THE INFLUENCE OF URIC ACID, HYPERTENSION, AND AVERAGE WALKING DISTANCE ON THE HISTORY OF DIABETES IN HUSBANDS IN BABAKAN VILLAGE, DRAMAGA SUBDISTRICT, BOGOR REGENCY

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Abstract

Diabetes mellitus is often associated with an increase in uric acid and serves as a risk factor for the occurrence of hypertension and walking activity. This study aims to examine the influence of uric acid, hypertension, and the average walking distance on the history of diabetes in husbands in the village of Babakan, Dramaga District, Bogor Regency. The research was conducted in the village of Babakan, Dramaga District, Bogor Regency. The method used in this research is a survey method through interviews using questionnaires, layered random sampling, the data obtained are primary data, processed with Microsoft Excel, analyzed using the Statistic Analysis System (SAS), and tested for significance using binary logistic regression with multiple independent variables. The results show a significant influence between uric acid and the average walking distance on the history of diabetes in husbands ($p<0.05$), but there is no significant influence between hypertension and the history of diabetes in husbands ($p>0.05$) in the village of Babakan, Dramaga District, Bogor Regency. The odds ratio indicates that husbands with uric acid and hypertension are more at risk of diabetes, and the farther the walking distance of husbands, the lower the likelihood of diabetes.

Keywords: diabetes mellitus, husband, hypertension, uric acid, walking activity

INTRODUCTION

Family health is closely related to the overall health condition of the individual, including the risk of diabetes in the husband. The prevalence of diabetes mellitus is rising annually, making it a global health concern. The World Health Organization (WHO) reports that Indonesia has the fourth-highest rate of diabetes worldwide, with 8,6% of the population living with the disease (Megawati et al., 2020). This findings of Riskesdas (2019), which indicate that the prevalence of diabetes in Indonesia increased from 6,9% in 2013 to 8,5% in 2018, with an estimated 16 million individuals living with the disease, corroborate this data. Globally, the International Diabetes Federation (IDF) noted that in 2019 there were around 463 million individuals aged 20–79 years who suffered from diabetes, with a prevalence of 9,3%, higher in men (9,65%) than women (9%). This number is expected to continue to increase to reach 700 million cases by 2045. At the national level, Riskesdas (2018) reported a diabetes prevalence of 1,5% for all age groups, with DKI Jakarta having the highest figure of 3,4%, followed by West Java at 1,7%. According to the 2017 Bogor City Health Profile, in Indonesia the number of diabetes cases was recorded at 27,000 cases per year. In contrast, Bogor City had 19.694 cases of diabetes mellitus in 2020, indicating a high regional disease burden (Rahmah & Parinduri, 2020).

Diabetes mellitus is a clinical condition characterized by elevated blood glucose levels that fall as a result of increasing insulin production and insulin resistance (Safitri & Nurhayati, 2019). The insulin hormone itself plays an important role in maintaining the balance of glucose levels in the blood. When the production or function of the insulin hormone is disrupted, glucose cannot be metabolized optimally, causing hyperglycemia or increased blood sugar levels above the normal threshold. Hyperglycemia is a typical manifestation of uncontrolled diabetes mellitus and if it persists in the long term can cause various systemic complications (Putra et al., 2019). Risk factors are conditions or circumstances that can influence the onset of a disease or a person's health status, and play a role in determining the likelihood of complications. There

are two types of risk factors for type 2 diabetes mellitus: modifiable and non-modifiable factors (Rediningsih & Lestari, 2022). According to the American Diabetes Association (ADA), non-modifiable factors include a family history of diabetes mellitus, advanced age, certain races or ethnicities, and other genetic factors. At the same time, modifiable factors include being overweight, not exercising, having high blood pressure (hypertension), having impaired blood fat (dyslipidemia), having elevated uric levels, and eating an unhealthy diet (Widiasari et al., 2021).

