International Journal of Health, Economics, and Social Sciences (IJHESS)
Vol. 8, No. 2, April 2026, pp. 1824~1832
DOI: 10.56338/ijhess.v8i2.10975
Website: https://jurnal.unismuhpalu.ac.id/index.php/IJHESS

Factors Related to the Incidence of Type 2 Diabetes Mellitus at the North Toto Health Center

Moh. Thamrin Happy[1*], Sirajuddien Bialangi[2], Nikmatisni Arsad[3]
[1,2,3]Jurusan Kesehatan Masyarakat, Fakultas Olahraga dan Kesehatan Universitas Negeri Gorontalo

*Email: anggahappy86@gmail.com

Article Info

Article history:

Received 12 Feb, 2026
Revised 29 Mar, 2026
Accepted 20 Apr, 2026

Keywords:

DMT2, Diet, Physical Activity, Obesity, Family History

ABSTRACT

Type 2 Diabetes Mellitus (DMT2) is a non-communicable disease that continues to experience an increase in cases and is a global and national health problem. Globally, the number of cases reached 537 million in 2023 and is expected to increase to 700 million by 2045. In Indonesia, 19.5 million cases were recorded in 2021. Meanwhile, in Gorontalo Province there are 10,735 patients in 2024, and in the North Toto Health Center there are 109 patients in 2025. The incidence of this disease is influenced by various risk factors, such as diet, physical activity, obesity, family history, and consumption of sugar-sweetened beverages (SSB). This study aims to analyze the relationship between these factors and the incidence of Type 2 Diabetes Mellitus. Quantitative research type, analytical survey method with cross-sectional design. The total sample of 81 respondents was selected using accidental sampling techniques. Data collection was carried out using FFQ, GPAQ, and questionnaires that were compiled and validated by the researcher. The data was analyzed using the chi-square test to find out the relationships between variables.

The results showed that diet (p=0.010), physical activity (p=0.000), obesity (p=0.002), and SSB consumption (p=0.037) were associated with the incidence of Type 2 Diabetes Mellitus, while family history was not related (p=0.227).

There is a relationship between diet, physical activity, obesity, and consumption of sugar-sweetened beverages (SSB) with the incidence of DMT2. On the other hand, the family history did not show a relationship with the incidence of DMT2 at the North Toto Health Center. It is recommended to the public to adopt a healthy diet, increase physical activity regularly, maintain an ideal weight, and limit the consumption of sweetened beverages to reduce the risk of DMT2.

INTRODUCTION

Diabetes Mellitus is a chronic metabolic disorder characterized by increased blood sugar levels due to the body's inability to produce insulin adequately, utilize insulin effectively, or because both mechanisms are disrupted. This condition affects the process of metabolism of carbohydrates, fats, and proteins, so it has the potential to cause various complications in important organs (Arlington & Virginia, 2023).

In the midst of the complexity of these health problems, the number of diabetes cases continues to show an increasing trend globally. International Diabetes Federation (2023) reports that as many as 537 million adults are living with diabetes and estimates that the global prevalence of people with diabetes will reach 578 million by 2030 and 700 million by 2045.

In Indonesia, the prevalence of diabetes mellitus has shown a significant increase in the past decade. Riskesdas 2018 data reported that the prevalence of DM rose from 6.9% in 2013 to 10.9% in 2018, indicating a sharp and worrying upward trend. (Riskesdas, 2018). In addition to the increase in prevalence shown by Riskesdas, data from Ministry of Health of the Republic of Indonesia (2022) It also describes the surge in the number of diabetics in Indonesia. The number of people with DM was recorded to increase from 10.7 million people in 2019 to 19.5 million people in 2021. This surge places Indonesia as the country with the fifth highest number of diabetics in the world.

Cases of diabetes mellitus (DM) are not only a problem at the national level, but are also seen in Gorontalo Province. Based on data from the Gorontalo Provincial Health Office in 2024 in (Monoarfa et al., 2025), there were

10,735 cases of diabetes mellitus, which illustrates that DM is a health problem that needs attention in Gorontalo Province.

