



ANALYSIS OF RISK FACTORS INFLUENCING THE INCIDENCE OF DIABETES MELLITUS AMONG EMPLOYEES

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ABSTRACT

Diabetes Mellitus (DM) is a chronic metabolic disorder that remains a major public health concern globally. Its prevalence is influenced by various lifestyle and hereditary factors. This study aims to analyze the risk factors contributing to the incidence of DM among employees at Segiri Community Health Center. A retrospective case-control study was conducted using secondary data from health screenings and fitness assessments of Segiri Community Health Center employees in September 2023. From 50 staff members, 40 with complete records were included: 10 DM cases and 30 non-DM controls (1:3 ratio). Data included medical history, lifestyle behaviors, and anthropometric measurements. Analysis involved univariate and bivariate tests using cross-tabulation and Odds Ratio (OR). The most significant risk factor was abnormal Body Mass Index (BMI), as all DM cases had abnormal BMI values. Other influential factors included parental history of diabetes (OR = 18.0), personal history of hypertension (OR = 9.3), and parental history of hypertension (OR = 6.0). Additional contributing factors were low fruit and vegetable intake (OR = 4.0), excessive salt intake (OR = 1.63), and abnormal waist circumference (OR = 1.31). Smoking and alcohol consumption were not significantly associated with DM in this sample. Abnormal BMI and a family history of diabetes and hypertension significantly contribute to the incidence of DM. Targeted interventions focusing on these modifiable and non-modifiable risk factors are essential for effective workplace prevention strategies.

Keywords: body mass index; diabetes mellitus; hypertension; lifestyle; risk factors

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INTRODUCTION

Lifestyle plays a pivotal role in the development of chronic diseases, including Diabetes Mellitus (DM). Modern dietary habits high in sugar, salt, and fat, combined with sedentary behavior, contribute to the increasing prevalence of degenerative diseases (Ayu Susilowati & Nata Waskita, 2019). DM is characterized by chronic hyperglycemia resulting from insulin secretion disorders or insulin resistance (Idris et al., 2017). Globally, DM accounts for approximately 5% of total deaths. The International Diabetes Federation reported 366 million cases in 2011, with 80% in low- and middle-income countries. Risk factors include age, genetics, physical inactivity, poor diet, hypertension, and abnormal lipid profiles (Idris et al., 2017). This study aims to determine the influence of various risk factors on the incidence of DM among healthcare workers, a population expected to be more health-aware, yet still at risk.

METHOD

This study employed a quantitative approach with a retrospective observational design using a case-control method. The research was conducted at Segiri Community Health Center in Samarinda during December 2023. The population consisted of all 50 employees of the health center. A total of 40 participants met the inclusion criteria and were selected as the sample, comprising 10 cases (employees diagnosed with Diabetes Mellitus) and 30 controls (employees without DM), with a 1:3 case-to-control ratio. The sample was selected purposively based on available health screening data. Inclusion criteria included employees

who participated in the September 2023 health screening and fitness test and had complete data. Exclusion criteria included employees who did not participate or had incomplete data records. Data sources were secondary, obtained from internal health screening and fitness assessment records. Variables included medical history (personal and family), smoking habits, alcohol consumption, physical activity, dietary intake (sugar, salt, fat, fruits, and vegetables), as well as anthropometric measures such as Body Mass Index (BMI) and waist circumference. Data analysis was performed using univariate analysis to describe variable distributions and bivariate analysis to examine the association between risk factors and DM occurrence through cross-tabulations and Odds Ratio (OR) calculations.

RESULT

Respondent Characteristics by Sex

The distribution of respondents by sex is presented in Table 1. A total of 40 participants were included in this study. The majority were female, accounting for 65.0% (n = 26), while the remaining 35.0% (n = 14) were male.

Table 1
Distribution of Respondents by Sex

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	14	35.0	35.0	35.0
	Female	26	65.0	65.0	100.0
	Total	40	100.0	100.0	

This finding indicates a greater representation of female participants in the study, which may reflect the demographic characteristics of the population from which the sample was drawn.

Respondent Characteristics by Age Group

The age distribution of respondents is shown in Table 2. The majority of respondents were in the late adulthood age group (35.0%, n = 14), followed by those in the early elderly group (32.5%, n = 13). Other respondents included individuals in early adulthood (17.5%, n = 7), late elderly (10.0%, n = 4), and late teenagers (5.0%, n = 2).

