The Relationship of Risk Factors to the Incidence of Type II Diabetes Mellitus in Pre-Elderly and Elderly (Study in Ternate City)

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ARTICLE INFORMATION

Publication Information

Research Article

HOW TO CITE

ABSTRACT

The purpose of this study is to clarify the relationship between risk factors to the incidence of type two diabetes mellitus in the pre-elderly and elderly in Ternate City. This research uses a cross-sectional study and uses univariate and bivariate analyzes to determine the relationship of factors with diabetes mellitus in pre-elderly and elderly. Samples were selected by a cluster random sampling technique. Data collection measures take the form of questionnaires with structured questions. This study was conducted on pre-elderly and elderly aged above 45 in the public health center (PUSKESMAS) in Ternate City, which amounted to 299 respondents. The results showed eight interesting findings. One of them is there was a significant relationship between age and the incidence of diabetes mellitus. Moreover, there was no significant relationship between sex and the incidence of diabetes mellitus.

Keywords: Diabetes mellitus type II, Elderly, Pre-Elderly

INTRODUCTION

Diabetes Mellitus (DM) is a chronic metabolic disease caused by impaired of insulin production, insulin action, or both and is characterized by an increase in glucose in the blood. The most common type of diabetes mellitus is type 2, commonly experienced in adults due to the onset of resistance to insulin and lack of insulin production. Type 1 diabetes occurs due to damage to cells β the pancreas, which results in at least the production of insulin or not producing insulin (Petersmann, 2019).

The World Health Organization revealed that DM is the sixth-ranked cause of death worldwide. The International Diabetes Federation (IDF) also estimates that 463 million people between the ages of 20 and 79 had diabetes in 2019, representing 9.3% of the total population of that age group. The IDF also estimates the prevalence of diabetes by sex in 2019 at 9% for women and 9.65% for men (Kementerian Kesehatan Republik Indonesia, 2020).

In the Southeast Asia Region, Indonesia is ranked 3rd highest in people with diabetes. An elderly person in a healthy, productive, and independent state has a positive impact. On the contrary, IDF data on the population aged 20-79 has identified the ten countries with the highest number of sufferers. Indonesia is ranked 7th among the ten countries with the highest number of diabetics, at 10.7 million, and is the only country in Southeast Asia on the list. The prevalence of DM based on the diagnosis of doctors in Indonesia based on Riskesdas 2018 is 2%. This condition shows an increase compared to Riskesdas 2013 by 1.5%. Based on age grouping, most DM sufferers are between 55-64 years old and 65-74 years old (Ministry of The Republic of Indonesia, 2018).

The elderly is someone who is more than 60 years old. The most frequent problems faced by the elderly are health problems, one of which is diabetes mellitus. Diabetes mellitus is a silent killer disease caused by many sufferers unaware of the disease before complications occur. Type two DM constitutes 90% of all categories of diabetes mellitus. Complications often include other cardiovascular systems disorders such as atherosclerosis, retinopathy, impaired kidney function, and nerve damage. Diabetic conditions with complications cause the highest mortality in Indonesia at 6.7%. The elderly with diabetes mellitus are long enough to generally have a poor quality of life because it negatively influences the sufferers' physical and psychological health (Kementerian Kesehatan Republik Indonesia, 2020).

Riskesdas 2018 by province results show that North Maluku is ranked in the bottom 10 for diabetics. This result is a prevalence based on a doctor's diagnosis, largely determined by the regularity and compliance of medical record recording (Ministry of The Republic of Indonesia, 2018).

According to the Health Office of Ternate City in 2017, the prevalence of DM cases was 41.5%. In addition, data was obtained from the Regional Technical Implementation Unit (UPTD) diabetes center in 2017, with 1802 cases (Wadja, Rahman, & Supriyatni, 2019).

Diabetes Mellitus can lead to a variety of both macrovascular and microvascular complications. The impact of diabetes Mellitus on the quality of human resources and the increase in medical costs is enormous, so a program to control type two DM is urgently needed. DM risk factors consist of irreversible and irreversible risk factors. Irreversible risk factors are race, ethnicity, age, gender, family history with DM, history of giving birth to babies >4,000 grams, and history of birth with low birth weight (BBLR

or <2,500 grams). Meanwhile, the risk factors that can be changed are more weight, abdominal/central obesity, lack of physical activity, hypertension, dyslipidemia, unhealthy and unbalanced diet, prediabetes conditions characterized by impaired glucose tolerance (TGT 140-199 mg/dl), or disturbed fasting blood sugar (GDPT <140 mg/dl), and smoking (Kementerian Kesehatan Republik Indonesia, 2020).

