TRANSPUBLIKA INTERNATIONAL RESEARCH IN EXACT SCIENCES (TIRES)

FACTORS ASSOCIATED WITH THE INCIDENCE OF DIABETES MELLITUS (DM) IN THE WORKING AREA OF UPTD PUSKESMAS LAGEUN, SETIA BAKTI DISTRICT, ACEH JAYA REGENCY, 2023/2024

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Abstract

The objective of this study is to ascertain the factors associated with the occurrence of diabetes mellitus in the Loyat Bakti sub-district, Aceh Jaya district, in the year 2024. The methodology employed is a quantitative analytical approach, utilizing a cross-sectional design. The study population encompasses all individuals afflicted with diabetes mellitus within the catchment area of the UPTD Puskesmas Lageun, Loyat Bakti sub-district, Aceh Jaya district. Primary data constitutes the basis for this research, acquired through the distribution of questionnaires among respondents. The majority of the sample panel comprises 50 respondents, of which 40 are female and 11 are male, representing a vulnerable group. The age distribution of most respondents falls within the elderly range of 46-74 years, accounting for 92.2% of the total. Analysis of the relationship between physical activity and Body Mass Index (BMI) reveals that the majority of respondents have an ideal BMI, comprising 26 individuals engaged in physical activity and 10 individuals within the sedentary category, totaling 36 respondents. Conversely, within the non-ideal BMI group, 7 respondents are physically active, while none are sedentary, summing up to 7 respondents. Additionally, among those classified as having an obese BMI, 7 individuals are physically active, with 1 person being sedentary, yielding a total of 8 respondents. Overall, the association between physical activity and BMI comprises 40 active individuals and 11 sedentary respondents, totaling 51 participants.

Keywords: *Diabetes Mellitus, Incidence, Lifestyle Changes, Junk Food, Physical Activity*

1. INTRODUCTION

Diabetes Mellitus (DM) is a chronic disorder of carbohydrate metabolism that can lead to chronic complications as well. DM represents a heterogeneous group of disorders characterized by elevated blood glucose levels, commonly referred to as hyperglycemia. Prolonged hyperglycemia in DM patients leads to arteriosclerosis, thickening of the basal membrane, and changes in peripheral nerves. This predisposes to the occurrence of diabetic foot ulcers (Handayani, 2016). According to the World Health Organization (WHO) (2016), diabetes mellitus is one of the four priority non-communicable diseases and is a leading cause of blindness, heart attacks, strokes, kidney failure, and lower limb amputations. Nearly 80% of diabetes mellitus patients are in low- and middle-income countries. The percentage of adults with diabetes mellitus is 8.5%. 1 in 11 adults suffers from diabetes mellitus. This disease poses a threat to human health worldwide (Morens, 2013; Khajedaluee, 2014). Reports from the World Health Organization (WHO) regarding diabetes mellitus studies in various countries indicate a continuous increase in the number of diabetes mellitus patients, reaching 8.00% in 2014 (WHO, 2014).

Indonesia ranks fourth largest in the number of diabetes mellitus patients, with a prevalence of 8.4 million people (Setiawan et al., 2018).

The incidence of Type 2 DM in women is higher than in men. Women are at greater risk of developing diabetes due to their physical predisposition to higher body mass index. The Basic Health Research results in 2008 showed a prevalence of DM in Indonesia increasing to 57%, while in 2012 the incidence of diabetes mellitus worldwide reached 371 million people, with Type 2 diabetes mellitus accounting for 95% of the world's diabetic population, and only 5% of them suffering from Type 1 diabetes mellitus (Fatimah, 2015).