This condition is in line with the situation in Bone Bolango Regency which also shows an increasing trend of Diabetes Mellitus cases in the last two years. In 2023, there were 3,803 patients, which then increased to 5,206 in 2024. Even as of August 2025, the number of sufferers has reached 2,263, which shows that Diabetes Mellitus is still a significant health problem in the region (Bone Bolango Health Office, 2025).

Puskesmas As a primary health service facility, it also reflects the burden of disease through the number of cases handled. At the North Toto Health Center, Bone Bolango Regency, the number of patients with type 2 diabetes mellitus in 2025 will reach 109 patients (North Toto Health Center, 2025). This figure is larger when compared to several other health centers in Bone Bolango Regency which only recorded a relatively low number of cases, such as Central Suwawa (32 cases), Pinogu (25 cases), and Bulango Ulu (54 cases).

Type 2 Diabetes Mellitus is the most dominant type of diabetes and is influenced by various factors, both behavioral and biological, such as diet, physical activity, obesity, family history, and consumption Sugar-Sweetened Beverages (SSB). An unhealthy diet and low physical activity contribute to increased blood glucose levels and the occurrence of insulin resistance (Zulkarnaini et al., 2022). Obesity, especially central obesity, plays a role through inflammatory mechanisms and an increase in free fatty acids that impact pancreatic β cell dysfunction, whereas a family history reflects a genetic predisposition to impaired glucose metabolism (Rahman et al., 2019). Research Hendrik et al (2024) also confirmed that these factors have a significant relationship with the incidence of Type 2 Diabetes Mellitus. In addition, the consumption of SSBs as a major source of excess simple sugar intake is known to increase the risk of metabolic syndrome and accelerate the development of insulin resistance (Jayanti et al., 2021).

The results of the preliminary interview at the North Toto Health Center showed that most of the respondents had a diet that was not in accordance with the principles of balanced nutrition, low physical activity, and still consumed sugary drinks such as tea and coffee. In addition, it was found that there was a family history of diabetes and obesity conditions before diagnosis. These findings indicate that the incidence of Type 2 Diabetes Mellitus is the result of multifactorial interactions between behavioral and biological factors. Therefore, this study is important to analyze the relationship between these factors, as well as fill the limitations of studies related to the role of SSB consumption at the primary health service level, so that it can be the basis for the development of more effective promotive and preventive efforts.

RESEARCH OBJECTIVES

This study aims to analyze factors related to the incidence of diabetes mellitus in the North Toto Health Center.

Research Methods

This study is a quantitative research with an analytical survey approach and cross-sectional design, where independent and dependent variable measurements are carried out at the same time to see the relationship between variables. The research sample totaled 81 respondents who were determined using the Lemeshow formula with accidental sampling techniques. Data collection was carried out using FFQ questionnaires for diet, GPAQ for physical activity, as well as additional questionnaires for SSB consumption, family history, and obesity status that have been tested for validity and reliability. Data were analyzed using a chi-square test with a significance level of $\alpha = 0.05$ to determine the relationship between variables.

RESULTS

Table 1 Characteristics of Respondents

Status DMT2	**n**	**(%)**
There	29	35,8
None	52	62,2
Total	81	100
Diet	**n**	**(%)**
Good	39	48,1
Not Good	42	51,9
Total	81	100
Physical Activity	**n**	**(%)**
Low	32	39,5
Medium	42	51,9
Height	7	8,6
Total	81	100
Family History	**n**	**(%)**
There	26	32,1

None	55	67,9
Total	81	100
Obesity Status	**n**	**(%)**
Obesity	31	38,3
Not Obese	50	61,7
Total	81	100
SSB Consumption	**n**	**(%)**
Height	26	32,1
Low	55	67,9
Total	81	100

Based on Table 1, respondents were dominated by the group that did not experience DMT2 (62.2%), compared to those who experienced DMT2 (35.8%). In terms of diet, most respondents were in the unfavorable category (51.9%). The majority of physical activity is in the medium category (51.9%), while the high category is the least (8.6%). Most respondents had no family history of diabetes (67.9%). Judging from the obesity status, the majority of respondents were not obese (61.7%). Meanwhile, in SSB consumption, most respondents were in the low category (67.9%), compared to high consumption (32.1%). In general, the characteristics of the respondents showed dominance in non-DMT2 conditions, but there was still a considerable proportion with poor diet and not optimal physical activity.