DM risk factors usually appear after the age of ≥45 years. There has been no visible class mechanism in the relationship between the sexes with DM. Therefore, DM is not a treatable disease but can be passed down to the next generation (Nasution, Andilala, & Siregar, 2021). Against the background of the issue, researchers are interested in conducting a study on the relationship between risk factors and the incidence of type 2 diabetes among children and the elderly in the city of Ternate.

LITERATURE REVIEW

Defining Diabetes Mellitus
Diabetes mellitus (DM) is a group of metabolic diseases with characteristics of hyperglycemia that occurs due to abnormalities in insulin secretion, insulin work, or both (PB PERKENI, 2021).

Epidemiology
Diabetes occurs in all populations and all regions of the world, including rural areas of low- and middle-income countries. The number of people with diabetes continues to rise. WHO estimates there were 422 million adults with diabetes worldwide in 2014. Age-adjusted prevalence in adults increased from 4.7% in 1980 to 8.5% in 2014, with the largest increase in middle-income countries compared to high-income countries. Additionally, the International Diabetes Federation (IDF) estimates that 1.1 million children and adolescents aged 14-19 years suffer from DMT1. By 2045, at least 629 million people will be living with diabetes if no intervention is taken to halt its rise. Severe blood color, a category of diabetes, kills 4 million people each year, and the IDF estimates that the global annual healthcare cost for adult diabetes in 2017 was US$850. Diabetes affects not only individuals but families and society. Especially in low- and middle-income countries, where diabetes is often associated with other diseases, the socioeconomic impacts are far-reaching, threatening national productivity and economies (World Health Organization, 2019).

Etiology and Risk Factors
The cause or etiology of type 2 diabetes mellitus is a combination of genetic factors such as impaired insulin production and insulin resistance, accompanied by environmental factors such as obesity, overeating, rare exercise, stress, and aging (Sya'diyah, Zulkarnain, & Sijd, 2021). Risk factors related to type 2 diabetes mellitus, especially in the elderly, are gender, age, physical activity, hypertension, and obesity. Regarding gender, women can be more at risk of developing type 2 diabetes mellitus than men. This condition is related to differences in the composition of the hormone estrogen. In addition, in the elderly who have experienced menopause, adipose or fat tissue has increased associated with insulin resistance (Milita, Handayani, & Setiaji, 2021).

Next, age is one of the factors of diabetes mellitus. Changes in physiology in humans begin to decrease significantly at over 40. Diabetes mellitus often appears in patients over the age of 45 years (Milita et al., 2021). Lack of physical activity is one of the risk factors for the occurrence of type 2 diabetes mellitus. When the body performs physical activities, glucose in the muscles will be more used than when the body rests. Physical

activity is a pillar of diabetes management to improves insulin sensitivity and helps glucose enter the cells (Milita et al., 2021).

Moreover, hypertension can also be a risk factor for diabetes mellitus in the elderly because changes in vascular patterns cause glucose to be more difficult to enter the cells. As well obesity is a risk factor for type 2 diabetes mellitus. This condition is due to a large amount of fatty tissue that makes insulin more resistant. Glucose cannot enter the cells because the work of insulin is blocked by fat and accumulates in the blood (Milita et al., 2021).

Management of Patient
In patients with type 2 diabetes mellitus, there are several drug regimens or preparations that can be given. Some of the therapeutic options that can be given are the Biguanide group (Prasetyo, 2019; Widiasari, Wijaya, & Saputra, 2021). The first-line diabetes treatment often given to patients is the biguanide group, and one of the regimens often given is metformin. Metformin is often used in treating diabetes because it is relatively safer and does not cause hypoglycemia. However, metformin is contraindicated in patients with advanced renal insufficiency. Sulfonylurea group—Sulfonylurea regimens often given to patients with type 2 diabetes mellitus are glimepiride, glibenclamide, gliclazide, and gliquidone. Treating the sulfonylurea group should pay attention to the risk of hypoglycemia. Thiazolidinedione group-Treatment options using thiazolidinedione should include a congestive heart history and patients with a high risk of falling or fractures. The drug regimen used is pioglitazone. And lastly, insulin treatment requires the patient or the patient's family to have good cognitive and functional awareness. Insulin therapy highly depends on the patient's or the patient's family's ability to inject insulin independently. To avoid hypoglycemia, insulin doses should be titrated to meet daily glycemic needs.

