

Analysis of Determinant Factors Affecting Blood Sugar Levels in Diabetes Mellitus Patients at the Johan Pahlawan Medical Facility of West Aceh

ABSTRACT:

Aims: A rise in blood sugar levels within the body is the cause of diabetes mellitus, a degenerative disease. Modifiable risk factors for diabetes mellitus include being overweight, not exercising, central obesity, Dyslipidemia, eating a diet rich Lacking in fiber and high in sugar, and non-modifiable risk factors including genetics.

Study Designs: Cross Sectional Design

Place and Duration of study: West Aceh Regency's Johan Pahlawan District is home to the Johan Pahlawan Health Center. The study was conducted between August and December of 2024.

Methodology: Sample: This study had 87 people, Of them, 63 were women and 24 were men. Ages range from 36 to 83. Every diabetic patient receiving care at the Johan Pahlawan West Aceh Medical Center.

Results: The analysis's findings demonstrated that, at the Johan Pahlawan West Aceh Health Center, there was a correlation among body mass index and diabetes mellitus (P Value = 0.049), and there is a connection among diet and blood sugar levels value (P Value = 0.009), knowledge (P Value = 0.003), family history (P Value = 0.044), and physical activities (P Value = 0.006).

Conclusion: According to the research, blood sugar levels value in diabetes mellitus sufferer at the Johan Pahlawan Medical Center in West Aceh are correlated with their diet, body mass index, knowledge, family history, and physical activity.

Keywords: Blood Sugar Level, Diet, Knowledge, Body Mass Index, Family History, Physical Activity

1. INTRODUCTION

Diabetes is a degenerative illness that arises when blood the amounts of sugar are abnormal brought on insulin secretion or the way insulin works, even a combination of the two (Rahman) *et al.*, 2023). Diabetes Mellitus can worsen quality of life and even lead to death (Anggreini & Lahagu, 2021). Diabetes can also affect various organs and systems of the body over a period of time, called complications (Rif"at *et al.*, 2023). The cause of Diabetes Militus is not exclusively the result of one factor nonetheless, the outcome of a combination of various risk factors. Risk factors for DM are differentiated into modifiable risk factors such as overweight, smoking, obese, dyslipidemia, dietary habit (high sugar and low in fiber), and smoke (Anri A 2022). Irreversible risk factors such as genetics (Lestari *et al.*, 2021). Research shows that these Numerous things may influence the risk of developing Diabetes Militus, such as unhealthy diet, low level of nutritional knowledge and family history. In addition, knowing the body mass index also plays a significant part in the early detection of diabetes risk and the management of its causative factors.

According to *International Diabetes Federation* (IDF), Every year, the quantity of diabetes mellitus cases rises globally. In 2021, the number of DM sufferers worldwide reached 537 (IDF 2021). In 2022, people with DM he World Health Organization (WHO) claims that in (Maharani *et al.*, 2024) are around 422 million people in the world. Indonesia is the 5th ranked country with 19.5 million DM sufferers in 2021 (IDF 2021). Meanwhile, in 2022 the number of DM sufferers in Indonesia increased to 41.8 million (IDF 2022). And in 2023, according to the Indonesian Health Survey (SKI), there are 877,531 people with DM in

Indonesia (SKI 2023). According to the Aceh Provincial Health Profile, there were 184,527 DM sufferers in 2021 (Profile 2021), while in 2022 DM patients in Aceh reached 189,464 sufferers (Profile 2022). And in 2023, according to the Indonesian Health Survey, the number of DM sufferers in Aceh will be 17,271 (SKI 2023).

Based on EPROFILKES, In 2021, there were 5.87 DM patients in West Aceh. In 2022, there are 4,310 people with DM in West Aceh and in 2023 there are 4,325 people with DM in West Aceh (EPROFILKES). The Johan Pahlawan Health Center has the most number of patients with diabetes mellitus in West Aceh, according to the West Aceh Health Office. There were 2,703 DM patients at the Johan Pahlawan Health Center in 2021, and 5,709 DM patients there in 2022. The Johan Pahlawan Health Center will have 5,251 DM patients in 2023. Additionally, 639 (67%), DM patients will be treated at the Hero Champion Health Center between January and August of 2024.