Table 2 Relationship of Diet with the Incidence of Type 2 Diabetes Mellitus

Diet	**Incidence of Type 2 Diabetes Mellitus**						***P Value***
	There		**None**		**Total**		
	n	**%**	**n**	**%**	**n**	**%**	
Not Good	20	51,3	19	48,7	39	100	
Good	9	21,4	33	78,6	42	100	0,010
Total	29	35,8	52	64,2	81	100	

Based on Table 2, the proportion of people with Type 2 Diabetes Mellitus is higher in the category of bad diet (51.3%) compared to good diet (21.4%). The results of the statistical test showed a p-value of 0.010 ($p < 0.05$), so there was a relationship between diet and the incidence of Type 2 Diabetes Mellitus.

Table 3 Relationship between physical activity and the incidence of type 2 diabetes mellitus

Physical Activity	**Incidence of Type 2 Diabetes Mellitus**						***P value***
	There		**None**		**Total**		
	n	**%**	**n**	**%**	**n**	**%**	
Low	20	62,5	12	37,5	32	100	
Medium	9	21,4	33	78,6	42	100	
Height	0	0,0	7	100,0	7	100	0,000
Total	29	35,8	52	64,2	81	100	

Based on Table 3, the proportion of patients with Type 2 Diabetes Mellitus is higher at low physical activity (62.5%) and lowest at high physical activity (0.0%). The results of the statistical test showed a p-value of 0.000 ($p < 0.05$), so there was a relationship between physical activity and the incidence of Type 2 Diabetes Mellitus.

Table 4 Relationship of Family History to the Incidence of Type 2 Diabetes Mellitus

Family History	Incidence of Type 2 Diabetes Mellitus						*P value*
	There		None		Total		
	n	%	n	%	n	%	
There	12	46,2	14	53,8	26	100	
None	17	30,9	38	69,1	55	100	0,227
Total	29	35,8	52	64,2	81	100	

Based on Table 4, the proportion of people with Type 2 Diabetes Mellitus was higher in respondents with a family history (46.2%) than in those without it (39.2%). However, the results of the statistical test showed a p-value of 0.277 ($p > 0.05$), so there was no relationship between family history and the incidence of Type 2 Diabetes Mellitus.

Table 5 Relationship between obesity and the incidence of type 2 diabetes mellitus

Obesity Status	Status of Type 2 Diabetes Mellitus						*P value*
	There		None		Total		
	n	%	n	%	n	%	
Obesity	18	58,1	13	41,9	31	100	
Not Obese	11	22,0	39	78,0	50	100	0,002
Total	29	35,8	52	64,2	81	100	

Based on Table 5, the proportion of people with Type 2 Diabetes Mellitus is higher in the obesity group (58.1%) than in the non-obese group (22.0%). The results of the statistical test showed a p-value of 0.002 ($p < 0.05$), so there was a relationship between obesity and the incidence of Type 2 Diabetes Mellitus.

Table 6 Relationship between Sugar-Sweetened Beverage Consumption and the Incidence of Type 2 Diabetes Mellitus

SSB Consumption	Incidence of Type 2 Diabetes Mellitus						*P value*
	There		None		Total		
	n	%	n	%	n	%	
Height	14	53,8	12	46,2	26	100	
Low	15	27,3	40	72,7	55	100	0,037
Total	29	35,8	52	64,2	81	100	

Based on Table 6, the proportion of people with Type 2 Diabetes Mellitus was higher in high SSB consumption (53.8%) than low consumption (27.3%). The results of the statistical test showed a p-value of 0.037 ($p < 0.05$), so there was a relationship between SSB consumption and the incidence of Type 2 Diabetes Mellitus.