Definition of Elderly
According to the Government Regulation of the Republic of Indonesia Number 43 of 2004, the elderly is people who have reached the age of 60 (sixty) years and above. The old population is growing rapidly in both developed and developing countries. This proportion is due to a decline in fertility (births) and mortality (deaths) rates and an increase in life expectancy, which changes the demographic structure. The process of aging of the population is influenced by several factors, for example: improving nutrition, sanitation, and health services to the improvement of education and socio-economic levels. Globally, the number of older people worldwide is expected to continue to grow as shown in the figure below. The picture also shows that globally, In 2015, Asia and Indonesia entered the age of global aging, and the population aged 60 and over (elderly population) exceeded 7% (Kementerian Kesehatan Republik Indonesia, 2017). According to World Health Organization (2020), the classification of the elderly is as follows:
1. Middle *age* 45 – 59 years ss
2. Elderly 60 – 74 years old
3. Elderly (*old*) 59-90 years old)
4. Very *old (very old)* over 90 years old

Type 2 Diabetes Mellitus in The Elderly
According to the International Diabetes Federation (as cited in Kementerian Kesehatan Republik Indonesia, 2020), it is predicted that there will be an increase in diabetes mellitus cases in Indonesia from 10.7 million in 2019 to 13.7 million in 2030. The 2018 RISKESDAS report shows that the prevalence of diabetics is in the age groups of 55-64 years and 65-74 years. A person over 60 years old is also referred to as the elderly. The elderly population continues to grow. A healthy, productive, and independent

elderly person has a positive impact. Conversely, fewer elderly people who are not in good health will increase the burden on the productive age population. The problem that is often faced by the elderly is health problems, especially non-communicable diseases, one of which is diabetes mellitus.

RESEARCH METHODS

This research was carried out from June 2022–August 2022 which was conducted at the PUSKESMAS area of Ternate City/Ternate Island (PUSKESMAS Kota, Siko, Kalumata, Kalumpang, Sulamadaha, Jambula, Bahari Memorable, Gambesi). This research used a cross-sectional study by using univariate and bivariate analysis to determine the relationship of risk factors with the incidence of Type II DM. This study was initiated with approval permits from the Ternate City Health Office and PUSKESMAS. The research sample was the elderly who came to the PUSKESMAS. The inclusion criteria for the study sample are:
1. Elderly people aged >=45 years
2. Elderly people who can communicate well and understand reading can respond to statements in the questionnaire.
3. Willing to be the subject of research by filling out an *informed consent* sheet.
4. Elderly people who come to PUSKESMAS

The exclusion criteria in this sample are:
1. Elderly people who do not come during data collection.
2. Elderly people who do not want to take data.

