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Early Screening of Diabetes Mellitus Through Blood Glucose Level Examination

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Abstract
Early detection of non-communicable diseases is essential to reduce the growing burden of diabetes mellitus and hypertension at the community level. This study aimed to identify individuals at risk through a community-based health screening program conducted at Graha Mas Residence. A descriptive observational design was applied. Twelve adult participants voluntarily underwent structured anamnesis, systolic blood pressure measurement, and random blood glucose (RBG) testing using a standard glucometer. Data were analyzed descriptively using frequency and percentage distributions. The results showed that 4 participants (33.3%) had RBG levels >150 mg/dl, while 5 participants (41.7%) had systolic blood pressure >140 mmHg. These findings indicate the presence of individuals at potential risk for metabolic and cardiovascular disorders within the community. Elevated random blood glucose levels suggest the need for further confirmatory testing, such as fasting plasma glucose or HbA1c measurement. Meanwhile, increased systolic blood pressure highlights the importance of early hypertension detection and management to prevent future cardiovascular complications. Although the sample size was limited, the proportion of abnormal findings underscores the relevance of community-based screening as a preventive strategy. Early identification allows timely health education, lifestyle modification, and referral to appropriate health services. Integrating routine screening with promotive and preventive interventions may contribute significantly to reducing the incidence and complications of diabetes and hypertension. In conclusion, community health screening is a feasible and practical approach for early risk detection of non-communicable diseases. Strengthening such programs at the local level may support broader public health efforts in controlling metabolic and cardiovascular risk factors.
Keywords: Community Screening, Hyperglycemia, Hypertension, Cardiovascular Risk, Preventive Health

1. Introduction

American Diabetes Association (ADA, 2024) defines diabetes mellitus as a chronic metabolic disorder characterized by hyperglycemia resulting from defects in insulin secretion, insulin action, or a combination of both. Persistent hyperglycemia contributes to long-term damage to various organs, including the kidneys (nephropathy), retina (retinopathy), peripheral nerves (neuropathy), and the cardiovascular system. These complications significantly increase morbidity, mortality, and healthcare costs worldwide (Ceriello & Colagiuri, 2025).

Globally, the burden of diabetes continues to rise. The International Diabetes Federation (IDF, 2023) reported that more than 500 million adults were living with diabetes in 2023, and nearly half of them were undiagnosed. This situation highlights the urgent need for improved early detection strategies, as delayed diagnosis increases the risk of long-term complications (Zhang et al., 2023). Indonesia is ranked among the top ten countries with the highest number of people living with diabetes (IDF, 2023), making diabetes prevention and control a national public health priority.

The World Health Organization (WHO, 2023) identifies diabetes as one of the leading causes of death from noncommunicable diseases (NCDs), particularly in developing countries. Rapid urbanization, unhealthy dietary patterns characterized by high sugar and fat intake, and sedentary lifestyles have contributed significantly to increasing rates of obesity and insulin resistance (Hu et al., 2025). Obesity plays a central role in the development of insulin resistance through elevated free fatty acids and pro-inflammatory mediators (Baynouna AlKetbi et al., 2025).

At the national level, the Kementerian Kesehatan Republik Indonesia has reported a steady increase in diabetes prevalence based on the latest National Basic Health Research (Riskesdas) findings (Kemenkes RI, 2023). This trend is consistent with recent evidence showing a significant rise in both diabetes and prediabetes prevalence in Indonesia over the past decade (Muharram et al., 2025).

Type 2 diabetes mellitus is the most common form and often develops gradually without specific symptoms in its early stages (ADA, 2024). According to WHO (2023), diabetes can be diagnosed when random blood glucose is ≥200 mg/dL accompanied by classic symptoms, or fasting blood glucose is ≥126 mg/dL. However, many individuals remain in a prediabetic state without being aware of their elevated risk (Yang et al., 2024). Chronic hyperglycemia induces oxidative stress and endothelial dysfunction, leading to microvascular and macrovascular complications (Ceriello & Colagiuri, 2025).