Data from the International Diabetes Federation (2019) indicates that in Southeast Asia, 8.8% of the adult population aged 20-79 years has diabetes, equivalent to 87.6 million adults with diabetes, with 56.7% of them undiagnosed. Most people in Southeast Asia with diabetes live in middle-income countries and as a result, experienced 1.2 million deaths in 2019, accounting for 14.1% of all causes of death. Research Data (*Riskesdas*) in 2018 showed a significant increase in the prevalence of diabetes mellitus, from 6.9% in 2013 to 8.5% in 2018. The prevalence of diabetes mellitus diagnosed by a doctor in individuals aged ≥15 years increased to 2%, with the highest rates found in the DKI Jakarta area at 3.4%, and Yogyakarta at 3.1%, and the lowest in East Nusa Tenggara (0.9%). In terms of age category, the prevalence of diabetes mellitus is highest in the 55-64 age group (Siregar & Mariati, 2022).

The current population of Indonesia is estimated to reach 240 million. According to the RISKESDAS 2007 data, the national prevalence of Diabetes Mellitus (DM) in Indonesia for individuals aged 15 and above is 5.7%. Currently, an estimated 9.1 million individuals in the population are diagnosed with Diabetes Mellitus. With this figure, Indonesia ranks fifth globally, up from seventh place in 2013 with 7.6 million individuals diagnosed with Diabetes Mellitus (Pranata et al., 2019). In 2017, Indonesia ranked sixth in the world for the highest prevalence of diabetes after China, India, the United States, Brazil, and Mexico, with an estimated 10.3 million people having diabetes, and the percentage of deaths due to diabetes in Indonesia being the second highest after Sri Lanka (IDF, 2017). According to the Basic Health Research (RISKESDAS) in 2013, the prevalence of diabetes in Indonesia showed an increasing trend from 5.7% in 2007 to 6.9% in 2013. The prevalence of overweight was 13.5%, obesity was 15.4%, which are among the significant risk factors for diabetes, increasing continuously compared to RISKESDAS 2007 and 2010, with Impaired Glucose Tolerance (IGT) reaching 29.9%, or about 52 million patients. This indicates an increasing number of individuals at high risk of developing Type II DM.

Several factors contribute to the onset of Type 2 DM, including lifestyle factors such as fast food consumption, physical activity, coffee consumption, tea consumption, smoking behavior, and patients' knowledge about DM (Wicaksono, 2011). Individuals who irregularly engage in physical activity are at a 4.5 times higher risk of developing Type 2 DM compared to those who regularly exercise (Handayani, 2003). Meanwhile, individuals who frequently consume fast food (≥2 times/week) tend to experience obesity compared to those who rarely or never consume fast food (Maulina, 2011). Obesity is one of the risk factors for Type 2 DM (Fikasari, 2012).

Lifestyle is a habitual behavior that can affect an individual's health. Type 2 DM patients are advised to engage in physical activity for 30 minutes a day, 3-4 times a week,

such as walking and light jogging. Individuals who rarely engage in physical activity experience an excess of consumed energy due to the body's low energy expenditure, leading to an imbalance of energy stored in adipose tissue. This condition can trigger the risk of Type 2 diabetes mellitus due to insulin resistance. Consuming vegetables and fruits can also reduce the risk of Type 2 DM. Recommendations for vegetable consumption are 3 servings/day, fruit consumption 2 servings/day. The benefits of consuming fruits and vegetables include reducing the absorption of cholesterol and fat. Not smoking can reduce the risk of Type 2 diabetes mellitus, as individuals who are more frequently exposed to cigarette smoke are at higher risk of developing this disease compared to those who are not/rarely exposed to cigarette smoke. This condition is caused by smoking-induced insulin resistance, leading to increased blood sugar levels (Silalahi, 2019).