Based on research conducted by Sahriana (2019), the results showed that there was a relationship between diet and the incidence of Diabetes Mellitus at the South Tapanuli Regional Hospital with a P value of $0.000 < P \text{ value} = 0.05$. The results of research conducted by Nurlaely et al., (2024) based on the chi square test conducted to determine the relationship between knowledge and the incidence of diabetes mellitus obtained a P value of $0.000 (P < 0.05)$, this shows that there is a significant relationship between knowledge and the incidence of Diabetes Mellitus. The same results were also obtained by Nurlaely et al., (2024) to determine the relationship between family history and the incidence of Diabetes Mellitus with a P value of $0.001 (P < 0.05)$. The results of Leseila's research (2019) based on the chi square test conducted, there was a relationship between physical activity and diabetes mellitus obtained a P value of $0.000 < 0.05$.

From these problems, his research focuses on examining determinants of Blood Sugar Level Values in Diabetic Mellitus sufferer such as diet, knowledge, family history, body mass index and physical activity. This approach is expected to provide new insights into comprehensive prevention efforts as well as more optimal diabetes risk predictor management strategies at the individual and population levels.

2. Material And Methods

2.1 Material

The instruments employed in this investigation are digital scales to measure weight, to measure height using microtoise (ZEA), then to measure blood sugar levels using a glucometer (Easytouch).

2.2 Method

This investigation employs a quantitative technique using a cross-sectional design and an analytical survey research type. All patients with diabetes mellitus at the Johan Pahlawan Medical Center in West Aceh comprise the study's populace. There were 639 individuals with diabetes at the Johan Pahlawan Medical Center between January and August of 2024. The non-probability sampling method combined with the accidental sampling method is used for sampling in this study. Diet, knowledge, family history, body mass index, and physical activity were the five independent variables in this study. The Johan Pahlawan Health Center's Determinant of Blood Sugar Levels value in Diabetes Sufferer is the study's dependent variable. From August to December 2024. The research instrument that will be used in this study is a questionnaire. In this study using univariate tests, bivariate tests and multivariate tests using SPSS.

3. Result And Discussion

3.1 Result

3.1.1 Responsive Features

1. Characteristics Respondent based on age

Table 1 below show results calculation frequency and percentage based on age

Table 1 Frequency Distribution of Age Characteristics of Diabetes Mellitus Respondents at the Johan Pahlawan Health Center, West Aceh

Age	Frequency	Percentage %	Mean
36-45	5	5.7	
46-55	25	28.7	
56-65	36	41.4	59.59
>65	21	24.1	
Total	87	100.0	

Based on table 1 is known that amount respondents in the study This as many as 87 respondents . Some of them big age is 56-65 years old as many as 36 people (41.4%), while Respondent the lowest are 36-45 years old as many as 5 people (5.7%). And average age respondents at 59.59 years .

2. Respondent characteristics based on type sex

Table 2 below show results calculation frequency and percentage based on type sex

Table 2 Distribution Frequency Characteristics Type Sex Respondents with Diabetes Mellitus at the Johan Pahlawan Health Center, West Aceh

Type sex	Frequency	Percentage %
Man	24	27.6
Woman	63	72.4
Total	87	100.0

Based on table 2 is known that amount respondents in the study This as many as 87 people. Most of them Respondent various sex Woman as many as 63 people (72.4%).

3. Respondent characteristics based on education

Table 3 below show results calculation frequency and percentage based on Education

Table 3 Distribution Frequency Characteristics of Education of Diabetes Mellitus Respondents at Johan Pahlawan Health Center , West Aceh

Education	Frequency	Percentage %
Elementary School	26	29.9
Junior High School	20	23.0
Senior High School	28	32.2
Diploma	9	10.3
S1	4	4.6
Total	87	100.0

Based on table 3 is known that amount respondents in the study This as many as 87 people. Most of them Respondent have a high school education of 28 people (32.2%), while the lowest that is Respondent with the last education college with a bachelor degree as many as 4 people (4.6%).

