

# Relationship of vegetable and fruit consumption and farmers' blood sugar levels in Public Health Center of Pakusari, Jember

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**ABSTRACT** Low consumption of vegetables and fruits are one of the causes of digestive problems, coronary heart disease, and diabetes. Farmers are a vulnerable group for consuming vegetables and fruit less than the recommended 5 portions (250 grams) a day. The aim of this study was to analyze the relationship between vegetable and fruit consumption and the level of blood sugar among farmers with non-communicable diseases in the integrated health post (Posbindu) of Pakusari Health Center, Jember Regency. A retrospective cohort study design was used to analyze secondary data of Posbindu registered patients from January to March 2020 among 140 farmers. The characteristics of participants, vegetable and fruit consumption, and blood sugar were measured through the monitoring card of Posbindu. The data were analyzed using Chi-square tests ( $p$ -value  $<0.05$ ). Among 140 farmers as many as 71.4% were identified who consumed vegetables and fruit less than 5 portions a day and 35.7% who have hyperglycemia. There was a relationship between vegetable and fruit consumption and the farmer's blood sugar level ( $p$ -value:  $<0.001$ ;  $\chi^2$ : 13.144). Farmers who consumed vegetables and fruits less than 5 portions a day were 5 times more likely to experience hyperglycemia (RR:5.727; 95% CI=2.072–15.827). Therefore, community health nurses and health care providers should provide counseling to improve the consumption of vegetables and fruits to prevent the incidence of hyperglycemia among farmers.

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## 1. Introduction

The highest number of deaths in Indonesia is from Non-Communicable Diseases (NCDs). According to the World Health Organization, as many as 73% of Indonesian population deaths are caused by NCDs, and 6% of them are due to diabetes mellitus (DM).<sup>1</sup> In 2018, data showed that 6.2% of patients with DM were farmers with 41.4% with Disrupted Blood Sugar (GDP) and 30.5% with Impaired Blood Tolerance (TGT).<sup>2</sup> Diabetes is an endocrine disease caused by increased blood sugar levels due to age, gender, family history, obesity, lack of physical activity, and

unhealthy diet.<sup>3</sup>

Indonesia is the 4th largest economy in Asia with a total of 14% of the Gross Domestic Product (GDP) comes from the agriculture sector, predominately from rice farmers. Farmer's work system and risky lifestyle can cause several NCDs such as hypertension and diabetes. In farmers with diabetes the main causes are unhealthy lifestyle behaviors such as smoking and the low consumption of fruits and vegetables that are not in accordance with the recommended daily portions.<sup>4</sup> Consumption of foods high in fiber has been shown to reduce the incidence of Type 2 DM.<sup>5</sup> Not only fiber, but several antioxidants contained in vitamins can also help regulate and metabolize blood sugar. The content of food consumed has a significant impact on changes in blood sugar levels that trigger

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the development of DM. It is necessary to monitor the level of blood sugar in the body and the pattern of food consumption to maintain the stability of blood sugar levels.

In patients with DM, the performance of the pancreas will decrease so that it cannot produce insulin properly and has an impact on increasing blood glucose.<sup>6</sup> However, the performance of the pancreas can be improved by consuming fiber. Fiber and vitamins can be found in vegetables and fruit. Unfortunately, the average fiber consumption of Indonesian people is still below the recommended average fiber that must be consumed per day, which is 20-30 grams for women and 22-37 grams for men.<sup>7</sup> In addition to fiber, vitamins that contain antioxidants also affect blood sugar metabolism in the body. Consumption of fruits and vegetables that contain fiber affects the metabolism of blood sugar in the body so that the consumption of less fiber can reduce the risk of diabetes.

Apart from being a chronic disease that causes many deaths in Indonesia, DM is also a disease with the highest sufferers in Indonesia.<sup>8</sup> One of the efforts that can be done to overcome the problem of DM in Indonesia is the prevention of and education concerning non-communicable diseases (NCDs) control, through an integrated health post (Posbindu) activity which is conducted at community health service centers (Puskesmas) with NCDs risk factor measurement activities, NCDs risk factor interviews, and early action of NCDs risk factors.<sup>9</sup> However, these efforts have not been able to fully control the incidence of NCDs. This is evidenced by the low achievements that have been made related to the DM service program, even though the results of the early screening of patients with DM have increased.<sup>10</sup> The Posbindu activity at the Pakusari Health Center, Jember Regency showed fluctuating results. After screening 1,344 people in January 2019, 8.5% of them were categorized as DM. Then in February 2019, it increased to 18.3% and continued to increase rapidly to 32.2% in March 2019. Therefore, this study aimed to analyze the relationship between vegetable and fruit consumption and the level of blood sugar among farmers with non-communicable diseases in the Posbindu of Puskesmas Pakusari, Jember

Regency.

