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Research Article

THE FACTORS ASSOCIATE WITH THE INCIDENCE OF TYPE 2 DIABETES MELLITUS IN WOMEN IN THE WORKING AREA OF THE BIARO COMMUNITY HEALTH CENTER

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ABSTRACT

Background: The global prevalence of type 2 diabetes mellitus is steadily increasing, with a particularly notable rise among women. This study aims to identify factors associated with type 2 diabetes mellitus among women in the working area of Biaro Public Health Center.
Methods: A case-control study design was employed, involving 50 women diagnosed with type 2 diabetes mellitus (cases) and 50 women without type 2 diabetes mellitus (controls), selected randomly from the same population. Data were analyzed using both bivariate and multivariate statistical methods to determine significant predictors of type 2 diabetes mellitus.
Results: Bivariate analysis revealed significant associations between type 2 diabetes mellitus with age, family history of diabetes, level of education, physical activity, and stress ($p < 0.05$). Multivariate analysis identified that low physical activity as the most influential risk factor.
Conclusion: These findings highlight the urgent need for targeted health promotion strategies—particularly in the Biaro Public Health Center area— behavioral interventions such as physical activity on high-risk groups to effectively reduce the incidence of type 2 diabetes mellitus among women.

Keywords: Factor, type 2 diabetes mellitus, women, physical activity

INTRODUCTION

Diabetes mellitus is a health issue that can cause death and suffering worldwide. The number of deaths due to diabetes mellitus increased from 1.5 million deaths in 2019 to 6.7 million deaths in 2021.(1–4) Indonesia is the fifth country with the highest number of sufferers in the world, with 19.47 million people and a diabetes prevalence of 10.6%.(3)) The number of deaths caused by diabetes mellitus in Indonesia in 2021 was 236,711 deaths.(5)

Type 2 diabetes mellitus (DM) is the most common type of diabetes, accounting for 95% of all cases.(2,6) The results of the 2023 Indonesian Health Survey (SKI) show that type 2 diabetes melitus accounts for 50.2% of cases, the highest percentage compared to other types of DM.(7) Based on gender distribution, type 2 DM affects more women due to their physical characteristics, which are more at risk than men. Women experience significant hormonal changes and body mass index fluctuations compared to men, increasing their risk of developing type 2 diabetes. Lifestyle, blood pressure, and psychosocial factors also influence the risk of type 2 diabetes in women.(8) Impaired glucose tolerance is more common in women than in men. The menopause phase in women also increases their risk of developing type 2 diabetes. After menopause, estrogen production decreases, leading to impaired insulin secretion and reduced insulin sensitivity by organs. Therefore, the risk of developing type 2 diabetes increases.(9)

The number of people with type 2 diabetes in West Sumatra has increased. In 2021, 43,464 people were diagnosed with diabetes.(10) In 2022, this number increased to 48,206 people with diabetes mellitus.(11)) Agam Regency ranks third in the number of diabetes mellitus cases in West Sumatra. There was a twofold increase in cases between 2020 and 2021, with 1,544 cases in 2020 and 2,863 cases in 2021.(12,13) Ampek Angkek Subdistrict is one of the subdistricts in Agam District with the highest number of diabetes patients in 2021 (433 cases), 2022 (1,835 cases), and 2023 (577 cases).(12–14)

Ampek Angkek Subdistrict has not yet succeeded in reducing the incidence of type 2 diabetes mellitus, particularly among women. The factors influencing the occurrence of type 2 diabetes mellitus in women need to be identified so that appropriate approaches can be implemented to reduce the incidence of type 2 diabetes mellitus. If risk factors can be controlled, then the incidence and mortality rates due to type 2 diabetes mellitus can also be controlled. This study aims to identify factors associated with type 2 diabetes mellitus among women in the Biaro Health Center service area.

MATERIAL AND METHODS

This study was conducted from April to May 2024 among women in the Biaro Health Center service area using a retrospective case-control design. Sampling was conducted using simple random sampling based on the medical record database of the Biaro Health Center from April to May 2024. A total of 50 samples were selected among women with type 2 diabetes mellitus and 50 samples were selected among women without diabetes mellitus. Data collection was conducted through interviews using questionnaires administered to the selected women during home visits.

The inclusion criteria for the case group were women with type 2 diabetes mellitus documented in the medical records of the Biaro Community Health Center in April–May 2024, residing in the Biaro

Community Health Center area, willing to participate, and able to communicate well. The inclusion criteria for the control group were women without diabetes mellitus, documented as patients in the medical records of the Biaro Community Health Center in April–May 2024, residing in the Biaro Community Health Center area, willing to participate, and able to communicate well.