Other factors contributing to the occurrence of DM include alcohol and tobacco/smoking consumption, lack of physical activity, and unhealthy diet, which are the highest risk factors for non-communicable diseases in adolescents. To achieve good health status in the next decade, pro-health behaviors are required from adolescence. Pro-healthy behaviors will greatly help prevent the onset of non-communicable diseases such as diabetes mellitus from an early age. Adolescents who do not adopt/mimic community habits that can increase the risk of type 2 diabetes mellitus (DM) from an early age will affect their health status in old age. The proportion of adolescents in Indonesia in 2010 was 18%, or about 43.5 million people. A large number of adolescents are at high risk of developing diabetes mellitus. Adolescence is a period of development in an individual's life or a transitional and unstable stage in holding values, norms, and personality. UNICEF in 2011 stated that adolescents are aged 10-19 years old. The current lifestyle of adolescents tends to be irregular, posing a risk of diabetes in the future. As many as 87% of adolescents enjoy consuming fast food and junk food. Adolescents are generally more interested in consuming food from outside the home, such as in school canteens and street vendors. The food/snacks available in street vendors and school canteens generally contain high fat and low fiber, vitamins, and minerals. Technological advancements also lead to a decrease in physical activity among adolescents (Silalahi, 2019).

Type 2 DM is the most common type of DM, accounting for about 90% of all DM cases. In Type 2 DM, hyperglycemia results from inadequate insulin production and the body's inability to respond to insulin fully, defined as insulin resistance. During insulin resistance, insulin does not work effectively, initially leading to increased insulin production to reduce elevated glucose levels, but over time, a condition of relatively inadequate insulin production may develop. Type 2 DM is most commonly seen in older adults but is increasingly seen in children, adolescents, and young adults. The causes of Type 2 DM are strongly associated with overweight and obesity, increasing age, and family history. Among dietary factors, recent evidence also suggests a relationship between high consumption of sugary beverages and the risk of Type 2 DM (Pangestika et al., 2022).

A proper diet can help control blood sugar levels from spiking. Dietary management often leads to changes in eating patterns, including the amount of food consumed by diabetes mellitus patients, resulting in dilemmas in implementing diabetes mellitus dietary compliance (Siregar & Mariati, 2022). Efforts to control the risk factors for Type 2 DM that have been promoted include the SMART action, which involves: 1) Regular health check-ups to control body weight, monitor blood pressure, blood sugar, and

cholesterol regularly, 2) Eliminate cigarette smoke and avoid smoking, 3) Regularly engage in physical activity for at least 30 minutes a day, 4) Balanced diet by consuming healthy and balanced nutrition, 5) Adequate rest, and 6) Manage stress properly and correctly (Silalahi, 2019).

Based on various data above, DM is a serious problem and complications and damage to target organs occur as a result of these complications. Therefore, the author feels it is necessary to address DM as a problem to be studied in this residency so that DM can be prevented and controlled to avoid complications. The issue studied in this research is the factors related to the incidence of Type 2 diabetes mellitus in 6 villages in the work area of the Lageun Community Health Center, Setia Bakti District, Aceh Jaya Regency. The purpose of this study is to analyze the risk factors associated with the incidence of Type 2 diabetes mellitus in the work area of the Lageun Community Health Center, Setia Bakti District, Aceh Jaya Regency (Donsu et al., 2014).

2. RESEARCH METHODS

This study was a quantitative analytical research with a cross-sectional approach. It focuses on variables related to the risk factors for diabetes mellitus (DM), such as obesity, dietary patterns, and levels of physical activity. The population in this study consists of all diabetes mellitus patients in the work area of the Health Center (UPTD) in Lageun, Setia Bakti District, Aceh Jaya Regency. According to data from the Health Center in Lageun, the number of DM patients amounted to 89 individuals in the year 2020. The sample size involved in this study was determined using proportional random sampling formula, totaling 50 individuals. The data used in this study are primary data obtained directly from the research subjects by distributing questionnaires to the respondents. Respondents were asked to answer questions posed by the researcher. This research was conducted from December 3, 2023, to January 13, 2024, across the entire work area of the Health Center in Lageun.

3. RESULTS AND DISCUSSION

3.1. Research Results

The characteristics of the respondents are presented in Table 1. Table 1 shows that the majority of the respondents were female, comprising 40 respondents with a percentage of 78.4%. This result is consistent with previous studies, where females tend to be at higher risk of having diabetes mellitus and gestational diabetes (Diani, Waluyo, & Sukmarini, 2013). This dominance of gender is associated with obesity, which is a precursor to Type 2 Diabetes Mellitus.

