The Relationship Between Basal Metabolism Index and Blood Sugar Levels Among Farmers: a Secondary Data Analysis of Non-Communicable Disease in Public Health Center of Pakusari, Jember Regency, Indonesia

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ABSTRACT

Obesity is a risk factor for hyperglycemia. Farmers are a group of people at risk of obesity and hyperglycemia due to a lifestyle that consumes foods high in fat and carbohydrates. The aim of this study wants to analyze the relationship between body mass index and blood sugar levels of farmers in the report of Integrated Development Post of Non-Communicable Disease (Posbindu PTM) Pakusari Jember Health Center. The survey analysis study used a retrospective cohort study. A design was used to analyze secondary data of Posbindu PTM Pakusari Jember Health Center registered from January to October 2020 among 345 farmers. A population of 345 farmers was selected by purposive sampling to be used as research samples. Characteristics of participants, height and weight, and random blood sugar levels were measured through a health monitoring book (KMS Posbindu PTM). The chi-Square test was used to answer the objective of the study. Among 146 farmers identified that 46.6% were obese and 45.9% were hyperglycemia. There was a relationship between body mass index and blood sugar levels in farmers (p-value = 0.000). Indirectly, body mass index affects blood sugar levels, manifesting as diabetes mellitus and other complications. Therefore, obesity should be identified as a risk factor associated with farmers' blood sugar levels.

KEYWORDS

Blood Sugar Levels, Body Mass Index, Obesity, Farmers

1. BACKGROUND

Farmers have risk factors for non-communicable diseases, including diseases related to blood sugar. In Indonesia, people with diabetes mellitus in agricultural communities reach 12.6% of the total population of Indonesia suffer from diabetes mellitus (10.9%) (Kemenkes RI, 2018). According to the Central Statistics Agency (2018), the number of farmers in

Indonesia reached 33.487.806 people (BPS, 2018). Jember Regency has the majority agriculture economy (51.89%) with a population working as farmers and farm laborers as many as 505.050 people (BPS Jember, 2020).

Farmers in rural communities have many risk factors for the occurrence of a health disorder, including lifestyle, physical factors, economic factors, sociodemographic factors, and factors from workload (Susanto, 2017). Blood sugar levels (KGD) are closely related to the incidence of health problems, namely type 2 diabetes as a result of KGD intolerance because insulin is not produced adequately by the pancreas gland caused by several factors including age, heredity, obesity, physical activity, hypertension, and obesity. nutritional intake (Kurniawati, 2016). Unbalanced nutritional intake impacts health problems, one of which is diabetes mellitus as a result of fat accumulation which results in obesity and hyperlipidemia and accumulation of KGD if it occurs for a long time can cause type 2 DM (Finley, 2019). One of the risk factors of non-convenient diseases that farmers may experience is obesity due to unbalanced nutrition intakes that create fat pillages in the body. Farmers have a risk of age-related disease and overworking hours in one day and 9.5% of coffee drinking and smoking activities if the farmers are obese (Susanto, 2016).

In Indonesia, according to the results of basic health research in 2018, the incidence of overweight in adults over 18 years reached (13.6%) and the incidence of obesity reached (21.8%) (Kemenkes RI, 2018). Consumption of unbalanced nutrition includes excessive fat consumption followed by regular work activities. It is not a sports activity where exercise has a regular intensity and schedule so that it can cause fat accumulation in adipose tissue, causing weight gain to obesity which can cause diabetes. mellitus due to insulin resistance caused by glucose metabolism cannot run smoothly (Malone, 2018). Excess fat in adipocytes results in oxidative stress, making glucose distribution by type 4 glucose carrier protein (GLUT4) inactive. Inactivation of GLUT4 reduces glucose response to insulin so that insulin fails to accumulate fat, which causes insulin to be produced more in the body by the pancreas, directly proportional to the increase in body fat. Individuals with excess fat will have high insulin as well as a result of inactivity (GLUT4) which makes insulin resistance in the body a cause of type 2 diabetes (Malone, 2019).

Specific identification of farmers regarding risk factors for non-communicable diseases due to blood sugar levels needs to be done to explain further the risk factors experienced by farmers. Therefore, identification was carried out related to farmers' body mass index and blood sugar levels. Furthermore, body mass index is not the only factor that causes an increase in blood sugar levels or the incidence of diabetes mellitus, it is necessary to identify the farmers further to determine the factors that can affect blood sugar levels in farmers to ensure that the body mass index is correct as a risk factor for non-communicable diseases due to blood sugar levels.