An rise in uric acid levels, a sign of inflammation or metabolic and cardiovascular problems in diabetic patients, is one of the modifiable risk factors that should be taken into account when a patient has a history of diabetes mellitus (Feqqi et al., 2021). Uric acid is the end result of metabolism in the body whose levels should not be excessive. The normal value of uric acid in the blood in men is 3,4-7,0 mg/dL, while in women it is 2,4-6,0 mg/dL (Jais et al., 2021). Uric acid is one of the metabolites that frequently have elevated levels in persons with type 2 diabetes mellitus. According to research by Jais et al. (2021), uric acid levels in people with diabetes mellitus increased. This is in line with the statement of Wijayakusuma and Setiawan (2015) in Jais et al. (2021), that hyperuricemia is one of the triggers for diabetes mellitus.

Increased uric acid (hyperuricemia) is a condition in which there is an increase in uric acid in the body due to increased production, decreased elimination through the kidneys, or increased consumption of purine-rich foods (Fitriani et al., 2021). This increase in uric acid levels is related to hyperinsulinemia, which can disrupt endothelial function by inhibiting nitric oxide production, thereby contributing to vascular dysfunction (Abbas et al., 2023). Because women's estrogen aids in the excretion of uric acid through urine, this condition is more common in men than in women (Pertiwi et al., 2014). According to a WHO (2017) report, gout is most prevalent in Indonesia, where 35% of gout patients are men 35 years of age or older. According to the Riskesdas (2018), the prevalence of gout-related diseases in Indonesia increased by 7.3% among joint diseases based on gout signs and symptoms. This is in line with research by Kuswandi et al. (2024) which shows that men tend to be more susceptible to hyperuricemia than women.

Another risk factor for diabetes mellitus is hypertension. Bogor District in West Java Province recorded 162.865 cases of hypertension, or 18,99% of the 3.531.916 individuals over the age of 18, according to the Dinkes Kota Bogor (2018). Hypertension can occur together with diabetes mellitus, or as a result of pathological changes that occur due to diabetes itself. Approximately two-thirds of people with diabetes mellitus also have hypertension, making it a frequent comorbidity (Husni et al., 2022). A person with hypertension has elevated systolic (>140 mmHg) and diastolic (>90 mmHg) blood pressure. Research by Putra et al. (2023) and Raphaeli (2017) showed that there was no significant relationship between blood pressure and blood sugar levels in diabetic patients. Almekinder (2017) explained that increased blood pressure in type 2 diabetes mellitus is associated with functional changes in the vascular endothelium that develop within 0 to 10 years, so the relationship between the two may not be directly visible (Reanita et al., 2022).

On the other hand, diabetes mellitus also has the risk of causing hypertension. People with diabetes mellitus have a two-fold greater risk of developing hypertension (Hariawan & Tatisina, 2020). Because decreased blood flow prevents body cells from absorbing glucose, chronic hypertension can raise the chance of developing diabetes mellitus (Simanjuntak et al., 2023). Conversely, diabetes mellitus also has the risk of causing hypertension due to thickening and narrowing of blood vessels by high glucose levels. Both are chronic diseases that are interrelated and require regular control of blood pressure and sugar levels to prevent complications (Syamsiyah, 2017). This condition can be detected together with a diagnosis of diabetes, and can even appear earlier before hyperglycemia occurs (Husni et al., 2022). Hyperglycemia in patients with diabetes mellitus can increase the production of angiotensin II, a compound that plays a role in increasing blood pressure, thus triggering hypertension. Diabetic retinopathy, kidney damage (diabetic nephropathy), coronary heart disease, and other severe consequences can result from uncontrolled hypertension in diabetic people (Tiara, 2020). Type 2 diabetes mellitus and hypertension are two chronic diseases that are commonly found in society and often occur together in one individual. This is because both are classified as degenerative diseases, namely diseases that arise due to a gradual decline in the function or structure of body organs, which are influenced by age and lifestyle factors. Without proper treatment, the combination of complications from these two diseases can increase the risk of death due to cardiocerebrovascular disorders and kidney failure (Husni et al., 2022).