4. Respondent characteristics based on work

Table 4 below show results calculation frequency and percentage based on work

Table 4 Distribution Frequency Characteristics Work Respondents with Diabetes Mellitus at the Johan Pahlawan Health Center, West Aceh

Work	Frequency	Percentage %
------	-----------	--------------

Farmer	4	4.6
Trader	4	4.6
civil servant	5	5.7
Retired	12	13.8
Housewife	43	49.4
Other	8	9.2
No Work	11	12.6
Total	87	100.0

Based on table 4 is known that amount Respondent as many as 87 people. Most of them Respondent own work That Mother House ladder as many as 43 people (49.4%), while Meanwhile, the jobs with the lowest frequency distribution were traders and farmers, only 4 people (4.6%).

3.1.2 Variable Characteristics

A. Up to Bloos Sugar

Table 5 below displays the findings of the frequency and percentage computation based on blood sugar level values:

Table 5 Distribution of Blood Sugar Level Value Frequency Characteristics among Respondents Considering Diabetes Mellitus at the Johan Pahlawan Medical Center in West Aceh

KGD Value	Frequency	Presented %
Tall	69	79,3
Lowly	18	20,7
Total	87	100.0

According to Table 5, 69 respondents, or 79.3%, had blood sugar levels that were too high.

B. Body Mass Index

Table 6 below displays the findings of the frequency and percentage computations based on body mass index:

Table 6 Frequency distribution of body mass index among Johan Pahlawan Medical Center patients with diabetes mellitus in West Aceh

Body Mass Index	Frequency	Presented %
Usual	69	79,3
Fat	18	20,7
Total	87	100.0

The highest responders have a normal BMI of 69 individuals (79.3), according to table 6.

C. Diet

Table 7 below displays the findings of the frequency and percentage computation depending on diet:

Table 7 Distribution of dietary frequency among Johan Pahlawan Health Center patients in West Aceh with diabetes mellitus

Diet	Frequency	Presented %
Good	37	42,5
Deficient	50	57,5
Total	87	100.0

Table 7 shows that 50 individuals, or 57.5% of the total responses, have poor diets.

D. Knowledge

Table 8 below displays the findings of the frequency and percentage computation based on knowledge:

Table 8 Distribution of Diabetes Mellitus Patients' Knowledge Frequencies at the Johan Pahlawan Medical Center in West Aceh

Knowledge	Frequency	Presented %
Good	34	39,1
Deficient	53	60,9
Total	87	100.0

Table 8 indicates that 53 individuals, or 60.9% of the total responses, have inadequate knowledge.

E. Family History

Table 9 below displays the findings of the frequency and percentage computation based on family history

Table 9 Distribution of Family History Frequencies in Johan Pahlawan West Aceh Health Center Patients with Diabetes Mellitus

Genetics	Frequency	Presented %
Have	45	51,7
Don't have	42	48,3
Total	87	100.0

Table 9 illustrates that the largest percentage of patients 45 individuals, or 51.7% had a family history of diabetes mellitus.

F. Physical Activity

Table 10 below displays the findings of the frequency and percentage computation based on family history

Table 10 The Johan Pahlawan Health Center in West Aceh's Diabetes Mellitus Patients' Distribution of Physical Activity Frequency

Physical activity	Frequency	Presented %
Good	24	27,6
Not good	63	72,4
Total	87	100.0

Table 10 show that the mostly of patients 63 individuals, or 72.4% have low levels of physical activity.

3.1.3 Bivariate Test

The Association In relation to the Body Mass Index and Blood Sugar Levels value in Diabetic Mellitus Sufferer at the Johan Pahlawan Medical Center in West Aceh

1. **Table 11** Correlation among Body Mass Index and KGD Value in Diabetes Mellitus Sufferer at Johan Pahlawan Medical Center, West Aceh

Body mass index	KGD Value				Total		P value
	Tall		Low				
	N	%	N	%	n	%	
Normal	58	84,1	11	15,9	69	100	0,049
Fat	11	61,1	7	38,9	18	100	

The table above also shows that the outcomes of the data processing using Chi Square relation body mass index and KGD value in diabetes Sufferer in the Johan Pahlawan Health Center, West Aceh, obtained a P value = 0.049 ($p < 0.005$), this states that H_a is be accepted and H_0 is rejected, It indicates that blood sugar levels and body mass index are related in diabetes mellitus Sufferer at the Johan Pahlawan Medical Center in West Aceh.