DISCUSSION

The Relationship between Diet and the Incidence of Type 2 Diabetes Mellitus at the North Toto Health Center

The results of the statistical test showed a p-value = 0.010 (p < 0.05) which means that there is a relationship between diet and the incidence of type 2 diabetes mellitus. Based on conditions in the field, people with type 2 diabetes mellitus tend to have a less varied diet. This condition is influenced by the presence of comorbidities, so sufferers severely limit the type of food consumed. As a result, respondents tend to avoid some food ingredients such as meat, green vegetables, and nuts due to concerns that they may worsen health conditions. In addition, fruit consumption is also relatively low, which has the potential to cause insufficient fiber intake and affect the control of blood glucose levels.

A less varied diet can lead to an imbalance in the intake of nutrients, especially fiber, vitamins, minerals, which are abundant in vegetables and fruits. This substance plays a role in glucose metabolism, a monotonous consumption diet tends to be dominated by certain carbohydrate sources and is low in protective foods, thus contributing to increased blood glucose levels and the risk of type 2 diabetes mellitus (Ministry of Health, 2025)

Zulkarnaini (2022) states that an unhealthy diet is one of the risk factors for type 2 diabetes mellitus. Low fiber intake also reduces the body's ability to slow down glucose absorption, making blood sugar levels more easily elevated and difficult to control. In the long term, this condition accelerates the occurrence of glucose metabolism disorders that lead to type 2 diabetes mellitus.

The presence of 9 (21.4%) respondents with a good diet but still experiencing Type 2 Diabetes Mellitus shows that diabetes is a multifactorial disease. Genetic factors, age, obesity, low physical activity, and a history of exposure to an unhealthy lifestyle can increase the risk of diabetes even if a healthy diet is good (Soelistijo, 2021).

On the other hand, 19 (48.7%) respondents with poor diet but did not experience Type 2 Diabetes Mellitus indicated the presence of other protective factors such as younger age, sufficient physical activity, still good metabolic function, and no family history of diabetes. This condition shows that the impact of an unhealthy diet does not necessarily directly trigger diabetes if the duration of exposure is not long (Ministry of Health, 2020).

The results of this study are in line with a study conducted by Anri (2022) which reported a significant relationship between diet and the incidence of type 2 diabetes mellitus, with a value of p = 0.003, where respondents with an unhealthy diet had a higher risk of developing diabetes than those who applied a healthy diet.

The Relationship of Physical Activity with the Incidence of Type 2 Diabetes Mellitus at the North Toto Health Center

The results of the statistical test obtained on this variable were p = 0.000 (p < 0.05), which means that there is a relationship between physical activity and the incidence of Type 2 Diabetes Mellitus. Low physical activity in respondents describes a lifestyle pattern with minimal movement and exercise activities. This condition can be influenced by the increasing age of the respondents, where the older a person is, the ability and endurance to do physical activities tends to decrease so that the body feels more easily tired or heavy when doing activities or sports.

In addition, the lack of motivation and lack of support from the surrounding environment to do physical activities, such as light to moderate exercise, also played a role in the low level of physical activity in the respondents.

Physical activity plays an important role in helping the body control blood glucose levels. When a person does physical activity or exercise, the body's muscles contract thereby stimulating the movement of glucose transporter type 4 (GLUT-4) to the surface of muscle cells. This transfer of GLUT-4 makes it easier for glucose in the blood to enter muscle cells to be used as an energy source. This process can occur even without the need for large amounts of insulin. Therefore, physical activity can help lower blood glucose levels while increasing insulin sensitivity, thereby contributing to maintaining blood sugar level control in individuals (Sukarno, 2021).

In addition, regular physical activity can also help improve the process of fat metabolism in the body. When a person does physical activity, the body will use fatty acids as one of the energy sources. This process can help reduce the accumulation of body fat. Reduced body fat is related to the body's increased sensitivity to insulin, so insulin can work more effectively in helping cells absorb glucose from the blood (Dandra et al., 2023).

The existence of 12 (37.5%) respondents who had low physical activity but did not experience Type 2 Diabetes Mellitus can occur because the metabolic condition of each person's body is different. Some individuals still have a good body ability to regulate blood sugar levels because insulin function is still optimal. In addition, other factors such as relatively younger age, body composition with a low amount of fat, and a relatively more balanced diet, can also help maintain stable blood sugar levels. Thus, although low physical activity is one of the risk factors, the incidence of Type 2 Diabetes Mellitus is still influenced by various other factors that interact with each other (Fitriq et al., 2024).