The data collected consisted of primary and secondary data. Primary data included family history of diabetes mellitus, physical activity, and stress. Secondary data included name, date of birth, address, weight, height, occupation, education, and history of hypertension. Data analysis included univariate analysis, bivariate analysis, and multivariate analysis.

RESULTS

Table 1. Characteristics of Respondents

Characteristics	n	%
History of Giving Birth to a Baby with Weight > 4000 Grams		
Yes	17	17
No	83	83
History of Hypertension		
Yes	56	56
No	44	44

Table 1 shows the characteristics of all respondents based on their history of giving birth to babies weighing more than 4000 grams. It can be seen that most respondents did not have a history of giving birth to babies weighing > 4000 grams (83%) and had a history of hypertension (56%).

Table 2. Frequency Distribution of Respondents with Diabetes Mellitus Incidence Type 2 in Women in the Biaro Health Center Working Area

Variable	Incidence of Type 2 Diabetes Mellitus			
	Case (50)		Control (50)	
	n	%	n	%
Age				
> 45 tahun	48	96	40	80
≤ 45 tahun	2	4	10	20
Family History of DM				
Yes	23	46	5	10
No	27	54	45	90
Education Level				
Low	27	54	15	30
High	23	46	35	70
Employment Status				
Not Working	34	68	30	60
Employed	16	32	20	40
Physical Activity				
Low	36	72	4	8
High	14	28	46	92
Nutritional Status				
Not Good	24	48	26	52
Good	26	52	24	48
Stress				
Stress	26	52	12	24
Not Stress	24	48	38	76

Table 2 shows a comparison of the characteristics of the cases and controls. Based on the table, it can be seen that percentage of cases is higher in the over 45 age group, those with a family history of DM, those with a low level of education, those with low physical activity, and those experiencing stress.

Table 3. Bivariate Analysis on Variables with the Incidence of Type 2 Diabetes Mellitus in Women in the Biaro Health Center Working Area

Variabel	OR	95% CI	*p-value*
Age	6,00	1,24 – 28,99	0,031
Family History of DM	7,67	2,60 – 22,54	<0,001
Educational Level	2,73	1,20 – 2,63	0,026
Employment Status	1,42	0,62 – 3,22	0,532
Physical Activity	29,57	8,96 – 97,57	<0,001
Nutritional Status	0,85	0,39 – 1,87	0,841
Stress	3,43	1,46 – 8,06	0,007

Table 3 shows the results of the bivariate analysis of risk factors for type 2 diabetes. The statistical results indicate that the variables of age, family history of diabetes, educational level, physical activity, and stress are significantly associated (p-value < 0.05) with type 2 diabetes. Women aged > 45 years have a 6-fold higher risk of developing type 2 diabetes compared to women aged ≤ 45 years. Women with a family history of diabetes mellitus have a 7.67 times higher risk of developing type 2 diabetes compared to women without a family history of diabetes mellitus. Women with a low level of education have a 2.73 times higher risk of developing type 2 diabetes compared to women with a high level of education. Women with low physical activity have a 29.57 times higher risk of developing type 2 diabetes compared to women with high physical activity. Women with stress have a 3.43 times higher risk of developing type 2 diabetes compared to women without stress.

Table 4. The Determine of the Incidence of Type 2 Diabeter Milleitus in Women in the Biaro Health Center Working Area

Variabel	OR	95% CI	*p-value*
Family History of DM	53,73	8,31 – 344,91	<0,001
Education Level	5,87	1,16 – 29,71	<0,001
Physical Activity	119,49	19,57 – 729,67	<0,001

Table 4 shows the results of the multivariate analysis. The purpose of this analysis was to determine which variables had the highest OR values, which would then be identified as the most dominant variables. The multivariate analysis also aimed to determine the adjusted OR values where the variables controlled each other. In the multivariate analysis, the backward method was used to remove insignificant variables from the model. Table 4 shows the final model obtained. Based on the table, it can be seen that the most dominant variable is physical activity, which has the highest OR value compared to family history of diabetes mellitus (DM) and educational level. Physical activity has an adjusted OR value of 119, meaning that women with low physical activity have a risk of developing type 2 DM that is 119 times higher than women with high physical activity under the same conditions of family history of DM and educational level.

DISCUSSION

This study found that age, family history of DM, education level, physical activity, and stress were significantly associated with the incidence of type 2 DM in women in the Biaro Community Health Center working area. The most dominant variable associated with the incidence of type 2 DM in women was low physical activity.