Figure 1. Research Flowcharts
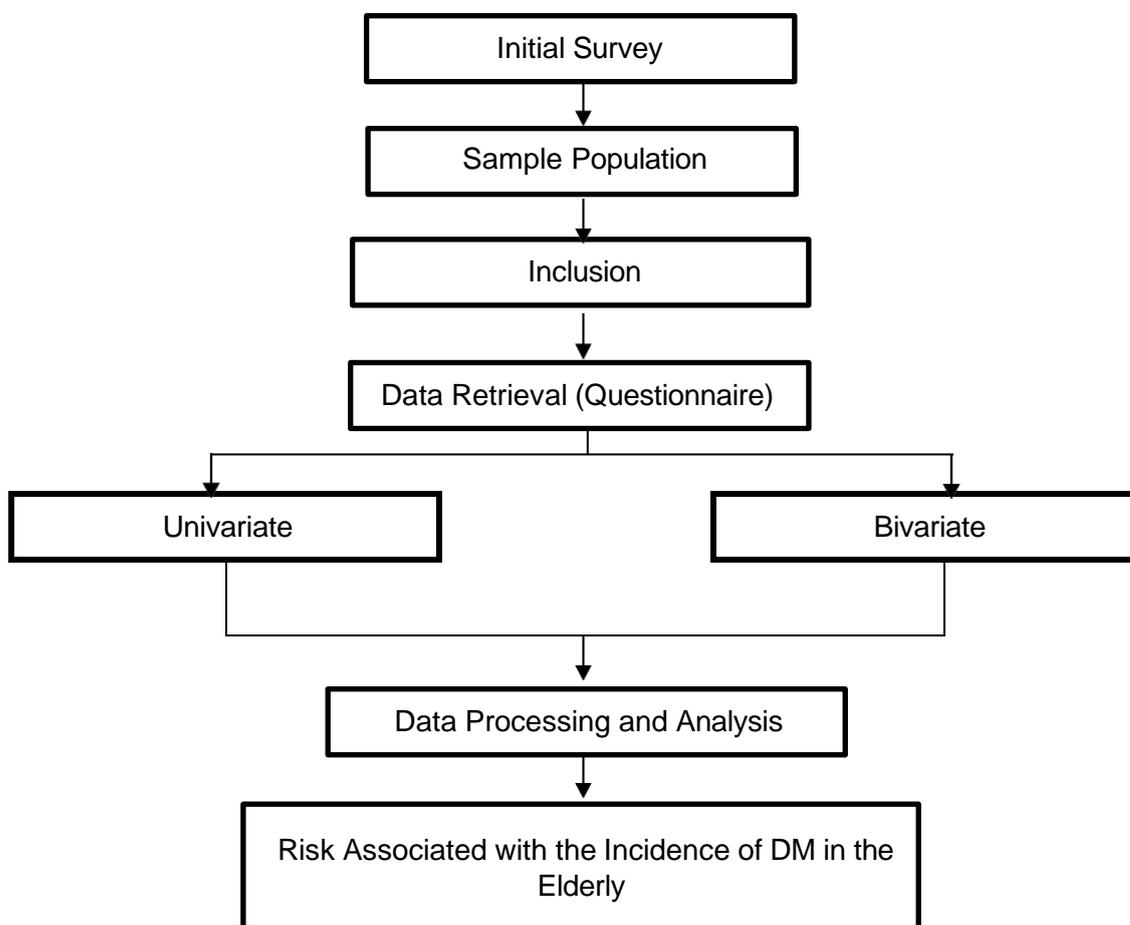
The samples in this study were selected through *the Cluster random sampling* technique. The selection of samples begins with grouping PUSKESMAS - PUSKESMAS in Ternate City, then taking PUSKESMAS that are affordable and located in the Ternate Island area. Then, from the PUSKESMAS, a sample of the elderly is taken with a population provision of 1000 elderly using the Slovin formula as follows:

$$N = N/(1+(Nxe^2)$$
$$= 1000/(1+1000x0.05^2)$$
$$= 286 \text{ samples} === 299 \text{ samples}$$

The sample will be divided into several health centers studied. The variables studied were age, gender, genetic factors, smoking history, history of hypertension, alcohol consumption, physical activity, obesity, and dyslipidemia. The data collection tool is in the form of a questionnaire with structured questions. The data collection results were then processed using SPSS using univariate analysis and bivariate analysis to see the relationship of risk factors with the incidence of diabetes Mellitus in the elderly and pre-elderly.

RESULTS

This study was conducted on patients with type 2 diabetes mellitus in the PUSKESMAS area of Ternate City (PUSKESMAS Kota, Siko, Kalumata, Kalumpang, Sulamadaha, Jambula, Bahari Berkesan, Gambesi) which totaled 299 respondents. The respondents' characteristics are summarized:

Table 1. Demographic Characteristics

Characteristic	Classification	Frequency	Percentage
Gender	Male	78	26.1
	Female	221	73.9
Age	45-59 years	197	65.9
	60-75 years	76	25.4
	>75 years	26	8.7
Occupation	Housewives	152	50.8
	Civil Servants (ASN/Honorary)	75	25.1
	Craftsman/Farmer	30	10
	Self-employed	34	11.4
	Retirees	8	2.7

From Table 1 above, there is a difference in the age distribution of the study subjects. The study subjects in the age group of 45-59 years amounted to 197 people (65.9%), the age group of 60-75 years amounted to 76 years people (25.4%), and the age group over 75 years totaled 26 people (8.7%). Furthermore, table 1 shows that the study subjects were the most female, as many as 221 people (73.9%), while the study subjects with the male sex numbered the most slightly, that is, 78 people (26.1%). Furthermore, based on table 5.1, the study subjects worked the most as IRT, as many as 152 people (50.8%), and pensioners were the least research subject jobs, namely eight people (2.7%). Based on the research results, a frequency distribution was obtained based on diagnosed DM.

Table 2. Frequency Distribution by Diagnosed DM

Characteristic	Frequency	Percentage
Diabetes Mellitus	153	51.2
No Diabetes Mellitus	146	48.8
Total	299	100

Based on Table 5.2, there were 153 people (51.2%) diagnosed with diabetes mellitus and 146 people who were undiagnosed with diabetes mellitus (48.8%).