Type 2 diabetes mellitus is caused by a combination of environmental factors like obesity, an unbalanced diet, lack of physical activity, stress, and aging, as well as genetic factors that interfere with insulin secretion

and cause insulin resistance. Type 1 diabetes mellitus is caused by an autoimmune reaction to proteins in cells in the pancreatic islets of Langerhans (Lestari et al., 2021). It is believed that the rise in diabetes mellitus cases in Indonesia in recent years is directly linked to changes in modern society's lifestyle, which is marked by a low level of physical activity and a propensity to consume foods heavy in fat and calories. Diabetes can actually be prevented by implementing a healthy lifestyle, such as consuming a balanced nutritious diet, doing regular physical activity, maintaining ideal body weight, and avoiding smoking (Veridiana & Nurjana, 2019). Because it helps decrease blood glucose, improve insulin sensitivity, and improve a number of cardiometabolic risk factors, such as high blood pressure and excess body fat, physical activity is one of the key pillars of diabetes care (Azhita et al., 2018). Therefore, the management strategy for diabetes mellitus needs to focus on controlling body weight through regular exercise and a healthy diet in order to achieve optimal glycemic control, as well as preventing or slowing the onset of chronic complications that accompany the disease (Ewers et al., 2018).

Any movement of the body that demands the contraction of skeletal muscles and the use of energy is considered physical activity (Sari & Purnama, 2019). Walking is a mild to moderate physical activity that is strongly advised to be done on a daily basis, according to the American College of Sports Medicine's (ACSM) guidelines. This is especially true for people who are at risk for or have a history of metabolic illnesses like diabetes mellitus (Sakinah et al., 2022). In patients with type 2 diabetes mellitus, walking activities carried out regularly for 30 to 60 minutes per day have been shown to provide significant benefits in lowering blood glucose levels by increasing glucose absorption by muscles, thereby reducing glucose accumulation in the bloodstream and helping to control hyperglycemia (Siregar et al., 2023). Patients with type 2 diabetes mellitus should engage in planned walking activities outside of their daily routines in order to achieve the best therapeutic benefits. They should aim for at least 3,000 steps per day for at least 30 minutes at a pace of about 100 steps per minute, which is comparable to moderate-intensity aerobic activity. According to a number of studies, diabetes individuals who regularly walk or participate in other physical activities have a more stable glucose profile and a lower risk of metabolic problems than those who do not (Siregar et al., 2023).

In order to better understand the risk factors that contribute to the incidence of diabetes mellitus in this population, research on the effects of uric acid, hypertension, and average walking distance on the history of diabetes in husbands in Babakan Village, Dramaga District, Bogor Regency, is necessary. In order to develop more focused promotion and prevention strategies within the framework of local public health, this study intends to investigate the relationship between uric acid, hypertension, and average walking distance and the history of diabetes in husbands in Babakan Village, Dramaga District, Bogor Regency.

METHODS

Research Design
This research was conducted in Babakan Village, Dramaga District, Bogor Regency, West Java. This study used a survey approach with stratified random sampling. Neighborhood Associations (RT) are strata spread throughout the village. From each Neighborhood Association (RT), 2 or 3 households were selected as samples, so that the total sample obtained was 87 households spread throughout the village.

Number and Method of Subject Selection
The population of this study was husbands in families domiciled in Babakan Village, Dramaga District, Bogor Regency, who were selected randomly. The inclusion criteria for selecting subjects were: husbands domiciled in Babakan Village, Dramaga District, Bogor Regency; have a history of illness; and are willing to be subjects. Exclusion criteria in selecting subjects include subjects who are not willing to be interviewed. The total number of subjects in this study was 87 people.

Types and Methods of Data Collection
The data collected in this study were primary data. Primary data included subject characteristics such as medical history and average walking distance per day. Subjects were asked several questions about their medical history, including hypertension, stroke, heart disease, diabetes, gout, liver disease, and cancer, as well as their average daily walking distance. Medical history was obtained based on complaints submitted by the patient's husband and the results of the diagnosis from medical personnel. The estimate of the average walking distance per day was based on the husband's subjective perception, without the aid of a measuring device. Data collection was carried out through face-to-face interviews using a structured question guide.