2. METHODS

This study was conducted with a case-control design and used a retrospective study approach to explain the course of the influence of independent factors on changes in dependent factors on the results of the study. This research was conducted by taking samples in the form of secondary data on implementing the integrated non-communicable disease development post on farmers in the work area of the Pakusari Jember Health Center (January-October 2020).

Inclusion criteria set out in this study include 1) Farmers who are registered as participants in Posbindu PTM with data on age, sex, and history of diabetes mellitus in the work area of the Pakusari Health Center Jember; 2) Posbindu PTM participants who have a record of checking blood sugar levels at random for three months in a row; 3) Posbindu PTM participants who have a record of checking their height and weight for three consecutive months; 4) Have random blood sugar test results in 75 mg/dl. The exclusion criteria for this study were: 1) Farmers participating in Posbindu PTM who did not have data on the characteristics of age, sex and history of diabetes mellitus; 2) Posbindu PTM participants who do not have the results of height or weight examination records; 3) Posbindu PTM participants who do not have the results of a random blood glucose examination record; 4) posbindu PTM participants who have a random blood sugar test record 75 mg/dl.

This research was conducted by collecting data on the Posbindu PTM register report and the health monitoring book of Posbindu PTM (KMS). Related to the respondent's random blood sugar level and body mass index. Body mass index was obtained from the records of the Posbindu PTM implementation of the respondent's

weight and height examination. Data on the respondent's weight and height were calculated using the formula weight/(height)², and then the respondent's body mass index value was obtained. The data obtained is then categorized based on the normal value of each data related to the randomization of blood sugar levels and body mass index. Random blood sugar levels were categorized into three categories, namely normal random blood sugar levels, pre-diabetes, and diabetes mellitus which each had a grading value of 80-144 mg/dl, pre-diabetes with a value of 145-199 mg. /dl, and hyperglycemia with a value of 145-199 mg/dl, value > 200 mg/dl. Body mass index categorization is categorized into two categories: normal weight with a value of 18-25 kg/m² and obesity with a value of 26 kg/m². Each category was processed using SPSS 23. Data analysis was carried out to determine the relationship between body mass index variables and blood sugar levels of farmers in the Pakusari Jember Health Center area with the Chi-square test with a significance level (p <0.05). This research has been approved by the Health Research Ethics Committee, Faculty of Nursing, University of Jember with number 978/UM25.8/KEPK/DL/2020.

3. RESULTS

The characteristics of the research respondents are presented in Table 1. There were 99 (78.6%) female visitors and 27 (21.4%) male participants. The age range of posbindu participants ranged from 22-59 years with a median value of 48 years. The majority of Posbindu participants work as farmers as many as 83 (65.9%) people with the most educational history being SD/SLTP 111 (88.1%) and the majority of participants with married status are 114 (90.5%) people.

Table 1. characteristic of the respondent (n=146)

characteristic		n (%)
Age (Years)	Mean ± SD	55.03±14.38
	Min-Max	22-96
	Std. Deviation	14.348
	Variance	205.854
	Range	74
Gender	Male	19.2
	Female	80.8
Diabetes Mellitus history on Family	Yes	17.1
	No	82.9

Note. Description: n (%) = Number of participants (percentage); Mean: Average; SD: Standard Deviation.

Body mass index categorization consists of two indicators: normal weight and obesity. The categorization was carried out to determine the body mass characteristics of farmers participating in Posbindu PTM. From Table 2 it is known that the characteristics of the body mass index of farmers participating in Posbindu PTM as much as 53.4% have a normal body mass index and 46.6% have an obese body mass index.

Table 2. Distribution of body mass index levels

Indicator	n (%)
Normal Body Mass Index	53.4
Obesity	46.6

Random blood sugar levels were categorized into three categories based on the Posbindu PTM examination records' results: normal, pre-diabetic, and diabetes mellitus. The random blood sugar levels of farmers participating in Posbindu PTM were categorized to determine the characteristics of random blood sugar levels possessed by farmers participating in Posbindu PTM in the work area of Pakusari Jember Health Center. Table 3 presents the characteristics of random blood sugar levels of posbindu PTM participants in the normal category of 37.7%, pre-diabetes at 16.4%, and hyperglycemia at 45.9%. (Table 3).