Age Relationship with Diabetes Mellitus in the Elderly
Based on the research results, distribution was obtained based on the relationship between diabetes mellitus and age.

Table 3. Frequency Distribution by Age

Age	Dm		Total	Significance	OR	The
	Yes	Not				
45 - 59 Years Old	93	104	197			
60 - 75 Years Old	36	40	76	0.000*	2.965	1.802 - 4.879
> 75 Years Old	24	2	26			
Total			299			

The analysis results obtained from respondents diagnosed with diabetes mellitus were 36 people aged 60-75 years and 40 who were undiagnosed with diabetes mellitus aged 60-75 years. Therefore, by obtaining a p = 0.000, it can be concluded that there is a significant relationship between age and diabetes mellitus.

Sex Relationship with Diabetes Mellitus in the Elderly
Based on the research results, distribution was obtained based on the relationship of sex with diabetes mellitus. The analysis results of women diagnosed with diabetes mellitus were 113 people and men diagnosed with diabetes mellitus as many as 40. Therefore, obtaining a value of p = 0.982, it can be concluded that there is no significant relationship between sex and diabetes mellitus.

Table 4. Gender Relationship of Diabetes Mellitus

Gender	Dm		Total	Significance	OR	The
	Yes	NOT				
Man	40	38	78			
Woman	113	108	221	0.982*	1.401	.524 - 3,742
Total			299			

Family History Relationship With Diabetes Mellitus in The Elderly
Based on the research results, distribution was obtained based on the relationship between Family History and Diabetes Mellitus.

Table 5. The Relationship Between Family History and Diabetes Mellitus

Family History DM	Dm		Total	Significance	OR	The
	Yes	Not				
Yes	77	26	103	0.000*	7.426	3.895 - 14.157
Not	76	120	196			
Total			299			

The results were obtained from respondents with a family history of diabetes mellitus who were diagnosed with diabetes mellitus, as many as 77. On the other hand, among the respondents with a family history of diabetes mellitus were diagnosed with no diabetes mellitus as many as 26 people. Obtained a p = 0.000, it can be concluded that there is a significant relationship between family history and diabetes mellitus.

The Relationship between Smoking and Diabetes Mellitus in the Elderly
Based on the research results, distribution was obtained based on the relationship between smoking and diabetes mellitus.

Table 6. The Relationship of Smoking With Diabetes Mellitus

Smoke	Dm		Total	Significance	OR	The
	Yes	Not				
Yes	27	21	48			
Not	126	125	251	0.442*	1.295	.513 - 3.270
Total			299			

The analysis was obtained by active smoking respondents who were diagnosed with diabetes mellitus among as many as 27 people, while non-active smoking respondents who were diagnosed with diabetes mellitus among as many as 126 people. Obtained a p = 0.442, it can be concluded that there is no significant relationship between family history and diabetes mellitus.

The Relationship between Alcohol Consumption and Diabetes Mellitus in the Elderly
Based on the research results, distribution was obtained based on the relationship between alcohol consumption and diabetes mellitus.

Table 7. The Relationship between Alcohol Consumption and Diabetes Mellitus

Consumption of Alcohol	Dm		Total	Significance	OR	The
	Yes	Not				
Yes	2	1	3			
Not	151	145	296	0.589*	9.071	.483 - 170.286
Total			299			

The analysis results obtained by respondents of alcohol consumption diagnosed with diabetes mellitus were two people. On the other hand, the respondents who were not consuming alcohol were diagnosed with diabetes mellitus, as many as 15. Therefore, obtaining a p = 0.589, it can be concluded that there is no significant relationship between alcohol consumption and diabetes mellitus.

Relationship of Hypertension History with Diabetes Mellitus in the Elderly
Based on the research results, distribution was obtained based on the relationship between a history of hypertension and diabetes mellitus.

Table 8. The Relationship of History of Hypertension with DM

History of Hypertension	Dm		Total	Significance	OR	The
	Yes	Not				
Yes	96	81	177			
Not	57	65	122	0.201*	1.305	.723 - 2.353
Total			299			

The analysis results obtained by respondents with a history of hypertension diagnosed with diabetes mellitus were 96 people, and among respondents with a history of hypertension who were diagnosed with no diabetes mellitus, as many as 57 people. Therefore, obtaining a value of p = 0.201, it can be concluded that there is no significant relationship between the history of hypertension and diabetes mellitus.