Data Processing and Analysis
The data obtained in this study are quantitative. The data were processed using Microsoft Excel and analyzed using Statistical Analysis System (SAS) software. The steps in forming a binary logistic regression model with several independent variables include the formation of design variables, estimating model parameters, testing parameter significance, testing model fit, and interpreting model parameters. Data analysis aims to test the relationship between the dependent variable (history of diabetes) and the independent variables (history of gout, hypertension, and average daily walking distance). According to Hosmer and Lemeshow (2000) in Sukandar and Rusyana (2023), the independent variable model is defined as:

$$\pi(X1, X2, X3) = \frac{e^{\beta 0+\beta 3x3+\beta 3x3}}{1 + e^{\beta 0+\beta 1x1+\beta 2x2+\beta 3x3}}$$

X1 = Average daily walking distance (meters/day)
X2 = Uric acid disease (1 = yes, 0 = no)
X3 = Hypertension (1 = yes, 0 = no)
Y = History of diabetes

With the logit function as follows:

$$g(X1, X2, X3) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3$$

Description of Variables:
X1 = Average walking distance (meters/day)
X2 = 1 if subject has uric acid disease; 0 otherwise
X3 = 1 if subject has hypertension; 0 otherwise

The logistic regression's parameters are estimated using the likelihood technique, and their significance is then examined. The likelihood ratio test is used to determine whether any predictor variables have a significant effect on the model. The Wald Chi-square test is used to assess the significance of individual model parameters, helping to identify which predictor variables influence the model.

RESULT

The binary logistic regression equation with several independent variables presents constant values and significance levels. Hypothesis assessment depends on the significance level of each variable, where the hypothesis is accepted if the significance level is less than 0,05 and rejected if it is more than 0,05 (Kurnia, 2017). When making decisions in statistical testing, the p value—is a computer generated probability value—is compared to the alpha value (a). The most widely used α value is 0,05 or 5%. If p <α indicates a significant effect; p <0,05 means significant (*), and p <0,01 means very significant (**). The following is the SAS output of the binary logistic regression equation with two independent variables (Table 1).

Table 1. SAS output: analysis of maximum likelihood estimates

Parameters	**DF**	***Estimate***	***Standard Error***	***Chi-Square***	***Wald PR > Chi-Square***
Intercept	1	0,0788	1,4521	0,0029	0,9567
Average Walking Distance (X1)	1	-0,00198	0,000808	6,0009	0,0143
Uric Acid (X2)	1	-3,2430	1,5879	4,1709	0,0411
Hypertension (X3)	1	1,2860	1,2054	1,1383	0,2860

The result of the binary logistic regression equation with multiple independent variables, namely X1 (average daily walking distance), X2 (uric acid), and X3 (hypertension), can be expressed as:

logit g(X1, X2, X3) = 0,0788 – 0,00198X1 – 3,2430X2

The Effect of Average Walking Distance on Diabetes History. Binary logistic regression analysis of the average walking distance of husbands in Babakan Village (see Table 1) shows a Wald Pr value > Chi-Square of 0,0143, indicating that the average walking distance has a significant effect on diabetes history. The negative coefficient (-0,00198*) indicates that the further the walking distance traveled each day, the lower the risk of developing diabetes.

The Effect of Uric Acid on Diabetes History. Binary logistic regression analysis of uric acid levels in husbands in Babakan Village (see Table 1) shows a Wald Pr value > Chi-Square of 0,0411, indicating that uric acid has a significant effect on diabetes history. The relationship between diabetes history and uric acid shows a real relationship, because individuals with a history of diabetes tend to have high uric acid levels in their bodies. The negative regression coefficient (-3,2430*) indicates an inverse relationship, namely that individuals with higher uric acid levels appear to have a lower likelihood of developing diabetes.