Age is one of the non-modifiable risk factors for type 2 diabetes mellitus. As a person ages, there is a decline in organ function, including the ability of pancreatic beta cells to produce insulin. The decline in insulin production by pancreatic beta cells in older age causes blood sugar levels to rise, leading to type 2 diabetes mellitus.(61) Based on the research results, there is a significant association between age and the incidence of type 2 diabetes mellitus in women. Women aged > 45 years have a 6-fold higher risk of developing type 2 diabetes mellitus compared to women aged ≤ 45 years. This is evidenced by an Odd Ratio of 6.0 (95% CI 1.24–28.99). However, these findings are inconsistent with the study conducted by Harris et al. (2017), which found no association between age and the incidence of type 2 diabetes mellitus in women (p-value = 0.314).(44) Most of the women in this study were over 45 years old, at which age bodily functions begin to decline. These hormonal changes and decreased physical activity increase the risk of developing type 2 diabetes mellitus.

A family history of diabetes mellitus can increase the risk of developing type 2 diabetes mellitus. If one or both parents in a family have diabetes mellitus, their children have a higher risk of developing diabetes mellitus.(61) The results of this study indicate that there is a significant association between family history of diabetes mellitus and the incidence of type 2 diabetes mellitus in women (p-value = <0.001). Women with a family history of diabetes mellitus are 7.67 times more likely (95% CI 2.61–22.54) to develop type 2 diabetes mellitus compared to women without a family history of diabetes mellitus. This study aligns with research conducted by Nurmaili et al. (2022), which found a significant association between family history of diabetes mellitus and the incidence of type 2 diabetes mellitus in women, with a p-value of 0.017.(47) A person with a family history of diabetes mellitus is 42.6 (95% CI 16.58–109.47) times more likely to develop diabetes mellitus than a person without a family history of diabetes mellitus.(54)

A person's level of education influences their knowledge, especially knowledge about health. People with higher education have better access to health information and are able to support themselves in living a healthy lifestyle. The results of this study show that there is a significant relationship between education level and the incidence of type 2 diabetes mellitus in women. This is indicated by a p-value of 0.026. Additionally, the odds ratio obtained is 2.74 (95% CI 1.20–6.23), meaning that women with lower education levels are 2.74 times more likely to develop type 2 diabetes mellitus compared to women with higher education levels. This study is supported by research conducted by Harris et al. (2017), which found a significant association between educational level and the incidence of type 2 diabetes mellitus in women (p-value = <0.001).(44)

Good physical activity can increase the body's sensitivity to insulin. In addition, good physical activity can manage weight by burning calories and increasing the body's metabolism. When a person's physical activity is low, the body becomes less efficient at using insulin and increases the risk of developing type 2 diabetes mellitus.(63) Based on the results of the study, there is a significant relationship between physical activity and the incidence of type 2 diabetes mellitus in women (p-value = 0.001). Women with low physical activity are 29.6 times more likely to develop type 2 diabetes mellitus than women with high physical activity. This study aligns with

research conducted by Nugrahaeni et al. (2020), which found a significant association between physical activity and the incidence of type 2 diabetes mellitus in women (p-value = 0.01). Women with low physical activity levels are 2.9 times (95% CI 1.24–6.94) more likely to develop diabetes mellitus compared to women with high physical activity levels.(50)

Stress is associated with an increased risk of type 2 diabetes mellitus. Under stressful conditions, the body releases stress hormones that cause an increase in blood sugar levels as a source of energy. If a person experiences prolonged stress, the body will develop insulin resistance. The body's cells cannot respond optimally to insulin, causing blood sugar levels to rise. This increases the risk of developing type 2 diabetes mellitus.(44) The results of this study obtained a p-value of 0.007, indicating a significant association between stress and the incidence of type 2 diabetes mellitus in women. Women experiencing stress are 3.43 times more likely to develop type 2 diabetes mellitus compared to those who are not stressed (95% CI 1.46–8.06). This study aligns with research conducted by Harris et al. (2017), which also found a significant association between stress and the incidence of type 2 diabetes mellitus in women (p-value = 0.001). Women experiencing severe stress are 2.3 times more likely to develop type 2 diabetes mellitus compared to women with mild stress.(44) This study is also supported by Latifah's (2020) research, which found that stress is associated with the incidence of diabetes mellitus (p-value = 0.005) and that people who experience stress are 3.8 times more likely to develop diabetes mellitus than those who do not experience stress.(60)

CONCLUSION

Factors associated with the incidence of type 2 diabetes mellitus in women in the Biaro Community Health Center working area are age, family history of diabetes mellitus, educational level, physical activity, and stress. Physical activity is the most strongly associated factor (OR=119.49) with the incidence of type 2 diabetes mellitus among women in the service area of the Biaro Health Center. Therefore, it is recommended that the Biaro Health Center actively conduct diabetes education and screening for type 2 diabetes among high-risk groups.

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