Table 2
Distribution of Respondents by Age Group

		f	%	Valid Percent	Cumulative Percent
Valid	Late adulthood	14	35.0	35.0	35.0
	Early adulthood	7	17.5	17.5	52.5
	Late elderly	4	10.0	10.0	62.5
	Early elderly	13	32.5	32.5	95.0
	Late teenagers	2	5.0	5.0	100.0
	Total	40	100.0	100.0	

Respondent Characteristics by Residential Area

Table 3 presents the distribution of respondents based on the condition of their residential area. The majority of participants (75.0%, n = 30) were from areas categorized as having good residential conditions, while the remaining 25.0% (n = 10) lived in areas classified as poor.

Table 3
Distribution of Respondents by Residential Area

		f	%	Valid Percent	Cumulative Percent
Valid	Good	30	75.0	75.0	75.0
	Poor	10	25.0	25.0	100.0
	Total	40	100.0	100.0	

This data suggests that most respondents reside in areas with relatively good environmental and infrastructural conditions, which may influence their health-seeking behavior and access to healthcare facilities.

Distribution by Diabetes Mellitus Case-Control Status

Table 4 shows the classification of respondents based on their case-control status regarding Diabetes Mellitus (DM). Out of 40 participants, 75.0% (n = 30) were classified as non-diabetic (controls), while 25.0% (n = 10) were identified as diabetic (cases).

Table 4
Distribution of Respondents by Diabetes Mellitus Case-Control Status

		f	%	Valid Percent	Cumulative Percent
Valid	Non-Diabetic	30	75.0	75.0	75.0
	Diabetic	10	25.0	25.0	100.0
	Total	40	100.0	100.0	

This distribution reflects the matched case-control design of the study, where the proportion of diabetic and non-diabetic participants is essential for comparative analysis of risk factors.

Distribution of Risk Factors Among Respondents

Table 5 presents the distribution of various behavioral and biological risk factors for Diabetes Mellitus among the respondents. Several key findings are noted:

- 50% of respondents had a family history of hypertension, and 47.5% had a family history of diabetes.
- 32.5% of respondents had personal hypertension.
- 12.5% were active smokers, while 32.5% reported physical inactivity.
- 20% consumed excess sugar, 35% consumed excess fat, and 15% consumed excess salt.
- 27.5% had low fruit and vegetable intake, and none reported alcohol consumption.
- 77.5% of respondents had abnormal BMI, and 55% had an abnormal waist circumference.

Table 5
Distribution of Risk Factors Among Respondents

Variabel	f	%
Parental Hypertension		
No	20	50
Yes	20	50
Parental Diabetic		
No	21	52.5
Yes	19	47.5
Personal Hypertension		
No	27	67.5
Yes	13	32.5
Smoking		
No	35	87.5
Yes	5	12.5
Physical Inactivity		
No	27	67.5
Yes	13	32.5
Excess Sugar Intake		
No	32	80
Yes	8	20
Excess Fat Intake		
No	26	65
Yes	14	35
Excess Salt Intake		
No	34	85
Yes	6	15
Low Fruit/Vegetable Intake		
No	29	72.5
Yes	11	27.5
Alcohol Consumption		
No	40	100
Yes	0	0

Variabel	f	%
BMI		
Normal	9	22.5
Not normal	31	77.5
Waist Circumference		
Normal	18	45
Not normal	22	55

Odds Ratio of Risk Factors Associated with Diabetes Mellitus

Table 6 presents the odds ratio (OR) values for various risk factors potentially associated with Diabetes Mellitus. Among all assessed factors, waist circumference and parental diabetes history showed the strongest associations with DM, both with ORs of 18.0, indicating a substantial increase in risk. Parental other illnesses (OR = 9.3) and parental hypertension (OR = 6.0) also showed strong associations. Additional factors such as low fruit and vegetable intake (OR=4.0), high salt intake (OR=1.63), and abnormal waist circumference (OR=1.31) were moderately associated. Factors like smoking and alcohol use showed no significant correlation in this population.

