



## Correlation between Nutritional Status and Fasting Blood Glucose Levels in the Elderly: An Investigative Study

Retno Dewi Noviyanti<sup>1</sup>, Dewi Pertiwi Dyah Kusudaryati<sup>1</sup>, An-Nisa Visi Asmara<sup>1</sup>,  
Dhinda Kusuma Hatifah<sup>1</sup>

<sup>1</sup> ITS PKU Muhammadiyah Surakarta, Surakarta, Indonesia

Correspondence author: Retno Dewi Noviyanti

Email: [retnodewin@itspku.ac.id](mailto:retnodewin@itspku.ac.id)

Address : Jl. Tulang Bawang Selatan. No.26, Kadipiro, Surakarta, 57136, Jawa Tengah, 081329314005

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### ABSTRACT

**Introduction:** Elderly is an advanced stage of a life process which is characterized by a decrease in the body's ability. One of the diseases that often affects the elderly is diabetes mellitus. Blood glucose levels in patients with diabetes mellitus must be controlled to prevent complications. In addition to diet and drug use, nutritional status also plays a role in maintaining blood sugar.

**Objective:** The purpose of this study was to determine the relationship between nutritional status and blood glucose levels in the elderly.

**Method:** The research method was cross sectional, with a sample of elderly people in the Gambirsari Surakarta health center area in August 2023, totaling 99 elderly people with an age range of 48 – 82 years. The variables studied were nutritional status and current blood glucose (GDS). Primary data collection method by measuring weight and height as well as examining the GDS. Data were analyzed with Spearman's rho.

**Result:** The research results showed that the majority were female (73.7%), the age range was 48 – 82 years with an average age of  $61.31 \pm 6.77$  years, an average nutritional status of  $25.56 \pm 4.85$  kg/ m<sup>2</sup> category, mostly fat, 54 people (54.5%), the average blood sugar level was  $135.13 \pm 63.26$  mg/dL with the normal category 88.9%, abnormal 11.1%, correlation test results nutritional status with random blood sugar levels ( $p=0.012$ ).

**Conclusion:** The conclusion of the study is that there is a relationship between nutritional status and blood sugar levels during.

**Keywords:** blood glucose, diabetes mellitus, elderly, nutritional status

## Introduction

Elderly individuals represent an advanced stage in the life process characterized by a decline in the body's ability to adapt to the environment, a condition marked by an individual's failure to maintain balance against physiological stress conditions (Effendi and Makhfudli, 2009). One of the common diseases affecting the elderly is diabetes mellitus. Diabetes Mellitus (DM) is a metabolic disorder characterized by an increase in blood sugar levels (hyperglycemia) due to abnormalities in insulin secretion, insulin action, or both. Insulin functions to regulate the balance of blood sugar levels; however, when glucose/carbohydrate intake is excessive, insulin is unable to maintain equilibrium, leading to hyperglycemia (ADA, 2017). The most severe consequences of DM include a higher risk of cardiovascular diseases, kidney diseases, blood vessel rupture, heart attacks, strokes, foot ulcers, and infections.

According to the International Diabetes Federation (IDF), the global prevalence is estimated to increase to 48% or 629 million individuals aged 20-79 by the year 2045. Indonesia ranks 6th globally with the highest number of diabetes patients, estimated at 10.3 million, and is projected to increase to 16.7 million by 2045 (IDF, 2017). IDF reports that 19.5 million people (10.6%) aged 20-79 in Indonesia suffer from diabetes (IDF, 2021). DM is the second leading cause of death in Indonesia at 8.5%, following strokes at 10.9%. Based on doctor diagnoses in Central Java, the prevalence is 1.59%, with 91,161 cases of DM, and the city of Surakarta has 1,370 cases (Riskasdas, 2018). Changes in lifestyle, unhealthy food consumption, and lack of physical activity contribute to the increasing number of diabetes patients (Smeltzer and Bare, 2015). Although DM is a chronic disease that does not directly cause death, improper management can have fatal consequences. The management of DM requires a multidisciplinary approach, encompassing both pharmacological and non-pharmacological therapies.

Most DM patients have higher nutritional status (especially obesity) (Eckel et al., 2011). DM patients with higher nutritional status tend to have higher blood glucose levels compared to those with normal nutritional status (Shu et al., 2017). Setyaningsih's research (2013) indicates an average blood glucose level of  $307 \pm 107.38$  mg/dL in DM patients with higher nutritional status, which is higher than patients with normal nutritional status at  $257.55 \pm 73.79$  mg/dL. Prolonged high blood glucose levels can trigger DM complications such as heart disease, stroke, neuropathy, retinopathy, kidney failure, and even death (Sanal et al., 2011).