Effect of Hypertension on Diabetes History. Binary logistic regression analysis of hypertension in husbands in Babakan Village (see Table 1) shows a Wald Pr value > Chi-Square of 0,2860, indicating that hypertension has no significant effect on diabetes history. This finding indicates that the presence of hypertension is not directly related to the possibility of individuals having a history of diabetes in the population studied. The positive coefficient (1,2860) on the hypertension variable indicates that individuals with high blood pressure have a greater tendency to suffer from diabetes.

Odds Ratio of Uric Acid (X2), Hypertension (X3), and Average Walking Distance (X1) to History of Diabetes (Y). The results of the analysis showed that the variable average walking distance (X1) had an odds ratio value of 0,998 with a 95% confidence interval (CI 95%) between 0,996 and 1,000. This indicates that every one unit increase in daily walking distance tends to reduce the likelihood of a history of diabetes, although the effect is very small. The variable uric acid levels (X2) showed an odds ratio of 6,250 with a 95% confidence interval (CI 95%) between 1,046 and 37,330. This value indicates that individuals with high uric acid levels have approximately 6,250 times greater chance of having a history of diabetes compared to individuals with normal uric acid levels, and this result is statistically significant because the confidence interval does not include the number 1. Meanwhile, the hypertension variable (X3) shows an odds ratio of 2,619 with a 95% confidence interval (95% CI) between 0,241 and 39,417. Although this number shows a tendency for an increased risk of diabetes in individuals with hypertension, the very wide confidence interval and includes the number 1 indicates that the relationship is not statistically significant. The following is the SAS output of the odds ratio value (Table 2).

Table 2. SAS output: odds ratio estimates

Effect	Point Estimates	95% Confidence	Limits
Average Walking Distance (X1)	0,998	0,996	1,000
Uric Acid (X2)	6,250	1,046	37,330
Hypertension (X3)	2,619	0,241	39,417

The odds ratio value for the hypertension variable (X3) of 2,619 indicates that husbands who suffer from hypertension have a 2,619 times greater risk of developing diabetes compared to those who do not suffer from hypertension. This shows a fairly strong relationship between high blood pressure and diabetes, although statistically not significant. The odds ratio value for the uric acid variable (X2) of 6,250 indicates that husbands who suffer from gout have a 6,250 times greater risk of developing diabetes compared to those who do not suffer from gout. This finding indicates a strong relationship between high uric acid levels (hyperuricemia) and the possibility of diabetes mellitus. The odds ratio value for the average walking distance variable (X1) of 0,998 indicates that every one unit increase in walking distance has the potential to reduce the risk of developing diabetes. Although the decrease looks small, it consistently shows that physical activity in the form of walking can provide protective benefits against the risk of diabetes mellitus.

DISCUSSION

The Effect of Average Walking Distance on Diabetes History. One type of physical activity that is known to help lower blood glucose levels is walking, which includes contracting muscles, particularly those in the lower extremities, to move from one place to another (Rusminarni, 2023). The results of this study are in line with the research of Mulia and Agus (2020), which showed that walking activity has a significant effect on reducing blood sugar levels. Tasman (2017) research in Rehmaitamalem and Rahmisyah (2021) concluded that walking activity in people with diabetes mellitus can reduce blood glucose levels. A similar study by Supriyanto et al. (2022) also reported a significant decrease in blood sugar levels. In addition, Yurida and Huzaifah (2019) noted a decrease in blood sugar levels, which confirms the effectiveness of walking in controlling blood glucose levels. The physiological mechanisms that occur include increasing insulin affinity for receptors in muscle cell membranes, thereby accelerating glucose transport into cells. During exercise, hormonal changes in the form of increased insulin and decreased glucagon can optimize liver glycogenolysis and gluconeogenesis, which overall maintains blood glucose stability. Increased glucose uptake by muscles is also strengthened by the activation of cellular signaling pathways that stimulate glucose transporters, especially GLUT4 (Hasanuddin et al., 2020).