2. The correlation Between Diet and Sugar In The Blood in Diabetic Sufferer at the Johan Pahlawan Medical Center in West Aceh

Table 12: Diet and KGD Value in Diabetes Mellitus Sufferer at Johan Pahlawan Medical Center in West Aceh

Diet	KGD Value				Total		P value
	Tall		Low				
	N	%	N	%	n	%	0,009
Good	24	64,9	13	35,1	37	100	
Not good	45	90,0	5	10,0	50	100	

The table above also shows that the outcomes of the data processing using Chi Square between diet and Blood Sugar Levels value in Diabetes sufferers at the Johan Pahlawan Medical Center, West Aceh obtained a P value = 0.009 ($p < 0.005$), this states that H_a is be accepted and H_0 is rejected, This indicates that blood sugar levels and diet are related with diabetes mellitus sufferer at the Johan Pahlawan Medical Center in West Aceh.

3. The Correlation Between Knowledge and Blood Sugar Level Value in Diabetic Mellitus Sufferer at the Johan Pahlawan Medical Center in West Aceh

Table 13 Knowledge and KGD Value Relationship in Diabetes Mellitus Sufferer at Johan Pahlawan Medical Center in West Aceh

Knowledge	KGD Value				Total		P value
	Tall		Low				
	N	%	N	%	n	%	0,003
Good	21	61,8	13	38,2	34	100	
Not good	48	90,6	5	9,4	53	100	

The table above also shows that the outcomes of data processing using Chi Square between knowledge and Blood Sugar Levels value in Diabetes Mellitus sufferers at the Johan Pahlawan Medical Center, West Aceh, obtained a P value = 0.003 ($p < 0.005$), this states that H_a is be accepted and H_0 is rejected, It indicates that among diabetes mellitus sufferer at the Johan Pahlawan Medical Center in West Aceh, there is a correlation between blood sugar levels and knowledge.

4. The Correlation Between Family History and Blood Sugar Level in Diabetic Mellitus Sufferer at the Johan Pahlawan Medical Center in West Aceh

Table 14 Family History and KGD Value in Patients with Diabetes Mellitus at Johan Pahlawan West Aceh Health Center

Family history	KGD Value				Total		P value
	Tall		Low				
	N	%	N	%	n	%	0,044
Ada	40	88,9	5	11,1	45	100	
No	29	69,0	13	31,0	42	100	

table above also shows that outcomes of data processing using Chi Square between Family History and Blood Sugar Levels in Diabetes Mellitus sufferer at the Johan Pahlawan Medical Center, West Aceh, obtained a P value = 0.044 ($p < 0.005$), this states that H_a is be accepted and H_0 is rejected, It indicates that blood sugar levels and family history are related diabetes mellitus sufferer at the Johan Pahlawan Medical Center in West Aceh.

5. The Correlation Between Physical Activity and Blood Sugar Levels Value in Diabetic Mellitus Sufferer at the Johan Pahlawan Medical Center in West Aceh

Table 15 Association relation KGD Value and Physical Activity in Patients with Diabetes Mellitus at Johan Pahlawan Medical Center in West Aceh

Physical activity	KGD Value				Total		P value 0,006
	Tall		Low				
	N	%	n	%	n	%	
Good	14	58,3	10	41,7	24	100	
Not good	55	87,3	8	12,7	63	100	

The table above also shows that outcomes of data processing using Chi Square relation physical activity and Blood Sugar Levelsvalue Diabetes Mellitus sufferer in the Johan PahlawanMedical Center, West Aceh obtained a P value = 0.006 ($p < 0.005$), this states that H_a is be accepted and H_0 is rejected , it indicates that Blood Sugar Levels and physical activity are related Diabetes Mellitus sufferer in the Johan Pahlawan Health Center, West Aceh.