Relationship of Physical Activity with Diabetes Mellitus in the Elderly
Based on the research results, distribution was obtained based on the relationship between Physical Activity and diabetes mellitus.

Table 9. The Relationship of Physical Activity with Diabetes Mellitus

| Physical Activity | Dm | | Total | Significance | OR | The |
	Yes	Not				
Heavy	8	38	46			
Keep	86	82	168	0.000*	5.072	2.988 - 8.609
Light	59	26	85			
Total			299			

The analysis results obtained by respondents diagnosed with diabetes mellitus were 86 people with moderate physical activity, and 82 people were undiagnosed with diabetes mellitus in moderate physical activity. Therefore, obtaining a p = 0.000, it can be concluded that there is a significant relationship between physical activity and diabetes mellitus.

The Relationship of Obesity with Diabetes Mellitus in the Elderly
Based on the research results, distribution was obtained based on the relationship between obesity and diabetes mellitus.

Table 10. The Relationship of Obesity with Diabetes Mellitus

| Obesity | Dm | | Total | Significance | OR | The |
	Yes	Not				
Yes	112	79	191			
Not	41	67	108	0.001*	2.768	1.512 - 5.066
Total			299			

The analysis results were obtained from respondents diagnosed with diabetes mellitus, as many as 112 people who suffered from obesity, and respondents who were not diagnosed with diabetes mellitus, as many as 41 people who suffered from obesity. Obtained a value of p = 0.001, it can be concluded that there is a significant relationship between obesity and diabetes mellitus.

Relationship of Dyslipidemia with Diabetes Mellitus in the Elderly
Based on the research results, distribution was obtained based on the relationship between obesity and diabetes mellitus.

Table 12. The Relationship of Dyslipidemia with Diabetes Mellitus

| Dyslipidemia | Dm | | Total | Significance | OR | The |
	Yes	Not				
Yes	60	53	113			
Not	93	93	186	0.603*	.741	.409 - 1.344
Total			299			

The analysis results obtained by respondents diagnosed with diabetes mellitus were as many as 60 people with dyslipidemia, and 93 people who were not diagnosed with diabetes mellitus were diagnosed with dyslipidemia. Obtained a value of p = 0.603, it

can be concluded that there is no significant relationship between dyslipidemia and diabetes mellitus.

DISCUSSION

General Characteristics
In this study, results were obtained based on the age characteristics of patients. The highest results were in the age group between 45-59 year age group, with results of 65.9% (197 people from 299 respondents) compared to the age group of 60-75 years and >75 years. As a person gets older, there will be physiological changes in the human body. Diabetes mellitus often appears at the age of more than 45 years. Some of the factors underlying this are reduced activity, weight gain, reduced muscle mass, and the consequences of aging resulting in shrinkage of cells β the pancreas and an effect on glucose intolerance (Milita et al., 2021).

Based on gender, the highest percentage were female respondents, with 221 people (73.9%) out of 299 respondents. This result is the same with research that states that based on gender, it turns out that most are women, with as many as 81 people (60.4%) out of 134 respondents. Women are more at risk of developing diabetes mellitus because physically, women more often experience an increase in body mass index. This tendency is due to the physical activity of women compared to men, who use muscles more often, and there is a burning of calories by more muscles (Komariah & Rahayu, 2020).

Based on job characteristics, the results of 299 respondents, most of whom were mothers who had jobs as IRT, totaled 152 people (50.8%). It still has something to do with the gender of diabetes mellitus. *The Netherland Nutrition Council* classifies household activities as light activities that increase the likelihood of an increase in the body mass index of homemakers (Betteng, Pangemanan, & Mayulu, 2014).

Frequency Distribution Based on Diagnosed Diabetes Mellitus
This study showed results that more respondents were diagnosed with diabetes mellitus, with a total of 153 people (51.2%) from 299 respondents, compared to respondents who were undiagnosed with diabetes mellitus, namely 146 people (48.8%). This result are same with research conducted, which states that from the study results, respondents who suffer from diabetes mellitus are the most, namely 93 people (73.8%) out of 126 respondents. Risk factors for diabetes mellitus vary widely, for example, those related to sociodemographic such as occupation, age, and gender, as well as health-related risk factors such as family health history. The factors related to the patient's lifestyle include physical activity, smoking, and alcohol consumption (Arania et al., 2021)

Age Relationship With Diabetes Mellitus in the Elderly
Based on the statistical analysis in table 5.3, the p-value = 0.000 can be concluded that there is a significant relationship between age and diabetes mellitus. These results are same with the study that there was a statistically significant association between respondents' age and the incidence of diabetes mellitus. The results of these two studies show that age is one of the risk factors for diabetes mellitus. The older the age, the higher the percentage of respondents affected by diabetes mellitus. The factor that causes this is that the more a person gets older, the more decreased the physiological function of the body (Milita et al., 2021). This condition is because aging can reduce insulin sensitivity and affect glucose levels in the blood.