The odds ratio value for the average walking distance indicates that every one unit increase in walking distance has the potential to reduce the risk of developing diabetes. Although the decrease looks small, it consistently shows that physical activity in the form of walking can provide protective benefits against the risk of diabetes mellitus. This is in line with research by Rehmaitamalem and Rahmisyah (2021) proves that physical activity in the form of walking three times a week for 30 minutes can significantly reduce blood glucose levels in people with diabetes mellitus. Research by Sakinah et al. (2022) shows that revealed a substantial difference between blood glucose levels before and after walking, is consistent with this finding. Participants in the study took six walks over the course of two weeks, lasting thirty minutes each time. The results showed a statistically significant decrease in blood sugar levels indicating the effectiveness of the intervention in lowering blood glucose levels (Sakinah et al., 2022). Similar research was also conducted by Patma (2019), who found that almost all respondents experienced a decrease in blood glucose levels after routinely walking, especially in patients with type 2 diabetes mellitus. This finding strengthens the evidence that walking is a simple but effective form of physical activity in helping to control blood sugar levels.

Increased insulin sensitivity in response to exercise is directly linked to how effective this walking exercise is. When insulin sensitivity increases, the body is better able to use glucose in the blood for energy, so that blood glucose levels decrease naturally. Thus, the further the walking distance that is done routinely, the lower the likelihood of a person developing diabetes. Walking is not only easy to do, but also has a significant positive impact on the prevention and management of diabetes mellitus, especially type 2. Consistency in doing physical activity, including walking, plays an important role in the success of overall diabetes management. Regular physical exercise is an integral part of daily diabetes management, because it has been proven to help maintain ideal body weight, stabilize blood pressure, increase the effectiveness of insulin, and provide additional benefits on psychological aspects (Patma, 2019). Therefore, people with

diabetes mellitus are advised to schedule regular walking activities, considering that it not only contributes to lowering blood sugar levels but also plays a role in maintaining overall physical fitness.

The Effect of Uric Acid on Diabetes History. The results of this study are in line with the research of Jais et al. (2021), uric acid levels in people with diabetes mellitus increased. This is in line with the statement of Wijayakusuma and Setiawan (2015) in Jais et al. (2021), that hyperuricemia is one of the triggers for diabetes mellitus. About 30% of uric acid, the byproduct of purine metabolism, is eliminated through the intestines, and 70% is eliminated through urine (Murray et al., 2014). Increased levels of uric acid in the body have been associated with insulin resistance, a condition that is the main precursor to type 2 diabetes mellitus. According to Penggalih et al. (2024), insulin resistance can result in increased blood acidity and pH imbalance by interfering with blood flow, decreasing renal function in eliminating purines, and causing uric acid accumulation. In addition, insulin resistance that causes hyperglycemia and hyperinsulinemia also reduces the ability of the renal tubules to excrete uric acid, resulting in increased levels of uric acid in the blood circulation (Jais et al., 2021). This disorder reflects a typical early stage of type 2 diabetes mellitus, in which body cells encounter barriers to absorbing insulin as efficiently as possible. This results in elevated blood glucose levels and further strains the kidneys' primary filtration units, the nephrons. In the long term, this can interfere with kidney function in removing metabolic waste, including uric acid (Ufi et al., 2023). Accumulation of uric acid that is not optimally disposed of can cause accumulation and accumulation of uric acid in body tissues, such as joints and kidneys, in the form of uric acid crystals that cause inflammation and further complications (Sholihah & Qomariyah, 2021).

Individuals with higher uric acid levels appear to have a lower likelihood of developing diabetes. This conclusion, however, appears to defy accepted ideas and may be explained by additional exogenous variables like smoking, glycemic management, obesity, and dietary patterns. Additionally, because of hormonal variations, particularly the influence of the hormone estrogen, men's uric acid levels are biologically higher than women's. According to Nurhidayah et al. (2021), estrogen is known to have a uricosuric action, which increases the excretion of uric acid through the kidneys. This effect diminishes as women enter menopause (Nurhidayah et al., 2021). Low fluid intake, high-fructose sweet drinks, hypertension drugs, and purine-rich meals are examples of external factors that raise uric acid levels (Tandra, 2023). Purine sources can be found in various types of foods, both plant-based such as green leafy vegetables, nuts, and some fruits, and animal-based such as shellfish, shrimp, squid, anchovies, and crabs (Jais et al., 2021). Therefore, the role of lifestyle and environmental factors needs to be considered in interpreting the results of the relationship between uric acid levels and diabetes history.