The latest data show that Indonesia is the third highest country with cases of undiagnosed diabetes in adults with the predominance of people coming from rural areas.<sup>11</sup> The significant increase in the Posbindu data made researchers conduct research related to the incidence of DM associated with the behavior of risk factors for low consumption of vegetables and fruit. Based on these data, it is important to conduct further research related to risk factors for DM, one of which is by examining the relationship between vegetable and fruit consumption and guideline daily amounts (GDA) levels.

## 2. Method

This study used a retrospective cohort method to analyze the correlation between risk factors for low consumption of vegetables and fruits on blood sugar levels in farmers with a population of 348 farmers who were registered at Posbindu Pakusari Health Center, Jember from January to March 2020.

This study used secondary data obtained in conjunction with the research of lecturers and the IDB research group. The inclusion criteria in this study were the participants of Posbindu Pakusari Health Center, Jember spread over 5 Posbindu, aged more than 15 years and worked as farmers. Meanwhile, the exclusion criteria in this study were participants who did not have complete data and were absent for 3 consecutive times in January until March, 2020. Based on these criteria, a total sample of 140 people was obtained.

The tools that were used in this study were a health monitoring card questionnaire containing identity data. The identity data include age, gender, education and marital status, results from examinations and interviews related to vegetable and fruit consumption, random blood glucose test results at Posbindu. The health monitoring card used in this study contains indicators of consumption of vegetables and fruit as well as the examination of random blood glucose result. In accordance with guideline book for Posbindu supervisor, the measurement of blood sugar risk factors is divided into two groups there is <200 mg/dl as the group with normal blood glucose and  $\geq 200$  mg/dl as the

**Table 1.** Distribution of sociodemographic data of participants

Characteristics	n	%
<b>Age (year)</b>		
Median (P25 - P75)	45	33.0-53.0
<b>Gender</b>		
Male	27	19.3
Female	113	80.7
<b>Education history</b>		
Not attending school	28	20.0
Elementary school	59	42.1
Junior high school	32	22.9
Senior high school	21	15.0
<b>Marital Status</b>		
Married	140	100.0
Single	0	0

**Table 2.** Distribution of consumption of vegetables and fruit in the Posbindu Pakusari Health Center

Levels of consumption of vegetables and fruit	n	%
More than equal to 5 portion a day	40	28.6
Less than 5 portion a day	100	71.4

**Table 3.** Distribution of GDA levels at the Posbindu Pakusari Health Center

GDA levels	n	%
<200 mg/dl	90	64.3
≥ 200 mg / dl	50	35.7

hyperglycemic group.<sup>12</sup>

The data obtained were entered manually through Microsoft Excel to be processed in SPSS (IBM Corp, Armonk, NY). The data entered into SPSS include the characteristics of the respondents, namely information related to gender, age, marital status, education as well as the results of the GDA examination at the time and data related to consumption of vegetables and fruit. All data from January-November 2020 were entered for further sorting in the next process. The data on vegetable and fruit consumption were taken from the Posbindu screenings including questions about NCDs risk factors: vegetable consumption <5 servings a day while for blood sugar levels using random GDA results from KMS Posbindu data. For inputting the data, the codes used were:

- For Fruit and vegetable consumption:

- 1) Less than 5 portion a day = 1
  - 2) More than equal to 5 portion a day = 2
- GDA Levels
  - 1) ≥ 200 mg/dl =1
  - 2) < 200 mg/dl = 2

In the data collection process, the researchers coordinated with the person in charge of the Posbindu program at the Pakusari Health Center and processed the data obtained so that they could be analyzed and conclusions drawn. This research has been approved by the Health Research Ethics Committee of the Faculty of Nursing, University of Jember number 978/UM25.8/KEPK/DL/2020.

The data processing in this study used the SPSS application. The data inputted into the application were respondent characteristics data and random blood glucose examination data contained in the health monitoring card of Posbindu. Univariate analysis used in this study included analysis related to the percentage and frequency of age, gender, education, marital status, level of consumption of vegetables and fruits, and the level of GDA. Meanwhile, the bivariate data were analyzed using the chi-square tests with a significant level of < 0.05 and odds ratio (OR) to determine the relationship and assessment of risk factors between the two variables.

### 3. Result

Table 1 shows that the median age of the visitors was 45 years old who are predominately women with a significant difference in gender, namely as many as 113 female farmers (80.7%) compared to men, namely 27 farmers (19.3%). Of the total 140 visitors, the majority of them had an elementary school education level (42.1%) and all of them were married.

In addition, as many as 100 farmers (71.4%) are farmers with low fruit and vegetable consumption with less than 5 portions a day and 40 (28.6%) do not eat vegetables and fruit less than 5 portion a day (Table 2). Table 3 describes that as many as 90 farmers (64.3%) had a random blood glucose level <200 mg/dl, and the rest (35.7%) had a random blood glucose level >200 mg/dl.

