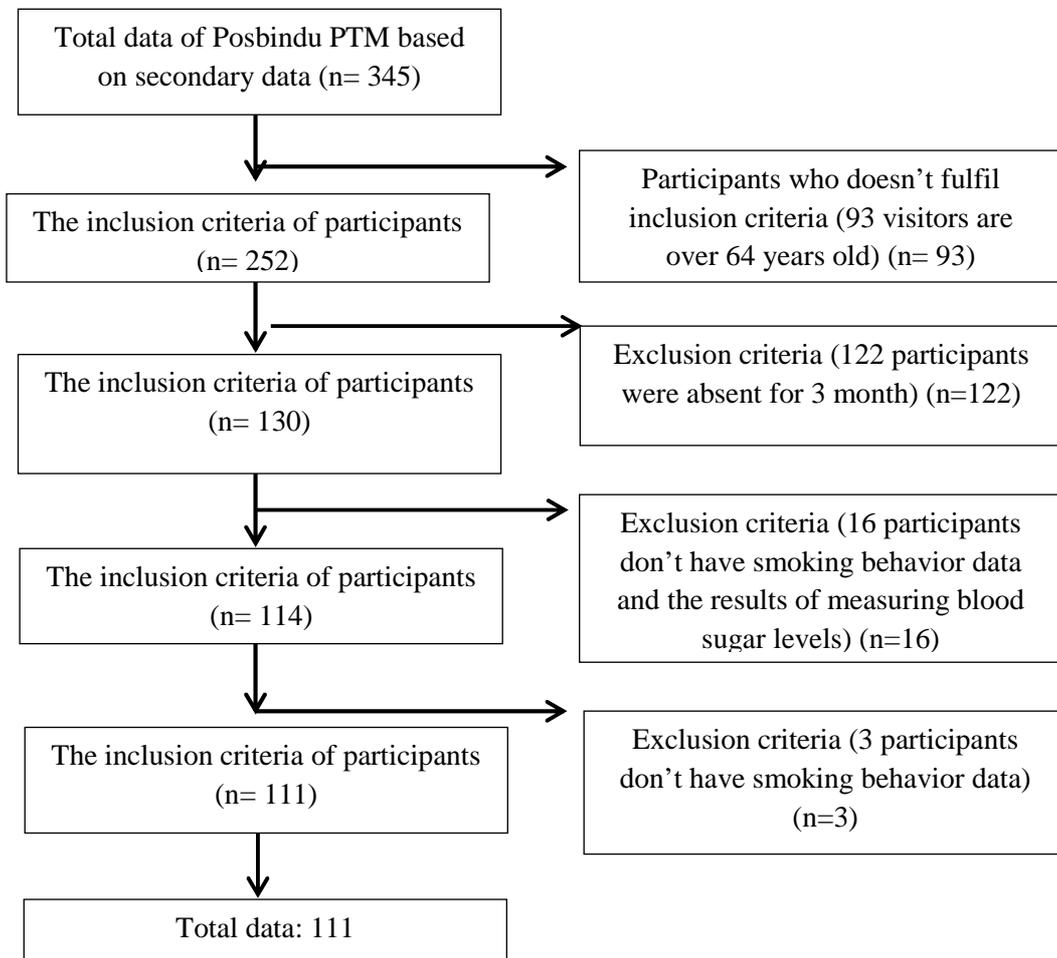
Figure 1. Sample Screening

Table 1. Characteristics of Participants in Posbindu PTM of Pakusari Public Health Centre, Jember Regency.

Characteristics	n (%)
Age (years)	
Md (P_{25}-P_{75})	50 (42-57)
Gender	
Man	23 (20.7)
Woman	88 (79.3)
Education	
Not attending school	4 (3.6)
Elementary School	55 (49.5)
Junior High School	28 (25.2)
Senior High School	24 (21.6)
Physical Activity	
Not enough	33 (29.7)
Enough	78 (70.3)
Consumption of fruit vegetables < 5 portions a day	
Less than 5 portions a day	79 (71.2)
More than 5 portions a day	32 (28.8)
Religion	
Islam	111 (100)
Marital status	
Married	111 (100)

Md=Median, P25-P75=25-75th percentile; n (%) =total percentage of participants

The majority of participants were 79.3% of female farmers. These findings indicate that the participants were dominated by female. Based on previous research female was more likely to control their health status than male (Andayasari and Opitasari, 2019).

Therefore, it was encouraged the female to come to posbindu PTM so that the participants were dominated by female. Figure 2 describe that the blood sugar levels among farmers of Posbindu PTM of Pakusari Public Health Centre were 35%

hyperglycemia. It was adjusted to the KMS Posbindu PTM which were divided into 3 categories as follow as; 80-144 mg/dl, 145-199 mg/dl and >200 mg/dl.