Table 6
Odds Ratio (OR) of Risk Factors Associated with Diabetes Mellitus

Risk Factor	Odds Ratio (OR)	Interpretation
Parental Hypertension	6.0	Higher risk with parental hypertension
Parental Diabetic	18.0	Strongest risk among all factors
Personal Hypertension	9.3	Higher risk with personal hypertension
Smoking	0	No association; no smokers among diabetic cases
Physical Inactivity	0.86	No significant effect
Excess Sugar Intake	1.0	No significant effect
Excess Fat Intake	0.15	Inversely related; possibly due to confounding
Excess Salt Intake	1.63	Mild increase in risk
Low Fruit/Vegetable Intake	4.0	Moderate increase in risk
Alcohol Consumption	-	Cannot be calculated (no alcohol use reported)
BMI	~	Perfect prediction (all cases had abnormal BMI)
Waist Circumference	1.31	Mild increase in risk

These findings underscore the relevance of both genetic predispositions and modifiable lifestyle habits. The role of BMI, in particular, highlights the importance of regular weight management and health promotion, especially within health institutions themselves.

DISCUSSION

This study comprehensively analyzes the risk factors that influence the incidence of Diabetes Mellitus (DM) among health workers at Segiri Health Center. A case-control design was applied, involving 10 diabetes cases and 30 non-diabetic controls. The variables assessed included personal and family history of hypertension and diabetes, lifestyle behaviors (smoking, physical activity, eating habits), and anthropometric factors such as Body Mass Index (BMI) and waist circumference. This discussion describes each result based on its influence and relates it to existing scientific literature. Family history of diabetes emerged as the strongest risk factor in this study, with an odds ratio (OR) of 18.0. This is in line with previous studies, which stated that family history of diabetes is the most dominant risk factor (Arnida et al., 2024). Around 47.5% of respondents reported having parents with diabetes, and all cases of diabetes had this family background. A person with a family history of diabetes will be at greater risk of developing diabetes than those without a family history of diabetes (Kundarwi et al., 2022; Nasution et al., 2021). Genetic predisposition plays an important role in the pathogenesis of diabetes, often interacting with environmental and behavioral factors. These results reinforce the importance of early screening and preventive counseling for individuals with a known family history.

A history of hypertension in parents was also associated with an increased risk of diabetes (OR = 6.0). Half of the study respondents had parents with hypertension. Although not directly causal, this condition may reflect the influence of genetics and lifestyle together that make individuals susceptible to hypertension and diabetes. Modern lifestyles sometimes take up time so that there is no opportunity to implement a healthy lifestyle. The lifestyle of modern humans tends to be less active, consume instant foods and lack outdoor activities. This lifestyle is at risk of causing disorders in the body such as hypertension, obesity and diabetes mellitus (Hartati et al., 2024). These findings support the implementation of family-centered health education and lifestyle interventions. Personal history of hypertension showed an equally strong association with diabetes (OR = 9.3), with 32.5% of respondents reporting this condition. Hypertension and diabetes share similar pathophysiological mechanisms, including endothelial dysfunction, oxidative stress, and chronic low-grade inflammation. High blood pressure can interfere with insulin-mediated glucose uptake in peripheral tissues, thereby worsening insulin resistance (Rediningsih & Lestari, 2022). The impact of thickening of the arteries, where hypertension causes blood vessels to narrow and disrupts the process of glucose transport in the blood (Delfina et al., 2021; Hartati et al., 2024).

The most prominent modifiable finding was that all respondents with diabetes had abnormal BMI values. This result is in line with the understanding that overweight and obesity are major modifiable risk factors for diabetes. Obesity is a condition where the Body Mass Index (BMI) is ≥ 25 kg/m². If a person with diabetes has a Body Mass Index (BMI) with this amount, it will increase blood sugar levels in the body (Delfina et al., 2021). Excess adipose tissue contributes to insulin resistance through the production of inflammatory cytokines, changes in the adipokine profile, and ectopic fat accumulation. The main factor of obesity is an imbalance between energy intake and energy expenditure (Arnida et al., 2024). In this study, 77.5% of respondents had abnormal BMI, indicating that weight management plays a major role in preventing diabetes among health workers. Waist circumference, which reflects central (visceral) adiposity, was abnormal in 55% of respondents. Although the odds ratio (OR = 1.31) was not as high as other variables, the presence of central obesity remains clinically relevant. Visceral fat is metabolically active and is more strongly associated with insulin resistance than peripheral fat. The combination of abnormal BMI and waist circumference in many participants underlines the double metabolic burden borne by individuals in this population (Suharno & Nisa, 2024).