Table 1. characteristics of the respondents

Characteristics	Amount	N	%
Gender			
Male		11	21.6%
Female		40	78.4%

Characteristics	Amount	N	%
Total	51		100.0%
Age			
Adults 28-45 Years		4	7.8%
Elderly 46-74 Years		47	92.2%
Total	51		100.0%
Address			
Sawang		21	41.2%
Lhok Geulumpang		13	25.5%
Lhok Timon		12	23.5%
Lhok Buya		1	2.0%
Gampong Baro		1	2.0%
Total	51		100.0%

The highest age of respondents was in the elderly range of 46-74 years with a percentage (92.2%). The majority of DM cases are found in the elderly, although currently DM cases do not only attack the elderly but also adolescents and children, nearly 50 percent of DM sufferers are over 65 years old (Suprapti, 2020). In Rusiana's research (2021). The majority of DM cases are found in the elderly, although currently DM cases not only affect the elderly but also adolescents and children, almost 50 percent of DM sufferers are over 65 years old (Suprapti, 2020). In Rusiana's research (2021). also states that DM disease is commonly found in the elderly because the elderly are unable to produce sufficient amounts of insulin according to their needs (Purqoti et al., 2022).

Based on table 1, Diabetes mellitus (DM) in the Working Area of the lageun puskesmas, setia Bakti District, which mostly occurs in sawang Village, with a total of 21 respondents with a percentage (41.2%). cases of DM disease according to UPTD puskesmas lageun data in 2020, DM sufferers numbered 89 people in all villages within the scope of the lageun puskesmas working area.

Table 2. Respondents Smoking History

Smoking	Frequency (f)	Percent (%)
Never Smoked	38	74.5%
Passive Smoker	7	13.7%
Smoker	6	11.8%
Total	51	100.0%

Table 2 shows that respondents have never smoked with 38 respondents with a percentage of 74.5%, for passive smokers with 7 respondents with a percentage of 13.7%. With smokers, the number of smokers was 6 respondents with a percentage of 11.8% with a total of 51 respondents with a percentage of 100.0%.

Table 3. Characteristics Responded Stress

Stress	Frequency (f)	Percent (%)
Yes	12	23.5%
No	39	76.5%
Total	51	100.0%

From table 3 we can see that respondents who often feel stressed or depressed are 12 respondents with a percentage of 23.5% who do not feel depressed are 39 respondents with a percentage of 76.5% with a total of 51 respondents with a percentage of 100.0%.

Table 4. Respondents with body mass index (BMI)

BMI (Body Mass Index)	Frequency (f)	Percent (%)
Ideal	36	70.6%
Not Ideal	7	13.7%
Obesity	8	15.7%
Total	51	100.0%

The majority of BMI respondents were in the ideal group 36 respondents with a percentage (70.6%). with BMI not ideal amounted to 7 respondents with a percentage of 13.7%. with BMI Obesity 8 with a percentage of 15.7% People with excess body weight have excess calorie input (Sugiritama et al., 2015). This condition is caused by fatigue experienced by beta cells so that they are unable to produce sufficient amounts of insulin. Insufficient insulin production cannot compensate for the excess calories that enter. The result is that blood glucose levels continue to rise which will eventually become DM.

Table 5. Distribution of study subjects based on baseline blood glucose

Random Blood Glucose Level (GDS)	Frequency	Percent
High (> 180)	47	92.2%
Normal (70-180)	4	7.8%
Total	51	100.0%

Based on the table 5, instant blood glucose (GDS) is classified into 2 parts: 1) Normal GDS if the concentration of blood glucose levels in a person who is not diabetic is in the range of 70 - 180 mg/dl., and 2) High GDS if the subject's GDS is expressed in the range of 180 mg/dl. Subjects with normal GDS were 47 subjects (92.2%) and subjects with high GDS were 4 subjects (7.8%).