This study shows conformity with the findings by Syafitri et al., (2025) which showed a significant relationship between physical activity level and the incidence of Type 2 Diabetes Mellitus, with a p-value of 0.046.

The findings indicate that individuals with low levels of physical activity have a higher risk of developing Type 2 Diabetes Mellitus compared to individuals who engage in regular physical activity.

The Relationship between Family History and the Incidence of Type 2 Diabetes Mellitus at the North Toto Health Center

The results of the statistical test showed a value of p = 0.227 (p > 0.05) which means that there is no relationship between family history and the incidence of type 2 diabetes mellitus. Genetic factors or family history are indeed known as one of the predisposing factors for the occurrence of diabetes mellitus. However, the presence of genetic factors does not always directly cause a person to develop diabetes. Genetic factors are indirect, so a family history of diabetes does not always lead to the occurrence of the disease if individuals are able to control behavioral risk factors such as diet and physical activity.

Family history is one of the risk factors that cannot be changed in the incidence of Type 2 Diabetes Mellitus, because it is related to the influence of genetic factors on the body's metabolic susceptibility, including the occurrence of insulin resistance. This happens because genetic factors can affect how the body responds to insulin and processes glucose in the blood. However, genetic factors are not the only cause of Type 2 Diabetes Mellitus. This disease is also influenced by interactions with other factors that are more dominant, namely life-style or lifestyle (Fauziyyah & Utama, 2024).

Murtiningsih et al., (2021) explained that the occurrence of Type 2 Diabetes Mellitus is not only influenced by genetic factors, but is the result of the interaction of various interrelated factors, such as genetic, behavioral, and environmental factors. The behavior in question is mainly related to lifestyle, for example an unbalanced diet and low physical activity. Meanwhile, the environment can affect these habits, such as the availability of food and the lack of environmental support to do physical activity. This condition can increase the risk of developing Type 2 Diabetes Mellitus, even in individuals who do not have a family history of diabetes mellitus.

There were 14 (53.8%) respondents who had a family history but did not suffer from type 2 diabetes mellitus, indicating that a family history of diabetes does not always cause a person to experience the disease, This can happen because even though there are genetic factors, the risk of developing the disease can still be controlled if the individual is able to adopt a healthy lifestyle. The implementation of a balanced diet, regular physical activity, and maintaining a normal weight can help the body better control blood glucose levels. Thus, efforts to maintain a healthy lifestyle can play a role in suppressing the possibility of developing Type 2 Diabetes Mellitus even if a person has a family history with the disease.

On the other hand, the finding of 17 (30.9%) respondents without a family history of diabetes who still had Type 2 Diabetes Mellitus showed that non-genetic factors have a more dominant role in the occurrence of this disease. Poor lifestyle such as low physical activity and unbalanced consumption patterns, and increasing age, as well as obesity conditions can trigger metabolic disorders that lead to Type 2 Diabetes Mellitus even though there is no genetic history (Utomo et al., 2020). The results of this study are in line with the research conducted by Aisyah & Prabowo (2025) stating that family history does not show a statistically significant association with the incidence of Type 2 Diabetes Mellitus.

The Relationship between Obesity and the Incidence of Type 2 Diabetes Mellitus at the North Toto Health Center

The p-value obtained in this variable was 0.002 (p < 0.05) which shows that there is a relationship between obesity status and the incidence of type 2 diabetes mellitus. Based on conditions in the field, some respondents who suffer from Type 2 Diabetes Mellitus are known to have poor diets and low levels of physical activity. An unbalanced diet and not balanced with sufficient physical activity can cause excess energy in the body. The unused energy is then stored in the form of fat, so that in a certain period of time it can result in the accumulation of body fat and weight gain. If this condition persists, it can increase the risk of obesity.