The odds ratio value for the uric acid indicates that husbands who suffer from gout have a greater risk of developing diabetes compared to those who do not suffer from gout. This finding indicates a strong relationship between high uric acid levels (hyperuricemia) and the possibility of diabetes mellitus. This is in line with research by Kuswandi et al. (2024) which shows that men tend to be more susceptible to hyperuricemia than women.

The difference in sex hormones is one of the primary factors. Men's testosterone hormone can raise uric acid levels and prevent the kidneys from excreting it. On the other hand, women are less likely to get hyperuricemia, particularly prior to menopause, because the estrogen hormone helps reduce uric acid levels and facilitate its excretion through the kidneys (Kuswandi et al., 2024). In addition to hormonal factors, purine metabolism also contributes to high levels of uric acid in the body. A naturally occuring substance in food and the body, purine is converted to uric acid. If the purine metabolism process occurs excessively, uric acid production will increase, which can ultimately cause hyperuricemia (Anggraini, 2022). Other factors including obesity, hyperlipidemia, and metabolic diseases like diabetes mellitus make this condition worse. The combination of these conditions can increase primary uric acid production, especially in men over the age of 30. While 10% of occurences of secondary hyperuricemia in women are typically brought on by post-menopausal hormonal changes, 90% of cases of hyperuricemia in males are primary. The prevalence of hyperuricemia in men has even been reported to reach 90–95% higher than in women (Anggraini, 2022). Thus, high uric acid levels, especially in men, are an important indicator in increasing the risk of diabetes. This supports the need for more attention to controlling uric acid levels as part of efforts to prevent diabetes mellitus, especially in the adult male group.

Effect of Hypertension on Diabetes History. According to studies by Putra et al. (2023), blood pressure and blood sugar levels in patients with diabetes mellitus did not correlate. These findings are consistent with that study. Similar findings were also reported by Raphaeli (2017), which stated that there was no

significant relationship between random blood sugar levels and systolic or diastolic blood pressure. Theoretically, Almekinder (2017) stated that increased blood pressure in patients with type 2 diabetes mellitus is related to functional changes in the vascular endothelium, which usually develop within 0 to 10 years. Therefore, the connection between diabetes and hypertension may not be immediately apparent in people who have not had microvascular or macrovascular problems (Reanita et al., 2022). Previous research by Rosnita (2016) in Reanita et al. (2022) also concluded that there was no significant relationship between hyperglycemia and hypertension in patients with type 2 diabetes mellitus. This can be explained by the complexity of the pathophysiological mechanisms that link the two conditions. Chronic hyperglycemia may be a contributing factor in the thickening of the blood vessel wall, which raises endothelial cell permeability and raises blood pressure (Reanita et al., 2022). However, in populations who have not yet encountered severe difficulties, this mechanism may not always be discovered because it tends to develop gradually.

The odds ratio value for the hypertension indicates that husbands who suffer from hypertension have a greater risk of developing diabetes compared to those who do not suffer from hypertension. This shows a fairly strong relationship between high blood pressure and diabetes, although statistically not significant. Research by Hashemizadeh and Sara (2013) found that individuals who have suffered from diabetes for 5-10 years have a three times greater risk of developing hypertension. High and uncontrolled blood sugar levels in people with diabetes mellitus can increase the risk of hypertension. People with type 2 diabetes usually experience hyperglycemia, which is a condition when blood glucose levels remain high for a long time. This condition can cause damage to the walls of blood vessels due to the accumulation of glucose, which then produces a substance called AGEs (Advanced Glycation End Products). This substance damages the inner lining of blood vessels (endothelium), triggers inflammation, and causes blood vessels to become stiff. Due to the irregular blood flow caused by this stiffness, blood pressure rises (Tandra, 2018).