These data were changed into 2 criteria that was hyperglycemia and not hyperglycemia. The change in this category based on the assessment of PTM risk factors, namely > 200 mg/dl is called hyperglycemia, while < 200 mg/dl is not hyperglycemia. The distribution of blood sugar levels can be seen clearly in Figure 2.
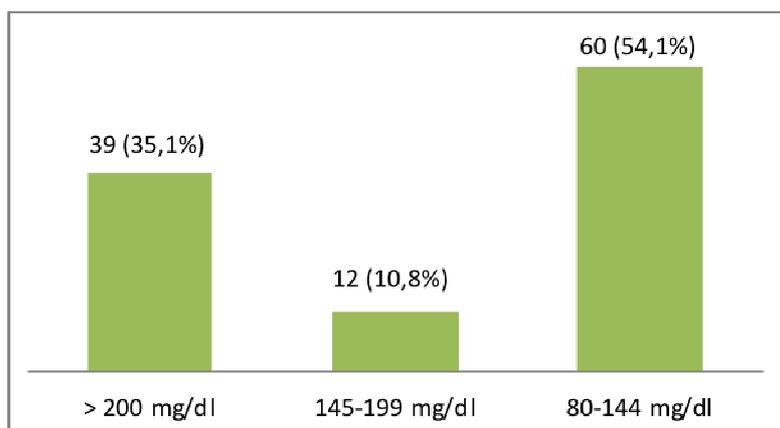
Figure 2. Blood Sugar Levels of Farmers

This study shows that farmers who had normal blood sugar levels were dominated than farmers who hyperglycaemia (35.1%). This study also showed that only a few farmers aged >45 years experienced hyperglycaemia. Therefore, it was identified that age had insignificant relationship with blood sugar levels (p=0.0259).

This result was dissimilar with state of previous research that there was a significant correlation between age and blood sugar levels, it caused by the risk factor of DM will increase of participants aged more than 45 years and then the insulin sensitivity will decrease so that can affect to the blood sugar levels (Masruroh, 2018).

Finally, in this study there is a difference between theory because it is influenced by participants characteristics which in the farmers have sufficient of physical activity.

Statistical analysis showed that there was insignificant relationship between gender and blood sugar levels. The other studies showed that there was a significant relationship between gender and blood sugar levels (Jarvis, 2019). The differences were influenced by data in this study which is dominated by female farmers. This study showed that the incidence of hyperglycaemia in female farmers to be higher 26.1% than male farmers 9%. There is 17% of that difference among female and male farmers.

This study is in line with previous studies related hyperglycaemia and gender that females are 1 time more at-risk factor of DM because physically female have a greater chance of increasing body mass index.

Based on that data, these differences indicate that female are more at risk factor of developing DM than male farmers.

This study is reverse proportional with other studies which get result that physical activity has a significant relationship with blood sugar levels, if a participant has high of physical activity so the glucose uptake by muscles will increase so that blood sugar levels in the body was balanced (Nurayati and Andriani, 2017).

Table 2. Blood Sugar Levels of Farmers.

		Blood Sugar Level (n, %)		p value
		Hyperglycemia	Not Hyperglycemia	
Age				
	Md (P$_{25}$-P$_{75}$)	39 (35.1)	72 (64.9)	0.259[a]
Gender				
	Man	10 (9.0)	13 (11.7)	0.486[b]
	Woman	29 (26.1)	59 (53.2)	
Physical Activity				
	Not enough	15 (13.5)	18 (16.2)	0.206[b]
	Enough	24 (21.6)	54 (48.6)	
Consumption of Fruit Vegetables < 5 portions a day				
	Less than 5 portions a day	34 (31.2)	44 (40.4)	0.013[b]
	More than 5 portions a day	5 (4.6)	26 (28.4)	
Total		39 (35.1)	72 (64.9)	

The level of significance was determined by the Mann Whitney test[a] and the Chi Square test[b]

Based on the Indonesian Ministry of Health, the recommended of physical activity is at least 30 minutes a day. This study showed that there was insignificant relationship between physical activity and blood sugar levels. This is possible because influenced by other factors such as rest of farmer's diet and gender.

Our results identified that consumption of fruit and vegetables was correlated with blood sugar levels. It is affected to the normal blood sugar levels of farmers. Other research identified that consuming fruit and vegetables can supported the balance of blood sugar level (Masruroh, 2018).

Improving daily consumption of fruit and vegetables can supported the blood sugar level's balance because the vitamins and fibre contained in fruit and vegetables can decrease the food intake so that it can supported the balance of blood sugar levels. Based on Table 3 it can be seen that most of the farmers in Posbindu PTM were no smoking but the results from Table 3 show

that there is a relationship between gender and smoking behavior in farmers (p = 0.001).

Furthermore, male farmers were smoking (8.1%) and then there are some of female farmers who are smoking (6.3%). This study showed that there was correlated between age and smoking behavior. It can be seen on statistical results (p = 0.026).

This study also showed that there was a relationship between physical activity and smoking behavior (p = 0.006) and there was no relationship between vegetable and fruit consumption and smoking behavior (p = 0.070). Furthermore, obtain information about smoking behavior can be seen in the following table.