3.1.4 Uji Multivariat

The table below shows the factors that, according to statistical findings, have the most effects on elevated blood sugar levels

Table 16The Johan Pahlawan Health Center in West Aceh's Diabetes Mellitus Patients' High Blood Sugar Levels Are the Most Important Factor

Variable	P value	OR	OR 95% CI	
			LOWER	UPPER
Body Mass Index	0.025	2.727	1.135	6.555
Diet	0.012	0.137	0.029	0.648
Knowledge	0.006	0.084	0.014	0.500
Family History	0.050	4.473	0.998	20.044
Physical activity	0.011	0.132	0.028	0.624

Family history is the most significant factor influencing blood sugar levels value in people with diabetes mellitus, according to the outcomes of the logistic regression test on each independent variable that influences the dependent variable. This means that individuals High blood sugar levels are four times more common in people with a family history of diabetes mellitus than in people without the condition.

3.2 Discussion

3.2.1 Body Mass Index

The findings of the studies that occurred conducted There is a Association between blood sugar levels value and body mass index with diabetes mellitus sufferer in the Johan PahlawanMedical Center in West Aceh, according to the outcomes of the Chi Square statistical test, which yielded a value of P value = 0.049, which is greater than $\alpha = 0.05$ ($P \text{ value} = 0.049 < \alpha = 0.05$). High levels of GDs are not usually associated with obesity. On the other hand, blood sugar levels can be impacted by the corticosteroid hormones and adrenaline that the adrenal glands release. While adrenaline might raise blood sugar requirements, corticosteroids typically lower blood sugar levels. Body mass index is frequently used by people to assess their risk of developing metabolic diseases (Sherwood, 2009). But the Body The results of this study are in line with the research (Sari 2024) Based on the outcome of *the Chi Square test*, the value of $P = 0.005 \leq 0.05$, There is a correlation between blood sugar levels and body mass index in sufferer with type II diabetes mellitus at the Telaga Dewa Health Center in Bengkulu City, indicating that H_0 is rejected and H_a is accepted. This study also supports studies (Harahap, 2020) that found a significant correlation among Body mass index and blood sugar levels in individuals with diabetes mellitus in Sisumut village, Kotapinang district.

3.2.2 Diet

Correlation between blood sugar levels value and diet with diabetes mellitus sufferer, according to the findings of a study done at the Johan Pahlawan West Aceh Health Center with 87 respondents. The outcome of the Chi Square test statistical test revealed that of $p (0.009) < \alpha (0.05)$. A diet is a collection of data that gives a general idea of the kinds of foods and quantities of food that people eat on a daily basis,

as well as what is particular to a particular group (Sulistyoningsih, 2011: Yanti 2016). Diet is one of the behaviors or habits that can impact your health. This is because a person's and society's consumption of certain foods and beverages has an effect. As a result, the body maintains a normal or healthy weight, is immune to infectious diseases, and avoids chronic illnesses and early mortality (Adriana, 2016). The results of this investigation align with those of a 2016 study by DwiRahmaFebriYanti at the Bengkulu City Fish Market Health Center, which found a correlation between diet and the incidence of diabetes mellitus with a P value of 0.000 ($p < 0.05$). The statistical test results showed a significant correlation among diet and the incidence of Diabetes Mellitus at the South Tapanuli Regency Hospital, with a value of $P = 0.000$ ($P \text{ value} < 0.05$), indicating that H_0 was rejected in accordance with Ritongga's (2019) research.