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Early screening through blood glucose testing is an effective strategy to identify individuals with prediabetes or undiagnosed diabetes (Zhang et al., 2023). A five-year risk prediction model demonstrated that early intervention significantly reduces the progression from prediabetes to type 2 diabetes (Zhang et al., 2025). Furthermore, WHO (2023) reports that lifestyle modification—including increased physical activity, healthy dietary practices, and weight management—can reduce the risk of developing type 2 diabetes by more than 50%.

Community-based interventions have proven effective in improving health awareness and promoting behavioral change (Priyanto et al., 2024). In addition, the development of risk-based early detection systems and digital screening innovations has expanded opportunities for broader community outreach (Ginting et al., 2023). Therefore, community service initiatives focusing on blood glucose screening and health education represent a strategic preventive approach to diabetes control.

This community-based screening program aims to identify individuals at risk, enhance public awareness regarding diabetes risk factors, and encourage sustainable lifestyle modifications. Through early detection and health education, such initiatives contribute to reducing the incidence of diabetes and its complications at the community level.

2. Materials and Methods

2.1 Study Design and Setting

This study employed a descriptive observational design conducted through a community-based screening activity. The screening procedures followed the guidelines for random blood glucose (RBG) testing recommended by the American Diabetes Association (ADA, 2024). The activity was carried out in the community of Graha Mas Residence.

2.2 Population and Sample

The target population comprised residents of Graha Mas Residence who were willing to participate in the screening program. A total of 12 participants voluntarily enrolled in this activity. Inclusion criteria were adults residing in the housing area who consented to undergo health assessment. There were no specific exclusion criteria other than refusal to participate.

2.3 Materials and Instruments

The materials used in this study included:

1. A calibrated digital sphygmomanometer for blood pressure measurement.
2. A standard glucometer with compatible test strips for random blood glucose testing.
3. Alcohol swabs, sterile lancets, and personal protective equipment (PPE).
4. A structured anamnesis form for demographic and health history data collection.

The measurement procedures adhered to the operational standards for point-of-care blood glucose testing recommended by the World Health Organization (WHO, 2023).

2.4 Procedures

The screening was conducted in three stages:

1. Anamnesis: Participants were interviewed using a structured form to collect data on age, sex, history of diabetes mellitus, family history, and current symptoms related to hyperglycemia.
2. Blood Pressure Measurement: Blood pressure was measured in a seated position after the participant had rested for at least 5 minutes.
3. Random Blood Glucose Examination: Capillary blood samples were obtained from the fingertip using sterile lancets. Random blood glucose levels were measured using a standard glucometer according to manufacturer instructions and WHO procedures.

All instruments were checked for proper functioning prior to use to ensure measurement accuracy.

2.5 Data Analysis

The collected data were analyzed descriptively using frequency distribution and percentage calculations. Results were presented in tabular form to describe participant characteristics, blood pressure status, and random blood glucose levels.

2.6 Data Availability

All materials, anonymized datasets, and screening protocols used in this study are available from the corresponding author upon reasonable request. No large datasets were deposited in a publicly accessible database, as the data were limited to community-level screening results.

3. Results

The community health screening conducted at Graha Mas Residence involved 12 participants who underwent random blood glucose (RBG) testing and systolic blood pressure measurement. The examination results are presented in Table 1 below.

Based on Table 1, four participants (33.3%) had random blood glucose levels >150 mg/dl, while eight participants (66.7%) had levels ≤150 mg/dl. Regarding systolic blood pressure, five participants (41.7%) had systolic blood pressure >140 mmHg, whereas seven participants (58.3%) had systolic blood pressure ≤140 mmHg.

Table 1. Distribution of Random Blood Glucose Levels and Systolic Blood Pressure Among Screening Participants (n = 12)

Variable	Category	Frequency (n)	Percentage (%)
Blood Glucose	>150 mg/dl	4	33.3
	≤150 mg/dl	8	66.7
Systolic Blood Pressure	>140 mmHg	5	41.7
	≤140 mmHg	7	58.3

4. Discussion

The screening results showed that 33.3% of participants had random blood glucose (RBG) levels >150 mg/dl. Although RBG testing is not a definitive diagnostic method for diabetes mellitus, random blood glucose levels ≥140 mg/dl have been identified as indicators requiring further evaluation. International studies have demonstrated that elevated glucose levels, even within the prediabetes range, are associated with an increased risk of cardiovascular complications and long-term mortality (Huang et al., 2016; Rawshani et al., 2018). Therefore, the finding that one-third of participants had RBG >150 mg/dl indicates the presence of a high-risk group requiring additional assessments such as HbA1c testing or fasting plasma glucose measurement.