Low fruit and vegetable intake (OR = 4.0) was another significant contributor. Approximately 27.5% of participants fell into this category. Fruits and vegetables provide dietary fiber, antioxidants, and phytochemicals that improve glucose metabolism and reduce inflammation. Deficiencies in these components may contribute to poor glycemic control and the development of insulin resistance. People who consume sufficient amounts of fruits and vegetables daily are 3.9 times less likely to develop diabetes compared to people who consume less fruits and vegetables daily (Sulistiyorini et al., 2023). Workplace nutrition education programs should emphasize the importance of plant-based diets in the prevention of chronic diseases. Excessive dietary patterns such as carbohydrates/sugar, protein, fat, and energy can be early risk factors for diabetes (Siagian et al., 2023). There is a significant relationship between excessive sugar and salt consumption and the incidence of diabetes cases with a 3.1 and 3.5 times greater risk of suffering from diabetes compared to people who do not consume excessive sugar and salt (Sartika et al., 2023). However, excessive sugar and fat consumption were not significantly associated with diabetes in this study. About 20% of respondents consumed excessive sugar, and 35% consumed excessive fat. Interestingly, excessive fat consumption had an inverse relationship (OR = 0.15), which could be due to food recall bias or compensatory behavior among those who are aware of their health risks.

This inconsistency highlights the need for more objective dietary assessments in future studies. While excessive salt consumption, observed in 15% of respondents, was moderately associated with DM (OR = 1.63). Although primarily associated with hypertension, high sodium intake can affect glucose metabolism through neurohormonal pathways and blood vessel damage. Sodium is the largest substance in salty foods that causes fluid retention and causes hypertension as one of the risk factors for DM cases (Sartika et al., 2023). These findings highlight the need for broader dietary interventions, including sodium reduction, to address overlapping cardiometabolic risks.

Physical inactivity, reported by 32.5% of respondents, did not show a statistically significant association with diabetes in this sample (OR = 0.86). However, the role of regular physical activity in improving insulin sensitivity, maintaining body weight, and increasing metabolic flexibility is well established. Regular physical activity can control blood sugar levels (Arnida et al., 2024; Delfina et al., 2021). Individuals who engage in light daily physical activity have a 2.68 times greater risk of developing type 2 diabetes compared to those who engage in moderate and vigorous daily physical activity (Murtiningsih et al., 2021). The lack of association in this study could be due to the small sample size or self-report bias. Nevertheless, health promotion strategies should continue to encourage physical activity among healthcare workers. Smoking was reported by 12.5% of respondents, but no cases of diabetes were found among smokers, resulting in an OR of 0. This result is in line with studies by Ali et al. (2023) and Nurbaiti et al. (2020). While this may appear protective, it may reflect the small sample size and limitations of behavioral reporting. Smoking is known to contribute to systemic inflammation and impaired glucose metabolism and remains a known risk factor for diabetes in larger population-based studies. The nicotine content in cigarette smoke has an effect on the occurrence of diabetes. The effects of nicotine on insulin include causing decreased insulin release due to activation of catecholamine hormones, negative effects on insulin action, disruption of pancreatic beta cells and development towards insulin resistance (Arnida et al., 2024).

Alcohol consumption was not reported by any of the respondents in the study. Therefore, its association with diabetes could not be evaluated. This absence may reflect cultural norms or underreporting. Nevertheless, excessive alcohol intake has been associated with both increased and decreased risk of diabetes, depending on consumption patterns, doses, and types of alcohol. According to Syukur et al. (2020), people who consume alcohol have a risk of developing diabetes that is 3 times greater than people who do not consume alcohol.

CONCLUSION

In summary, this study identifies family history of diabetes, personal and parental history of hypertension, abnormal BMI, low intake of fruits and vegetables, and excessive salt intake as the most prominent risk factors for DM among health workers. Although some variables did not reach statistical significance, their biological plausibility and public health relevance remain strong. The findings emphasize the importance of early detection, targeted interventions, and the development of workplace health programs that integrate screening, counseling, and lifestyle modification. Future research should consider larger sample sizes, longitudinal designs, and objective measurements of behavioral factors. Given the occupational stress and demanding nature of healthcare work, interventions should also address systemic factors influencing behavior, such as workload, access to healthy food, and institutional support for physical activity. Ultimately, health institutions must not only promote but also embody the principles of preventive health, ensuring that their workers are protected from the very conditions they strive to treat.

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