Table 3 Distribution of random blood sugar levels

Random blood sugar category	n (%)
Normal	37.7
Pre-diabetes	16.4
hyperglycemia	45.9

The results of the Chi-square test (Table 4) show a relationship between the body mass index and blood sugar levels of farmers in the working area.

Table 4. The relationship between body mass index and blood sugar levels of farmers in the working area of the Pakusari Jember Health Center

			Sugar blood levels			p-value
			Normal (<144)	Pre-diabetes (145-199)	hyperglycemia (>200)	
Body mass index	normal (18.5-25)	Count	44	14	20	0.000
		Expected Count	29.4	12.8	35.8	
	obesity (≥26)	Count	11	10	47	
		Expected Count	25.6	11.2	31.2	

4. DISCUSSION

Based on the results of 146 respondents the characteristics of respondents were dominated by women with 118 farmers (80.8%) while male visitors only found 28 farmers (19.2%) with an average age of 55. BMI levels of farmers participating in Posbindu PTM Pakusari Health Center in 2020, as many as 78 (53.4%) had a normal BMI category of 18.5-25 kg/m² and farmers had obesity nutritional status with BMI calculations 26 kg/m² as many as 68 (46.6%). Farmers participating in the Posbindu PTM in the Pakusari Jember Health Center work area have normal GDA levels of 37.7% and do not suffer from DM. Based on these data, there are 16.4% of farmers at pre-diabetes level and 45.9% hyperglycemia.

Obesity in terms of nutritional intake occurs in farmers because farmers consume food that is not balanced in terms of the number of nutrients in one serving of food and the frequency of eating in one day (Nur Imamah, 2022). Obesity in farmers occurs not only because of food consumption factors but also because of a decrease in the basal metabolic rate (BMR), namely a decrease in metabolism in resting conditions, this condition occurs due to age (Nadimin, 2019). The decrease in BMR occurs after the age of 25 years where the BMR decreases by 4% every ten years after the age of 25 years. In this study, the average age of farmers registered at PTM Posbindu is 54 years, most likely the BMR of farmers has decreased by 12%. The decrease in BMR results in the need for calories to maintain body weight whereas in old age the calories that exceed the body's needs in women are converted into fat. In contrast, in men it is converted into ready-to-use energy (Nadimin, 2019). The number of respondents in this study where as many as 46,6% of farmers were obese was also related to gender-related gender; in this study most of the respondents were female and had more risk for obesity than men (Puspitasari, 2018).

In this study, obesity was analyzed as a risk factor for disease due to blood sugar levels. It is known that obesity can be a cause of insulin resistance which causes type 2 diabetes mellitus (Malone, 2018). The increase in the level of BMI will increase the risk of hyperglycemia in farmers where the respondents in this study 46.6% are obese (Gray, 2016). Obesity can increase the risk of death from diabetes mellitus by up to 40% (Gray, 2016).

The conclusion of this study is that there is a relationship between body mass index and blood sugar levels of farmers in the Pakusari Jember Health Center Work area. Body mass index has a role in non-communicable diseases due to blood sugar levels. A body mass index that is more than ideal is determined to be one of the risk factors for the incidence of non-communicable diseases in farmers due to blood sugar levels. With this research, it is hoped that it can become the basis of information for health workers, especially in the field of education and provide preventive measures against risk factors for non-communicable diseases due to blood sugar. Of the respondents who attended the Posbindu PTM, the presence of men was minimal due to a lack of attention to preventing non-communicable diseases so

this research is expected to increase the capacity of nurses to provide motivation and confidence to farmers on the importance of disease prevention before they get sick because trust can be built from their awareness regarding the occurrence of a disease and the consequences for other people on the condition of the illness (Koike, 2019).

5. CONCLUSION

This study concludes a relationship between physical activity and blood pressure in PTM Posbindu participants in the work area of the Jenggawah Health Center. With this research, it is hoped that later health workers or local cadres can provide educational information, health promotion, and anti-hypertensive exercise programs that can increase respondents' physical activity under PTM Posbindu.

Further researchers can use primary data to calculate and determine the intensity of daily/weekly physical activity for each Posbindu participant in determining the adequacy of their activities. Future researchers can also consider other factors that may cause changes in blood pressure.

AUTHOR CONTRIBUTIONS

Substantial contributions to conception, data collection, analysis, and writing: Rizki Rama Aji. Data analysis and writing: Tantut Susanto, Latifa Aini Susumaningrum, Mokhlas Kholidi. Revise manuscript: Rismawan Adi Yunanto.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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