Gender Relationship With Diabetes Mellitus in the Elderly

Based on the statistical analysis results in table 5.4, p>0.05 (p = 0.982) it can be concluded that there is no significant relationship between sex and diabetes mellitus. This study showed that 40 male respondents were diagnosed with diabetes mellitus, and 38 people undiagnosed with diabetes mellitus. Female respondents were diagnosed with diabetes mellitus as many as 113 people and undiagnosed as many as 108 people. This study's results differ from the research conducted by the results that there is a weak correlation between the sexes and the incidence of diabetes mellitus. (Arania, Triwahyuni, Esfandiari, & Nugraha, 2021)

Gender relationship with diabetes mellitus can occur because the sensitivity of the insulin response in the blood can increase due to the presence of estrogen and progesterone. When menopause occurs, the hormone estrogen will decrease, which causes a decrease in insulin response. Another influential factor is women's weight which is often not ideal in the criteria for body mass index. This tendency leads to a decrease in insulin in the blood. (Arania et al., 2021)

Family History Relationship With Diabetes Mellitus in the Elderly

After conducting the study, in table 5.5, the results of respondents diagnosed with diabetes mellitus were obtained from as many as 77 people with a family history of diabetes mellitus and 26 respondents who were not diagnosed with diabetes mellitus. The study results obtained a p = 0.000 value, concluding a significant relationship between family history and diabetes mellitus.

The same results were also found by 20 respondents diagnosed with diabetes mellitus, 16 of whom had a family history of diabetes mellitus. The same result was also found byEthics and Monalisa (2017), Paramita and Lestari (2019) those who stated that the family history factor increased the risk of diabetes mellitus (Paramita & Lestari, 2019)

The Relationship Between Smoking and Diabetes Mellitus in the Elderly

Table 6 shows that respondents who smoked were 27 people with diabetes mellitus diagnosed and those who did not smoke, as many as 21 people with diabetes mellitus diagnosed. So that the p-value = 0.442 was obtained, and it was concluded that there was no significant relationship between smoking and diabetes mellitus. The same results were also found in the number of respondents who smoked, which were as many as 1868 people. Meanwhile, those diagnosed with diabetes mellitus were as many as 109 people, while those undiagnosed with diabetes mellitus were 1759. So that a p-value = 0.208 was obtained, and it can be stated that there is no significant relationship between smoking and diabetes mellitus (Irnayanti and Bantas, 2021)

The Relationship Between Alcohol Consumption and Diabetes Mellitus in the Elderly

Based on the analysis that has been carried out, two respondents who consumed alcohol diagnosed with DM and 151 respondents who did not consume alcohol diagnosed with DM, from these respondents obtained a value of p = 0.589 so that it can be concluded that there is no significant relationship between alcohol with DM. Furthermore, the same result was also obtained by Suryanti (2021) at Bhayangkara Hospital, Makassar, where a p = 0.628 value was obtained so that it can be concluded that there is no significant relationship between alcohol and DM.

However, a p = 0.013 value was obtained in a study, concluding a significant relationship between alcohol and DM. The effect of alcohol on blood sugar depends not only on the alcohol consumed. Alcohol will affect the performance of the insulin hormone, increasing blood sugar levels.

Relationship of Hypertension History With Diabetes Mellitus in the Elderly

Based on the analysis, 96 respondents with a history of hypertension were diagnosed with DM, while 57 respondents without a history of hypertension were diagnosed with DM. These respondents obtained a p-value = 0.201, so it can be concluded that there is no significant relationship between the history of hypertension and DM.

However, in a study conducted by Setyaningrum and Sugiyanto (2015) at Tugurejo Regional Hospital, Semarang, a p-value = of 0.039 was obtained to conclude that there is a significant relationship between the history of Hypertension with DM. Although some studies associate hypertension with insulin resistance, hypertension affects DM due to the thickening of arterial blood vessels, which causes the diameter of blood vessels to narrow. As a result, the transport of glucose from the blood becomes disturbed.