Table 3. Distribution of Smoking behaviour of farmers.

		Smoking (n, %)		p value
		smoking	No smoking	
Age				
	Md (P25-P75)	16 (14.4)	95 (85.6)	0.026[a]
Gender				
	Man	9 (8,1)	14 (12.6)	0.001[b]
	Woman	7 (6.3)	81 (73.0)	
Physical Activity				
	Not enough	10 (9.0)	23 (20.7)	0.006[b]
	Enough	6 (5,4)	72 (64.9)	
Consumption of Fruit Vegetables < 5 portions a day				
	Less than 5 portions a day	8 (7.2)	71 (64.0)	0.070[b]
	More than 5 portions a day	8 (7.2)	24 (21.6)	
Total		16 (14.4)	95 (85.6)	

The level of significance was determined by the Mann Whitney test[a] and Fisher's Exact test[b]

The study results also identified that majority of farmers in Posbindu PTM of Pakusari Public Health Centre were no smoking 85.6%. This is possible because influenced by the data in this study which is dominated by female, most of them not smoking. The results showed that gender correlated with smoking behavior. This results consistent with a previous study that smoking behavior of male influenced by several factors such as environmental factors, psychological factors and biological factors balanced (Nurayati and Andriani, 2017; Nur, 2019). Furthermore, the analysis showed that smoking behavior to be carried out by farmers aged 35 years.

Smoking behavior of male farmers may have been started when they were in adolescence. In

addition, this study showed that physical activity correlated with smoking behavior. It shows that smoking can reduce the physical performance so that it has an impact to their health status. However, this study shows that there is no correlated between consumption fruit and vegetables with smoking behavior.

Table 4 described that there was no significant difference in blood sugar levels among smoker farmer and non-smoker farmers. The results of the chi square analysis are presented in table 4 as follows:

Table 4. Difference blood sugar levels among smoker farmers and non-smoker farmers.

Smoke	Blood Sugar Level		*X2*	*P value*	RR	95% CI	
	Hyperglycemia	No Hyperglycemia				*Min*	*Max*
Yes (n, %)	6 (5.4%)	10 (9.0%)	0.046	1.000	1.080	0.541	2.152
No (n, %)	33 (29.7%)	62 (55.9%)					

Source: secondary data of NCD Posbindu in Pakusari Public Health Centre, 2020

Discussion

Our results identified that there was no significant difference in blood sugar levels among smoker farmers and non-smoker

farmers. The study results was consistent with a previous study but contradicted with another research (Jarvis, 2019). The difference results in each study are possible because of the different characteristics. Participant characteristics such as hereditary disease, diabetes history, diet, stress and lifestyle that are nothing in this study need to be considered. The literature review described that smoking is one of the risk factors for hyperglycaemia, but it can be prevented by increasing a healthy lifestyle such as doing physical activity, diet, and no smoking (Nurayati and Andriani, 2017). Other factors such as physical activity, gender, diet can affect to blood sugar levels and it is contribute to the incidence of DM, so that these factors can be controlled to decrease the incidence of DM. Furthermore, the result showed that there was no difference of blood sugar levels among smoker farmers and non-smoker farmers, but the incidence rate of 16

smoker farmers had hyperglycaemia as many as 6 farmers. It means that smoking can be a risk factor for hyperglycaemia which in this study showed 6 out of 16 smoker farmers had hyperglycaemia. Based on that incidence rate, clinical considerations show a fairly large results although statistically it shows no significance.

These results can be considered to providing nursing interventions. The importance in the provisioning of health screening programs and health education programs such as diet and physical activity to prevents and reduce the occurrence of health problems (Nur, 2019).

Lastly, this study has several limitations. The limitations in this study were due to the non-routine visits of participants to Posbindu PTM, it caused several data must be eliminated. A small amount of data can cause a lack of data variation that affects the results of this study. Besides the incomplete data in at least the variables studied, so that it can also cause the interpretation to be less broad. Therefore, research with primary data is needed to get a wider interpretation of the results and more complete data. Furthermore,

health workers are expected to provide health screening on the blood sugar levels and smoking behaviour of farmers and provide health education, counselling on the importance of the possess the blood sugar level's balance and than decrease a smoking intensity.

Conclusion: This study showed that there is no difference of blood sugar levels among smoker farmers and non-smoker farmers in Pakusari Public Health Centre of Jember Regency. The risk factors of DM can reduce by controlled the physical activity, diet, stress and smoking behaviour. However, in this study was found that there was a relationship between age and smoking behaviour, there was as relationship between gender and smoking, there was a relationship between physical activity and smoking behaviour and then there was a relationship between consumption of fruits and vegetables with blood sugar levels. Thus, the study results suggest that further identification of the factors that affect blood sugar levels needs to be control to reduce the incidence of DM.

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Appendix 1. KMS Questionnaire