Obesity is one of the main risk factors in the occurrence of Type 2 Diabetes Mellitus. The accumulation of excess fat tissue can lead to insulin resistance, which is a condition when the body's cells are unable to respond optimally to the hormone insulin. As a result, glucose that is supposed to enter the cell to be used as energy becomes trapped in the blood, causing an increase in blood sugar levels. If this condition persists for a long period of time, it can develop into Type 2 Diabetes Mellitus (Paleva, 2019).

In addition, obesity is also associated with metabolic disorders such as increased levels of free fatty acids, chronic inflammatory processes, and changes in hormonal function that play a role in regulating glucose metabolism. This condition can worsen insulin sensitivity and accelerate the occurrence of glucose metabolism disorders. Therefore, individuals who are overweight or obese have a higher risk of developing Type 2 Diabetes Mellitus compared to individuals with normal nutritional status (Soelistijo, 2021).

However, in the results of this study, it was also found that 11 respondents (22.0%) were not obese but experienced Type 2 Diabetes Mellitus. This shows that diabetes is a multifactorial disease, which is not only influenced by obesity but also by other factors such as genetics, age, diet, physical activity, and unhealthy lifestyle. These factors can affect glucose metabolism in the body so that it is still possible for a person to develop diabetes even though they are not obese.

In contrast, there were 13 respondents (41.9%) who were obese but did not suffer from Type 2 Diabetes Mellitus. This condition can be caused by protective factors such as sufficient physical activity, a relatively healthier diet, and a good metabolic function. In addition, the duration of a person experiencing obesity can also affect the risk of developing diabetes, so individuals who have recently become obese may not have shown significant metabolic impacts.

The results of this study are in line with the research conducted by Hendrik et al (2024) which suggests that obesity has a significant association with the incidence of Type 2 Diabetes Mellitus. Individuals with obesity have a greater risk of developing insulin resistance and impaired glucose metabolism compared to individuals of normal weight.

Consumption of Sugar-Sweetened Beverages with the Incidence of Type 2 Diabetes Mellitus at the North Toto Health Center

The results of the bivariate analysis obtained a p-value = 0.037 ($p < 0.05$) which means that there is a relationship between independent and dependent variables. Based on conditions in the field, some respondents still have the habit of consuming sweetened drinks such as packaged drinks, sweet teas, soft drinks, and instant drinks that contain added sugar. The consumption of these drinks is often done regularly because it is easy to obtain, has a sweet taste, and is part of people's daily habits. The high consumption of this sweetened drink can increase the intake of simple sugars that are quickly absorbed by the body, thereby causing a rapid increase in blood glucose levels. If this habit lasts for a long time, it can increase the risk of insulin resistance which contributes to the development of Type 2 Diabetes Mellitus.

Conceptually, the consumption of sugar-sweetened beverages (SSB) is known to play a role as a risk factor in the development of Type 2 Diabetes Mellitus. The high content of simple sugars in SSB is easily and quickly absorbed by the body, so it can cause a spike in blood glucose levels. Frequent exposure to SSB consumption has the potential to increase the work demands of the pancreas in producing insulin and trigger a decrease in insulin sensitivity. If this condition lasts for a long time, there can be a disruption of glucose regulation which eventually leads to the occurrence of Type 2 Diabetes Mellitus. On the other hand, SSB also contributes to empty calorie intake, which can worsen metabolic conditions (Listiani & Ayubi, 2024).

The results showed that there were 15 (27.3%) respondents with low consumption of sugar-sweetened beverages (SSB) but still experienced Type 2 Diabetes Mellitus. This condition can occur because even though respondents fall into the category of low SSB consumption, they still consume at least one type of sugary drink every day. The habit of consuming drinks such as coffee or tea with added sugar is still quite common and part of the daily routine. The added sugar from the drink still contributes to the intake of simple sugar in the body. Simple sugar consumed regularly can increase blood glucose levels because it is easily absorbed by the body, so in the long term it has the potential to affect the balance of glucose metabolism.