3.2.3 Knowledge

In light of the findings of research conducted at the Johan Pahlawan West Aceh Health Center from 87 Respondents, the Chi Square test statistical results revealed that the value of p (0.003) $< \alpha$ (0.005), indicating a correlation between the KGD value and knowledge in patients with diabetes mellitus. Understanding diabetes mellitus can aid in diabetes management, enabling more and more individuals with the disease to become aware of their condition, learn how to modify their behavior, and control their diabetes to extend their lives and improve their quality of life (Teslatu 2023). Knowledge is the product of a person's curiosity and through a sensory process that uses their five senses, primarily the ears and eyes, towards a particular item. Knowledge plays a major role in shaping open and open conduct (Donsu, 2017). With a association coefficient of -0.281, the findings of this study are consistent with Azra's research from 2024 at Mitra Siaga Hospital in Tegal Regency, which demonstrated that the lower the blood sugar level and the direction of the negative relationship with low relationship closeness, the higher the level of knowledge. The findings of this study also support those of a study by Fadhli et al. (2022) that found a substantial correlation between blood sugar levels and knowledge.

3.2.4 Family History

Correlation link blood sugar levels and family history value with diabetes mellitus sufferer, according to the findings of a study done at the Johan Pahlawan Medical Center in West Aceh with 87 respondents. The outcome of the Chi Square test statistical test revealed that the value of p (0.044) $< \alpha$ (0.005). Genetic risk factors for diabetes mellitus indicate a connection between the disease and inherited variables. In "genetic" words, genes are elements that influence whether a person's offspring will inherit particular traits from them. However, a person's elevated risk does not guarantee that they will get diabetes mellitus. Genetic factors are only seeds. As an illustration, these seedlings will (Sutanto, 2015). The findings of this investigation are consistent with those of Siregar's (2022) study, which found a correlation between genetics and the incidence of diabetes mellitus in the elderly population of AekGodang Village in 2022, with a P value = 0.023 ($P < 0.05$). The results of this study showed a correlation between genetic history and DM patients in Lalang Village with a P value of 0.029 ($p < 0.05$), which is consistent with the research done by Sibagariang et al., (2024).

3.2.5 Physical Activity

Correlation between physical activity and the KGD value with diabetes mellitus Sufferer, according to the findings of a study done at the Johan Pahlawan West Aceh Medical Center with 87 respondents. The outcomes of the Chi Square analyze statistical test revealed that the value of p (0.006) $< \alpha$ (0.005). One of the key tenets of clinical treatment for people with type 2 diabetes (T2DM) is physical activity. In addition to improving glucose balance and other metabolic risk factors, physical activity enhances quality of life. There is proof that rigorously regulated physical activity can raise blood cholesterol and blood sugar levels (Serbis et al., 2021). P value = 0.013 ($P < 0.05$), it indicates that H_0 is rejected and H_a is accepted, indicates that there is a relationship among blood sugar levels and physical activity in patients with type II diabetes mellitus at Padangsidempuan City Hospital. This study is consistent with research done by Oktapia (2019) at Padangsidempuan Hospital. According to Ananda's (2024) research, there is a correlation between glucose levels and physical activity in patients with diabetes mellitus at the Dempet Health Center; the P-value, also known as the Sig (2-tailed), is 0.04 or less than 0.005.

3.2.6 Multivariate Discussion

Five factors significantly impacted blood sugar levels value in individuals with diabetes, according to the study's findings utilizing the logistic regression test. These factors include physical activity, family history, knowledge, nutrition, and body mass index. Among the five variables, family history is the variable that most affects blood sugar levels value with diabetes mellitus sufferer with an OR value of 4,473 which means that individual with diabetes mellitus who have a family history will be at 4 times greater risk of high blood sugar levels compared to people with diabetes mellitus who do not have a family history.

4. Conclusion

Blood sugar levels and diet are related with diabetes mellitus sufferer at Johan Pahlawan MedicalCenter in West Aceh, with a P value of 0.009 <0.05. Blood sugar levels and knowledge are related in diabetes mellitus sufferer at Johan PahlawanMedicalCenter in West Aceh, with a P value of 0.003 <0.05. Blood sugar levels and family history are related with diabetes mellitus sufferer at Johan PahlawanMedical Center in West Aceh (P value = 0.044 <0.05). Blood sugar levels and physical activity are related in patients with diabetes mellitus at Johan PahlawanMedicalCenter in West Aceh, with a P value of 0.006 <0.05 correlation exists between blood sugar and body mass index.