Table 6. Relationship between Physical Activity and Body Mass Index (BMI)

BMI * Physical Activity Crosstabulation			
	Physical Activity		
	Active	Sedentary	Total

BMI	Ideal	26	10	36
	Not Ideal	7	0	7
	Obesity	7	1	8
Total		40	11	51

The relationship between physical activity and BMI The majority of BMI respondents were in the ideal group totaling 26 respondents actively doing physical activity and with a total of 10 respondents with a category of 10 respondents with a total of 36 respondents, For the non-ideal group 7 active respondents and the sedentary category 0 respondents with a total of not ideal 7 respondents, For BMI Obesity category active 7 respondents 1 sedentary person with a total of 8 respondents with a total overall relationship between physical activity and BMI with a total of 40 active people with 11 sedentary respondents with a total of 51 respondents.

Table 7. Relationship between body mass index and blood glucose level (GDS)

BMI * Blood Sugar Levels Crosstabulation

			Blood Sugar Levels		Total
			High	Normal	
BMI	ideal	Count	34	2	36
		% within BMI	94.4%	5.6%	100.0%
		% within Blood Sugar Levels	72.3%	50.0%	70.6%
		% of Total	66.7%	3.9%	70.6%
	not ideal	Count	7	0	7
		% within BMI	100.0%	0.0%	100.0%
		% within Blood Sugar Levels	14.9%	0.0%	13.7%
		% of Total	13.7%	0.0%	13.7%
	obesity	Count	6	2	8
		% within BMI	75.0%	25.0%	100.0%
		% within Blood Sugar Levels	12.8%	50.0%	15.7%
		% of Total	11.8%	3.9%	15.7%
Total		Count	47	4	51
		% within BMI	92.2%	7.8%	100.0%
		% within Blood Sugar Levels	100.0%	100.0%	100.0%
		% of Total	92.2%	7.8%	100.0%

In Table 7, the results of Ideal BMI with high GDS amounted to 34 respondents (66.7%). with Normal GDS amounted to 2 respondents 3.9%. then with BMI not ideal for normal GDS amounted to 0 (0.0) with high GDS amounted to 7 respondents (13.7%). for the category of Obesity BMI with high GDS the number of respondents was 6 people (11.8%) and with normal GDS the number of respondents was 2 people (3.9%).

Table 8. Spearman's Test Results

Correlations				
			BMI	Random Blood Glucose Level (GDS)
Spearman's rho	BMI	Correlation Coefficient	1.000	.173
		Sig. (2-tailed)	.	.224
		N	51	51
	Random Blood Glucose Level (GDS)	Correlation Coefficient	.173	1.000
		Sig. (2-tailed)	.224	.
		N	51	51

Based on Table 8, by looking at the significant value, it was found that there was no correlation between BMI and blood glucose levels during p ($p = 0.173$, $p>0.05$) while the p value of BMI and GDS correlation was $p = 0.224$ ($p>0.05$).

3.2. Discussion

Based on the results of the above research, it is evident that this study reveals factors associated with the occurrence of diabetes mellitus in the Work Area of Lageun Health Center, Setia Bakti District, Aceh Jaya Regency in 2024, where Diabetes Mellitus is a genetically inherited disease passed down to the next generation following the pattern of disease inheritance based on Mendel's Law or Mendelian Inheritance Pattern (Deo, 2006). This disease is inherited in an autosomal dominant manner, meaning that each child born, whether male or female, has an equal recurrent risk of 50% (Sunil, 2013). The characteristics of the subjects indicate that females outnumber males, and the duration of suffering from Type 2 DM is greater among the elderly, ranging from 46 to 74 years, with a percentage of (92.2%) (F. Sihombing, 2023). The majority of DM cases are found in the elderly, although nowadays, DM cases are not only affecting the elderly but also adolescents and children, with almost 50% of DM patients being over 65 years old (Suprapti, 2020).