Globally, diabetes mellitus is one of the fastest-growing non-communicable diseases. Large-scale epidemiological analyses have shown that the rising prevalence of diabetes occurs particularly in developing countries and urban communities, in parallel with lifestyle transitions and dietary changes (Zheng et al., 2018). Early detection through community-based screening has been proven effective in identifying previously undiagnosed cases, thereby enabling earlier interventions to prevent chronic complications (Si et al., 2020).

In addition to glycemic abnormalities, 41.7% of participants had systolic blood pressure >140 mmHg. Hypertension is a major global risk factor for cardiovascular disease and is often underdiagnosed because it is frequently asymptomatic in its early stages. A large meta-analysis demonstrated that every 20 mmHg increase in systolic blood pressure doubles the risk of mortality from ischemic heart disease and stroke (Lewington et al., 2002). These findings indicate that nearly half of the participants were in a condition associated with an increased risk of future cardiovascular events.

The relationship between hyperglycemia and hypertension is synergistic. Individuals with diabetes are approximately twice as likely to develop hypertension compared to the general population, and the coexistence of both conditions significantly increases the risk of macrovascular complications (Cheung & Li, 2012). A large national cohort study further demonstrated that simultaneous control of glucose levels and blood pressure significantly reduces the risk of major cardiovascular events and mortality (Rawshani et al., 2018).

Thus, the findings of this screening activity reveal the presence of a high-risk group within the community that requires preventive interventions and clinical follow-up. Although the sample size was limited, the proportion of participants with abnormal findings is substantial enough to highlight the importance of community-based early detection programs. Lifestyle-based interventions—including increased physical activity, healthy dietary patterns, and weight management—have been shown to effectively reduce the progression from prediabetes to type 2 diabetes (Knowler et al., 2002).

Community screening serves not only as an early identification tool but also as a promotive and preventive strategy in controlling non-communicable diseases. Integrating routine screening with health education and a clear referral system can be a strategic approach to reducing the burden of diabetes and hypertension at the community level.

5. Conclusions

This community-based screening study identified a substantial proportion of participants with elevated random blood glucose and systolic blood pressure levels. Specifically, 33.3% of participants had random blood glucose levels >150 mg/dl, and 41.7% had systolic blood pressure >140 mmHg. These findings indicate the presence of a high-risk group within the community for metabolic and cardiovascular disorders.

The results support the objective of this study, which was to identify early risk factors for non-communicable diseases through community screening. The findings demonstrate that simple, point-of-care assessments conducted at the community level are capable of detecting individuals who may require further clinical evaluation. Elevated random blood glucose levels suggest the need for confirmatory testing such as fasting plasma glucose or HbA1c measurement, while increased systolic blood pressure highlights the importance of hypertension monitoring and management.

The coexistence of hyperglycemia and elevated blood pressure further emphasizes the potential risk of future cardiovascular complications. Therefore, community-based screening programs can serve as an effective preventive strategy to reduce the burden of undiagnosed diabetes and hypertension.

However, this study has several limitations. The small sample size limits the generalizability of the findings to the broader population. Additionally, the use of random blood glucose testing alone does not allow for definitive diagnosis of diabetes mellitus. Future research should involve larger sample sizes, incorporate confirmatory laboratory measurements, and explore longitudinal follow-up to assess the progression of identified risk factors.

In conclusion, this study highlights the importance of early detection initiatives at the community level. Integrating routine screening with structured health education and referral systems may significantly contribute to the prevention and control of non-communicable diseases, particularly diabetes mellitus and hypertension

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Ethical considerations

This study was conducted in accordance with ethical principles for research involving human subjects. Participants provided informed consent prior to data collection. The screening activity followed national and institutional ethical standards for community health services. Participant confidentiality and anonymity were strictly maintained throughout the study.

Conflict of Interest

The authors declare no conflicts of interest.

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