ACKNOWLEDGEMENTS

My sincere appreciation goes out to everyone who helped in the making of this project.

AUTHORS' CONTRIBUTIONS (KONTRIBUSI PENULIS)

Efforts to improve the degree of public health to avoid symptoms of diabetes mellitus at the research location by providing education on managing a good diet, increasing knowledge about the impact of diabetes mellitus, reducing risk factors for family history of diabetes mellitus and doing regular physical activity.

ETHICAL APPROVA:

This Research Has Passed the Code of Ethics from the University Research Institute and the Dean of the Faculty of Health Sciences

REFERENCES

- Adriana, M. (2016) Introduction to Community Nutrition. Jakarta: KENCANA. Available at: https://books.google.com/books/about/Pengantar_Gizi_Masyarakat.html?hl=id&id=kqhADwAAQBAJ
- Alamsyah, T., Marniati, M., Niswah, N., Nurhayati, N., Fajriansyah, F., & Ritawati, R. (2023). Support in providing adequate nutrition for the length of treatment for patients after bone fracture surgery at the Meuraxa Hospital, Banda Aceh. *AcTion: Aceh Nutrition Journal*, 8(4), 596-603.
- Ananda, E. Y. (2024). *The Relationship Between Physical Activity and Blood Glucose Levels in Type 2 Diabetes Mellitus (Doctoral Dissertation)*, Sultan Agung Islamic University, Semarang).
- Anggreini, S. N., & Lahagu, E. L. (2021). The Influence of Health Education on Diabetes Mellitus on the Attitude of Type 2 Diabetes Mellitus Patients in the Rejosari Health Center Area, Pekanbaru. *Science Tower: Journal of Research and Scientific Studies*, 15(2).
- ANRI, A. (2022). *The Effect of Body Mass Index, Diet, and Physical Activity on the Incidence of Type 2 Diabetes Mellitus*. *Journal of Nursing and Public Health*, 10(1), 7-13.
- Anwar, S., Alamsyah, T., Safrida, S., Duana, M., Khairunnas, K., Putri, E. S., ... & Muliadi, T. (2024). Associated between hypertension and body mass index, cholesterol, and blood sugar levels in elderly women. *AcTion: Aceh Nutrition Journal*, 9(3), 496-504.
- Donsu, genius. 2017. *Nursing Psychology*, Yogyakarta. New libraries