Lack of knowledge about diabetes mellitus is caused by various factors, including educational background, occupation type, income level, and access to public health information. The higher the level of education, the greater the opportunity to access information about diabetes mellitus (Achenef et al., 2015). Diabetes mellitus (DM) cases in the work area of Lageun Health Center, Setia Bakti District, are most prevalent in Sawang Village, with 21 respondents, comprising 41.2% of the total. According to data from the Lageun Health Center in 2020, there were 89 DM patients in all villages within the work area of Lageun Health Center.

Based on information obtained through interviews, the majority of families of diabetes mellitus patients are unaware of the risk of disease inheritance in the next generation. Therefore, patients' families do not pay special attention to a healthy lifestyle, let alone regularly monitoring health at the Health Center, especially in maintaining stable blood sugar levels. However, blood sugar testing is very easy, quick, and inexpensive.

According to the results, Random Blood Glucose (RBG) is categorized into two parts: 1) Normal RBG if the blood glucose concentration in someone who is not a diabetes patient is in the range of 70 - 180 mg/dl, and 2) High RBG if the subject's RBG is in the range of 180 mg/dl. Subjects with normal RBG were 47 subjects (92.2%), and subjects with high RBG were 4 subjects (7.8%).

Another impact is from the level of anxiety (Falco 2015). The level of anxiety among diabetes mellitus patients varies greatly. The research results show that anxiety among diabetes mellitus patients in the work area of Lageun Health Center, Setia Bakti District, Aceh Jaya, mostly experiences moderate anxiety or depression, with 12 respondents comprising 23.5%, while those who do not feel pressured amount to 39 respondents, comprising 76.5%, with a total of 51 respondents, comprising 100.0%. The data shows that diabetes mellitus patients often experience feelings of restlessness, easy anger, easy irritation, tension, inability to rest soundly, sadness, muscle pain, and often feeling weak. This is because diabetes mellitus patients are worried about their condition (Setiawan et al., 2018).

Based on the results of this study, it is known that there is no correlation between RBG and BMI. Clinically, if someone is overweight, the level of leptin in the body will increase. The leptin hormone is related to the obesity gene. If the leptin level in the plasma increases, weight gain will occur. Leptin works on the peripheral and central nervous systems. Leptin will inhibit glucose uptake. Thus, an increase in blood sugar levels will occur. Data analysis results obtained from research subjects with a BMI of 30 kg/ not accompanied by high RBG, and it can be seen that age also does not affect high RBG or BMI > 30 kg/m² or BMI < 18.5 kg/m². Obesity does not always have high RBG. According to Sustriani (2004) cited from Witasari et al. (2009), the level of blood sugar depends on the activity of hormones released by the adrenal glands, namely adrenaline and corticosteroids. Adrenaline will stimulate an increase in blood sugar needs, and corticosteroids will reduce them again. BMI can be one of the references to determine. a person's risk of possible metabolic diseases. Underweight can increase the risk of infection, while overweight will increase the risk of degenerative diseases. Therefore, maintaining a normal weight allows a person to achieve a longer life expectancy (J. A. Sihombing et al., 2018).

4. CONCLUSION

Diabetes mellitus is a disease that continues to escalate in the future; it has already become one of the major threats to human health in the 21st century. Based on the findings of the research above, it is evident that this study reveals factors associated with the occurrence of diabetes mellitus, namely, age factor, where individuals suffering from diabetes mellitus are more vulnerable to the elderly, and the majority of diabetes mellitus patients are women. Stress also significantly affects diabetes mellitus because it impacts blood glucose control and levels. Stressful situations can lead to an increase in adrenaline hormones, which eventually can convert glycogen reserves in the liver into glucose. Additionally, body weight is also one of the factors that can affect an individual's blood sugar level. Underweight can increase the risk of infectious diseases, while overweight can increase the risk of degenerative diseases. Therefore, maintaining a normal body weight enables individuals to achieve a longer life expectancy.

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