On the other hand, it was also found that 11 (84.6%) respondents with high SSB consumption but did not experience Type 2 Diabetes Mellitus showed that the impact of SSB on the risk of diabetes was influenced by the duration of consumption and individual characteristics. The effects of consumption of sweetened beverages on blood glucose levels can vary between individuals, especially in those who still have sufficient physical activity, normal nutritional status, and relatively good metabolic function. This condition shows that high SSB consumption does not necessarily immediately trigger diabetes if it has not lasted for a long time or is still balanced by other protective factors (Jayanti et al., 2021).

The findings in this study are consistent with the results of a study conducted by Sari et al., (2025), which identified a significant association between the consumption of sweetened beverages and the incidence of Type 2 Diabetes Mellitus. The study showed that individuals with high levels of sugar-sweetened beverage consumption had a greater risk of developing impaired glucose tolerance to diabetes compared to individuals with lower consumption of sugar-sweetened beverages.

CONCLUSIONS AND SUGGESTIONS

Based on the results of the study on factors related to the incidence of Type 2 Diabetes Mellitus at the North Toto Health Center, it can be concluded that there is a relationship between diet, physical activity, obesity, and consumption of sugar-sweetened beverages (SSB) with the incidence of Type 2 Diabetes Mellitus, while family history does not show a relationship. In this regard, it is recommended to the North Toto Health Center to increase promotive and preventive efforts through health education related to healthy diets, increasing physical activity, and limiting the consumption of sweetened drinks. People are also expected to implement a healthy lifestyle by maintaining a balanced diet, regular physical activity, and reducing SSB consumption to reduce the risk of Type 2 Diabetes Mellitus. In addition, for future researchers, it is recommended to use a different research design and add other variables such as central obesity, duration of exposure to risk factors, and psychosocial factors to obtain a more comprehensive picture.

REFERENCES

Aisyah, R., & Prabowo, N. A. (2025). Association Of Family History , Body Mass Index , And Exercise Regularity With Hba1c Status In Type 2 Diabetes Mellitus Patients. 12(February), 1–8. Https://Doi.Org/10.26714/ Magnamad. 12.1.2025.1-8

Arlington, & Virginia. (2023). The American Diabetes Association Releases The Standards Of Care In Diabetes—2024. Https://Diabetes.Org /Newsroom /Press-Releases/American - Diabetes-Association-Releases-Standards-Care-Diabetes-2024

Dandra, S. G., Ambarsarie, R., Febrianti, E., Ilmu, B., Dalam, P., Pain, R., Region, U., Bengkulu, M. Y., & Visceral, M. L. (2023). The Role of Physical Activity Level in Influencing Visceral Fat Mass in Patients with Type 2 Diabetes Mellitus: A Review. 9(1).

Bone Bolango Health Office, D. B. B. (2025). Data on Diabetic Mellitus. Bone Bolango Health Office.

Fauziyyah, M. H., & Utama, F. (2024). Literature Review: Factors related to the incidence of diabetes mellitus in Indonesia. 8(April), 266–278.

Fitriq, N., Lutfiah, L., Ratnawati, R., & Wibowo, P. A. (2024). Relationship Between Physical Activity And The Incidence Of Type 2 Diabetes In The Banjarejo Community Health Center. 17(2), 190–194. Https://Doi.Org/ 10.24252/Health.V17i2.39127

Hendrik, Nirvana, & Saasa. (2024). Factors related to the incidence of type II diabetes mellitus in outpatients at Konawe Hospital Classification of Diabetes Mellitus (DM), Diabetes Association (ADA) and World Further, data from Menuru's Global Nutrition Report. 3(3), 202–213.

IDF, I. D. F. (2023). IDF Diabetes Atlas. 10th Edition. Https:// Diabetes Atlas. Org/Resources/Idf-Diabetes-Atlas-2025/

Jayanti, A. K., Sufyan, D. L., Puspita, I. D., & Puspareni, L. D. (2021). The Relationship between Sugar-Sweetened Beverages Consumption and Online Food Ordering and Blood Glucose Levels of Workers 25-44 Years in Kasuari Housing, Cikarang. 5(2).