## Objective

The purpose of this study was to determine the relationship between nutritional status and blood glucose levels in the elderly.

## Method

This study employed a cross-sectional research design and was conducted in August 2023 in the working area of the Gambirsari Community Health Center, Surakarta City. The research involved a sample of 99 elderly individuals, selected using purposive sampling. The research instruments included a Sample Identification Form, an informed consent form, and an Easy Touch GCU.

The independent variable was nutritional status, and the dependent variable was fasting blood sugar levels. Data collection involved measuring weight and height and examining fasting blood sugar levels. Statistical analysis of the data utilized Spearman's rho test. The research procedures included a letter requesting participation as a sample, an explanatory

letter to the sample, and a letter of willingness to become a sample, ensuring no coercion was imposed on the participants.

## Result

### Univariate analyses

Table 1. Univariate analyses

Variables	N MIN-MAX	% $\bar{x} \pm SD$
<b>Sex</b>		
Male	26	26.3
Female	73	73.7
Age	48 – 82	61.31 ± 6.77
<b>Nutritional Status</b>		
Underweight	5	5.1
Normal	40	40.4
Overweight	54	54.5
<b>Blood Glucose</b>		
Normal	88	88.9
Abnormal	11	11.1

Table 1 shows mostly females (73.7%), aged 48–82 years with an average of 61.31 ± 6.77 years. The average BMI is 25.56 ± 4.85 kg/m<sup>2</sup>, mostly in the overweight category (54.5%). Fasting blood sugar averages 135.13 ± 63.26 mg/dL, with 88.9% in the normal range and 11.1% abnormal.

### Bivariate analyses

Table 2. Bivariate analyses

Variabel	$\bar{x} \pm SD$	r	p*
Status Gizi (kg/m <sup>2</sup> )	25,56 ± 4,85	0,252	0,012
Kadar Gula Darah Sewaktu (mg/dL)	135,13 ± 63,26		

\*Spearman's rho

Based on the Spearman's rho test, the results indicate a significant relationship between nutritional status (BMI) and blood sugar levels (p=0.012).

## Discussion

### Sex

In this study, the majority were females (73.7%). Research indicates that females (31.1%) have a 2.15 times greater risk of developing type 2 diabetes mellitus compared to males (14.5%). This is attributed to females being more prone to weight gain, especially post-menopause, where hormonal processes lead to fat accumulation (Rosita et al., 2022).

### **Age**

The age range of the sampled patients was 48 – 82 years, with an average age of 61.31 ± 6.77 years. Research suggests that individuals aged ≥45 years (56.2%) have an 8 times higher risk of type 2 diabetes mellitus compared to those <45 years (43.8%). Increased risk in those aged >45 is associated with degenerative factors leading to decreased glucose metabolism function (Kekenusa et al., 2013; Wicaksono, 2011).

### **Nutritional Status**

The average nutritional status (BMI) in this study is 25.56 ± 4.85 kg/m<sup>2</sup>, with 54.5% classified as overweight. Obesity, a significant risk factor for Type 2 Diabetes Mellitus (T2DM), results in excess fat interfering with metabolic processes and contributing to insulin resistance (Wu et al., 2014; Ma and Chan, 2013).

### **Blood Glucose**

The average fasting blood sugar level in this study is 135.13 ± 63.26 mg/dL, with 88.9% falling within the normal range and 11.1% categorized as abnormal. Blood glucose, a crucial energy source for cells, is tightly regulated. Normal blood glucose ranges from 3.5-5.5 mmol/L. Prolonged imbalance, as observed in diabetes, disrupts glucose homeostasis (Suryati, 2021).

### **Correlation between Nutritional Status and Fasting Blood Sugar**

According to the Spearman's rho test, there is a significant relationship between nutritional status (BMI) and fasting blood sugar levels (p=0.012). Nutritional status, particularly in overweight conditions, influences blood glucose levels in T2DM patients. Imbalances in energy intake and expenditure lead to fat accumulation, affecting glucose homeostasis. Elevated free fatty acids interfere with insulin signaling pathways, causing insulin resistance and hyperglycemia (Boden, 2011; Toit et al., 2012).

### **Conclusion**

There is a relationship between nutritional status and fasting blood sugar levels in the elderly (p=0.012).

### **Source of funding**

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### **Conflict of interest**

There is no conflict of interest.

### **Ethical approval**

This study was approved by Institutional Research Board No. 399/LPPM/ITS.PKU/IX/2023.

### **Authors' contribution**

Each author contributed equally in all the parts of the research. All authors have critically reviewed and approved the final draft and are responsible for the content and similarity index of the manuscript.

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