- Fadhli, R., Turcia, R., & Ekaputri, M. (2022). *The Relationship between the Level of Knowledge and Dietary Adherence to Blood Sugar Levels of Patients with Type II Diabetes Mellitus at the Internal Medicine Polyclinic of Sansani Hospital, Pekanbaru*. *Journal of Nursing*, 11(2).
- Federation, I. (2021). *IDF Diabetes Atlas Eighth edition 2017*. International Diabetes Federation. IDF Diabetes Atlas, 2017
- Harahap, A. M., Ariati, A., & Siregar, Z. A. (2020). *The relationship between body mass index and blood sugar levels in patients with diabetes mellitus in Sisumut Village, Kotapinang District*. *IbnuSina: Journal of Medicine and Health-Faculty of Medicine, Islamic University of North Sumatra*, 19(2), 81-86.
- International Diabetes Federation. International Diabetes Federation's guide for diabetes epidemiological studies. Available at: <https://www.idf.org/our-activities/epidemiology-research/idf-guide-for-diabetes-epidemiologystudies.html>, accessed 24th September 2021. 2021.
- Lestari, L., & Zulkarnain, Z. (2021, November). *Diabetes Mellitus: Review of etiology, pathophysiology, symptoms, causes, examination, treatment and prevention*. In *Proceedings of the National Seminar on Biology (Vol. 7, No. 1, pp. 237-241)*.
- Marniati, M. (2016, December). The influence of people's knowledge and attitudes toward traditional treatment. In *1st Public Health International Conference (PHICo 2016)* (pp. 159-162). Atlantis Press.
- Novita, A., Marniati, M., Husna, A., Iskandar, I., Putranto, R. H., Putri, E. S., & Anwar, S. (2022). Study of Intrinsic and Extrinsic Factors with Diabetes Mellitus Classification. *J-Kesmas: Jurnal Fakultas Kesehatan Masyarakat (The Indonesian Journal of Public Health)*, 9(2), 18-25.
- Oktapia, M. (2019). *The Relationship Between Physical Activity and Blood Sugar Levels in Type II Diabetes Mellitus Patients at Padangsidempuan Hospital*
- Putri, E. S., Khairunnas, K., Maifizar, A., Anwar, S., & Marniati, M. (2022, March). The Effectiveness of Giving Dried Belimbing Wuluh/Averrhoa bilimbi L. (Sunti Aceh) Extract Dose 25 mg/gr of Body Weight on Reducing Blood Sugar Levels in Diabetic Rats. In *THE 3RD INTERNATIONAL CONFERENCE ON PUBLIC HEALTH (ICPH) 2021*.
- Putri, E. S., Marniati, M., & Yarmaliza, Y. (2017). Difference in the mean risk factors that can be changed with the incidence of type II DM kidney failure complications. *Pros Semin Nas IKAKESMADA "The Role of Health Workers in SDGs Implementation"*, 81-4.
- Putri, E. S., Marniati, M., Husna, A., & Maifizar, A. (2020). The Influence of Hypertension and High-Density Lipoprotein on the Diabetic Nephropathy Patients. *prevalence*, 2(10), 11.
- Putri, E. S., Marniati, M., Khairunnas, K., Mulyani, I., Siregar, S. M. F., & Anwar, S. (2024). EMPOWERING POSYANDU LANSIA GROUP THROUGH LOCAL FOOD PROCESSING TRAINING FOR PREVENTION OF DIABETES. *Abdi Dosen: Jurnal Pengabdian Pada Masyarakat*, 8(1), 67-76.
- Rahman, A., Yustian, A. A., Fitria, A., Hariyanto, A. Y., Rahmah, A., Saputri, R., & Hakim, A. R. (2023). *Education about Diabetes Mellitus in Sungai Rangas Tengah Village Health Cadres*. *Scholar Magazine*, 1(3), 141-145.
- Rif'at, I. D., Hasneli, Y., & Indriati, G. (2023). *Overview of Diabetes Mellitus Complications in People With Diabetes Mellitus*. *Journal of Professional Nursing*, 11(1), 52-69
- Ritonga, S. (2019). *The relationship between diet and the incidence of diabetes mellitus at the South Tapanuli Regency Hospital*.
- Sari, R. M., Marlana, F., & Nurhasanah, N. (2024). *The relationship between body mass index (BMI) and physical activity with blood sugar levels in patients with type II diabetes mellitus at the Telaga Dewa Health Center, Bengkulu City*. *INJECTION: Nursing Journal*, 4(1), 87-95.
- Sherwood (2009) 'Introduction to Human Physiology', *American Journal of Public Health and the Nations Health*, 38(11), pp. 1590–1590. doi: 10.2105/ajph.38.11.1590-b.
- Sibagariang, E. E., Simajuntak, M. R., Zega, B. E., & Sibagariang, A. (2024). *The Relationship of Knowledge, Activities, and Genetics in Diabetic Mellitus Patients in Lalang Village*. *Ibn Sina: Journal of Medicine and Health-Faculty of Medicine, Islamic University of North Sumatra*, 23(2), 279-286
- Sulistyoningsih, H. 2011. "Nutrition for Maternal and Child Health". Yogyakarta: Graha Ilmu.
- Susanto, J.P. (2015). Maturity-Onset Diabetes of the Young (MODY). *CDK- 223/Vol.41 No.12*. Diakses 10 Desember 2016, Dari www.kalbemed.com/.../06_223CME-maturu

Yanti, D. R. F. (2016). *The Relationship between Sedentary Behavior and Diet with the Incidence of Diabetes Mellitus at the Bengkulu City Fish Market Health Center in 2016* (Doctoral dissertation, Dehasen University of Bengkulu).