Individuals with type 2 diabetes mellitus generally experience insulin resistance, which is a condition when insulin is available in sufficient quantities but is unable to work effectively in the glucose metabolism process. Blood glucose levels rise as a result of insulin resistance, and this is the primary cause of diabetes mellitus. Insulin has an impact on blood pressure management in addition to controlling glucose metabolism (Kurniadi & Ulfa, 2015). Insulin resistance and high insulin levels in the blood (hyperinsulinemia), which can increase tension in the muscles of blood vessels and cause blood pressure to rise (Ichsantiarini & Pringgodigdo, 2013). Diabetes also accelerates the occurrence of blockage of large blood vessels (atherosclerosis), which obstructs blood flow and causes blood pressure to rise (Kholifah et al., 2020). In addition, according to Cheung and Li in Julianti (2021), hypertension and diabetes are often part of the metabolic syndrome, which is a collection of interrelated conditions that can appear together in one individual. Therefore, high blood pressure is more likely to occur in patients with diabetes. This happens as a result of the kidneys retaining more salt and the sympathetic nervous system being activated, both of which can raise blood pressure over time (Kurniadi & Ulfa, 2015). Moreover, endothelial dysfunction, an increase in bodily fluid volume, and a reduction in blood vessel relaxation can all result from insulin resistance. When these illnesses are combined, hypertension may develop, particularly in people who have had kidney problems as a result of diabetes mellitus (Djamil et al., 2021).

A cohort study by Ichsantiarini and Pringgodigdo (2013) also supports the significance of blood pressure control in the context of diabetes, showing that a 5–10 mmHg drop in blood pressure can significantly lower the risk of heart failure, reduce the incidence of stroke by up to 50%, and reduce the risk of death from type 2 diabetes mellitus by up to three times. In addition, according to Winta et al. (2018), blood pressure control in patients with hypertension and type 2 diabetes mellitus provides greater benefits in reducing the risk of microvascular complications compared to controlling blood glucose levels alone. Therefore, even though the study's statistical analysis revealed that hypertension had no direct, significant impact on diabetes history, knowledge of the physiological connection between the two conditions is still crucial to bolstering efforts to prevent and treat non-communicable diseases holistically. Research by Boer et al. (2016) also shows that hypertension is an important and modifiable risk factor, and plays a major role in the occurrence of diabetes complications, both in large and small blood vessels. Blood vessel function can be disrupted by hyperglycemia, which makes it easier for fat to enter blood vessel walls and speeds up the obstruction process. As a result, the heart works harder because blood flow is disrupted (Setiawan, 2018). In addition, as age increases, the risk of diabetes also increases, especially if blood sugar levels are not controlled. In the long term, this condition can cause damage to large blood vessels (macroangiopathy), which also increases blood pressure (Gemini & Natalia, 2023). Therefore, the reciprocal relationship between diabetes and hypertension is important to note in efforts to prevent and manage both.

CONCLUSION

This study shows that the prevalence of diabetes in husbands in Babakan Village, Kecamatan Dramaga District, Bogor Regency, is significantly influenced by walking distance and uric acid levels. As the amount of time spent engaging in daily activities decreases, the likelihood of developing diabetes increases. In addition to this, a higher urat kadar is also associated with an increased risk of having diabetes. Although there is evidence that hypertension can increase the risk of diabetes, it does not significantly affect the risk of diabetes in the studied group. In light of this, researchers are advised to extend their study by examining additional factors that may contribute to the risk of diabetes and by using more sophisticated research designs to identify mechanisms that demonstrate the relationship between the aforementioned factors. It is important to promote an active lifestyle by increasing physical activities like walking as part of diabetes prevention and treatment strategies, especially for those with high blood sugar levels. Pembuat kebijakan can be used to support a health program that emphasizes physical activity and urat detection as a preventative measure to lower the prevalence of diabetes in the general population.

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