**Table 4.** Distribution of consumption of vegetables and fruit in the Posbindu Pakusari Health Center

Vegetables and fruit consumption	Random blood glucose		$\chi^2$ (p-value)	RR	CI 95%	
	$\geq 200$ mg/dl n (%)	$< 200$ mg/dl n (%)			Min	Max
Less than 5 portion a day	45 (90.0)	55 (61.1)	13.144 ( $< 0.001$ )	5.727	2.072	15.827
More than equal to 5 portion a day	5 (10.0)	35 (38.9)				

CI, confidence interval; RR, risk ratio.

Table 4 shows that using chi-square analysis obtained a p-value of 0.001 ( $< 0.05$ ). A total of 45 farmers consumed vegetables and fruit with less than 5 portion a day having a random blood glucose  $\geq 200$  mg/dl or hyperglycemia (90%), while 55 other farmers had a random blood glucose  $< 200$  mg/dl (61.1%). The 95% confidence value is 2.072-15.872 with an OR of 5.727, which means that farmers who eat less than 5 portions a day of vegetables and fruit have 5 times higher risk of experiencing hyperglycemia.

#### 4. Discussion

Consumption of vegetables and fruit can be a solution to reducing the number of NCDs, especially related to DM.<sup>13</sup> Several factors such as occupation, age, education and income can affect the consumption of vegetables and fruits. In this study, from a total of 140 samples, the mean age of visitors to PTM Posbindu was 45 years old, which is in line with research that found consumption of vegetables and fruit at the age of 45-55 years was only 1 - 2 portion a day.<sup>13</sup>

Based on the register data and the health monitoring card of the Posbindu questionnaire, there is no detailed explanation regarding the specifications for the amount of vegetable and fruit individual consumption. The different fiber content in certain vegetables and fruits can lower the glycemic index number which affects the decrease in insulin. Consumption of vegetables and fruit has a different impact, especially on increasing blood sugar levels. Consumption of vegetables and fruit  $> 4$  servings per day was found to have a blood glucose-lowering effect in men but not in women.<sup>13</sup> However, there is one study that showed that no significant impact was found in patients with type 2 DM.<sup>10</sup>

In this study, the consumption of vegetables

and fruit in farmers was less than 5 servings per day with blood sugar mostly  $< 200$  mg/dl or normal (61.6%). However, we found 64.3% farmers with normal blood glucose ( $< 200$  mg/dl) and 35.7% with hyperglycemia ( $\geq 200$  mg/dl). Most of the farmers visiting Posbindu are in the married status. Family strength is the potential of individuals in influencing changes in the behavior of others in a positive direction.<sup>14</sup> A good pattern of family strength can motivate family members to take preventive measures to increase fruit and vegetable consumption so that blood sugar conditions in more farmers are within the normal range.

Consumption of fruits and vegetables is one of the triggers for balancing blood sugar levels. The fiber content found in vegetables can lower the glycemic index number which affects insulin production. The same effect also happens with the relatively high vitamin content in fruits, whereby the vitamin D and antioxidants can stabilize the condition of blood sugar levels. Some fruits such as bananas, avocados, watermelons, and melons have high fructose content. Generally, the fructose content in fruit ranges from 5-10%. In this case, it triggers an increase in blood sugar levels even though the consumption of vegetables and fruit is fairly good.<sup>15</sup> Therefore, consumption of vegetables and fruit has an impact on blood sugar conditions related to hyperglycemia as an indication of DM.

Based on this study, there is a correlation between fruit and vegetable consumption and blood glucose levels in Pakusari Jember Regency of Indonesian farmers. The results of this study are in line with previous studies indicating that the consumption of vegetables and fruit can reduce DM risk factors but not with a significant impact.<sup>10</sup> The relationship in this study indicates that most of the farmers with consumption of vegetables and

fruit < 5 servings per day have normal random blood glucose or < 200 mg/dl.

This study has some limitations, since the retrospective case-control method limits the research results because the researchers used past data with low accuracy due to the respondents having to recall past events. This study also used secondary data based on the results of the PTM Posbindu examination for only 3 months due to the pandemic conditions during the study. Additionally, this study only focused on the consumption of vegetables and fruit as a risk factor for random blood sugar of farmers, when there are several other important factors such as exercise in daily life activities. There is a need for further and specific research related to the consumption of vegetables and fruits with GDA results. Bias in the study may arise because the research only focuses on fruit and vegetable consumption and GDA levels in farmers, so further research is needed regarding the relationship between other variables that are known diabetes risk factors in a wider population.

## 5. Conclusion

There is a correlation between the consumption of vegetables and fruit with blood sugar levels in farmers at the Posbindu Pakusari health center. The blood sugar levels in farmers at Posbindu Pakusari health center were normal in 90 farmers (64.3%) and consumption of vegetables and fruit in farmers was relatively low, indicated by consumption of vegetables and fruit < 5 servings/day which was found in 100 farmers (71.4%). In this regard, it is hoped that farmers with hyperglycemia will take advantage of the Posbindu service as an effort to control health-related issues, especially related to diabetes mellitus. Furthermore, research using primary data can be conducted so that it can determine the indicators and questionnaires needed to find out more specific correlations.

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## Conflict of interests

There is no conflict of interest in this study.

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