Ministry of Health. (2025). The Role of Nutrition in Improving the Quality of Life of Diabetic Mellitus. Ministry of Health of the Republic of Indonesia. Https://Keslan.Kemkes.Go.Id/View_Artikel/4221/Peran-Nutrisi-Dalam-Meningkatkan-Kualitas-Hidup-Penderita-Diabetes-Melitus

Ministry of Health, K. K. (2020). Guidelines for Balanced Nutrition. Https://Kesmas.Kemkes. Go.Id/Assets/Upload/Dir_519d41d8cd98f00 /Files/Seim bang-Nutrition-Guidebook-2020_1579.Pdf

Ministry of Health of the Republic of Indonesia, K. K. R. I. (2022). Prevent Diabetes Mellitus with 6 Healthy Steps. Https://Ayosehat.Kemkes.Go.Id/Cegah-Diabetes-Melitus-Dengan-6-Langkah-Sehat

Listiani, R. Y., & Ayubi, D. (2024). Risk Factors for Consumption of Sugary Drinks on the Incidence of Type 2 Diabetes Mellitus in the Modern Lifestyle Era at a Young Age Literature Review. 7(1), 563–569.

Monoarfa, H. S., Djamaluddin, N., & Arsad, S. F. M. (2025). Level of knowledge and behavior of foot care for people with diabetes mellitus. 7(1), 90–101.

Murtiningsih, M. K., Pandelaki, K., & Sedli, B. P. (2021). Lifestyle as a risk factor for type 2 diabetes mellitus. 9(28), 328–333.

Paleva, R. (2019). Mechanisms of Insulin Resistance Related to Obesity. 10(2), 354–358. Https://Doi.Org/10.35816/Jiskh.V10i2.190

North Toto Health Center, P. T. U. (2025). Data on Patients with Type 2 Diabetes Mellitus. North Toto Health Center.

Rahman, M. N., Sukmawati, I. N., & Puspitasari, I. M. (2019). Pattern Of Glycemic Markers And Inflammatory Markers In Centrally Obese Men Glycemic And Inflammation Markers Pattern Of Type 2 Diabetes Mellitus Disease Progression In Centrally Obese Men Health Republic of Indonesia. 8(4). Https://Doi.Org/10.15416/ Ijcp.2019. 8.4.281

Riskesdas, R. K. D. (2018). Ministry of Health of the Republic of Indonesia. (2018). Riskesdas National Report 2018. Health Research and Development Agency. Https://Www.Litbang.Kemkes.Go.Id/Wp Content/Uploads/2019/07/Report-Riskesdas-2018-Nasional.Pdf

Sari, P., Juniarsana, W., & Kusumayanti, D. (2025). The relationship between consumption of sugary drinks and physical activity and blood sugar levels in patients with type II diabetes mellitus. 3(1).

Soelistijo, S. A. (2021). Guidelines for the Management of Type 2 Diabetes Mellitus Prevention in Indonesia 2021. Https://Pbperkeni.Or.Id/Wp-Content/Uploads /2021/11/22-10-21-Website-Guidelines-Management-and-Prevention-DMT2-Ebook.Pdf

Sudarta, P. T. C. N., Rini, S., Arjita, I. P. D., & Andriana, A. (2025). The relationship between sugar sweetened beverage consumption, body mass index (BMI), and physical activity with blood sugar levels in patients with type 2 diabetes mellitus at Mataram City Hospital. 5, 3190–3204.

Sukarno, D. A. (2021). The Effect of Physical Exercise on the Improvement of Insulin Resistance. 2(2), 108–112.

Syafitri, D. N., Sari, M. T., Rahman, S., & Lufiana, F. (2025). The Relationship between Central Obesity and Physical Activity and Type 2 Diabetes Mellitus in Prolanis Patients at the Iman Medan Clinic in 2025 e-ISSN: 2722-0877. 6(4).

Utomo, A. A., Rahmah, S., & Amalia, R. (2020). Risk Factors for Type 2 Diabetes Mellitus: A Systematic Review. pp. 1, 44–53.

Zulkarnaini, A., Mahatma, G., Puspita, D., Vani, A. T., & Abdullah, D. (2022). Physical activity, diet, and consumption of high-glycemic foods increase the risk of the occurrence of type 2 diabetes mellitus. 15(2), 154–162.