Relationship of Physical Activity With Diabetes Mellitus in the Elderly

The results show that eight respondents with strenuous activity were diagnosed with DM, 86 with moderate activity diagnosed with DM, and 59 with light activity diagnosed with DM. These respondents obtained a p-value = 0.000 with a chance of 5.072 times to be exposed to DM compared to individuals with regular physical activity, so it can be concluded that there is a significant relationship between physical activity and Diabetes Mellitus. Megasari (2017) also found the same results in the elderly population at Arifin Achmad Hospital, Riau. A p= 0.000 value was obtained with a 21-time chance of getting DM compared to individuals with regular physical activity.

However, in the research conducted by Rosita, Kusumaningtiar, Irfandi, and Ayu (2022) at the Balaraja Health Center, Tangerang Regency, where a p = 1,000 value was obtained, it can be concluded that there is no relationship between physical activity and DM. Physical activity is a body movement that requires energy. Strenuous activity is the body's movement that requires greater energy expenditure compared to moderate and light activities. Thus, in more strenuous physical activity, the amount of sugar in the body will also decrease; thus, the need for the hormone insulin is reduced.

The Relationship of Obesity With Diabetes Mellitus in the Elderly

Based on the analysis that has been carried out, 112 respondents with obesity diagnosed with DM and 41 non-obese respondents who were diagnosed with DM, from these respondents obtained a p-value = 0.001 and a chance of 2.768 times to be exposed to DM compared to non-obese individuals, so it can be concluded that there is a significant relationship between obesity and Diabetes Mellitus. Megasari (2017) also found the same results in the elderly population at Arifin Achmad Hospital, Riau. A p= 0.000 value was obtained with an 11.2 times chance of getting DM compared to non-obese individuals.

Obesity conditions with fatty tissue body tissue, muscle tissue will be more resistant to the work of insulin, especially if body fat or overweight accumulates in the area central or abdominal. This fat will inhibit the work of insulin so that glucose cannot be transported into the cells and accumulates in the blood circulation.

Relationship of Dyslipidemia With Diabetes Mellitus in the Elderly

Based on the analysis, 60 respondents with DM-diagnosed dyslipidemia were obtained, and 93 non-dyslipidemia respondents who were diagnosed with DM, from these respondents obtained a p= value of 0.603, so it can be concluded that there is no significant relationship between dyslipidemia with DM.

However, in a study conducted by Setyaningrum and Sugiyanto (2015) at Tugurejo Hospital, Semarang, a p-value = 0.007 was obtained with a 3.986 chance of getting DM compared to non-dyslipidemia individuals. Dyslipidemia often accompanies DM. Lipid toxicity results in an increased process of atherogenesis. As a result, lipoproteins undergo metabolic changes, increasing the risk of insulin resistance, which later becomes DM type 2.

CONCLUSION

In this study, several interesting findings emerged. First, there was a significant association between age and the incidence of diabetes mellitus. Second, there was also no significant association between gender and diabetes mellitus. Third, there was also a significant association between family history and the incidence of diabetes mellitus. Finally, however, there was no significant association between smoking and the incidence of diabetes mellitus.

Similarly, there was also no significant association between alcohol consumption and the incidence of diabetes mellitus. Next, there was no significant association between the history of hypertension and the incidence of diabetes mellitus. Moreover, there is a significant association between physical activity and the incidence of diabetes mellitus. There was also a significant association between obesity and the incidence of diabetes mellitus. Nonetheless, there was no significant association between dyslipidemia and the incidence of diabetes mellitus.

The conclusion above then leads to propose suggestions. Practically, it is hoped that the public will increase awareness and awareness of their health conditions, and people who have risk factors for age, obesity, smoking, and lack of physical activity need to improve lifestyle and community patterns and carry out routine examination activities in the form of early detection or regular screening to prevent complications. Moreover, it is hoped that POSBINDU activities carried out regularly by each PUSKESMAS can be used as an initial screening or early detection of risk factors for type 2 diabetes mellitus. The activity can be done by examining blood sugar so that if it is found, people with risk factors can immediately be educated, intervened, and referred to the PUSKESMAS. Furthermore, in POSBINDU activities, counseling should be carried out on foods that are low in glycemic loads, such as fruits and vegetables, to be consumed every day and motivate the community, especially the elderly, to do physical activity or 30-minute diving exercise that can be done 3-5 times a week while at home. It is also expected to provide counseling to schools with specific counseling on Type 2 DM disease about information on risk factors for developing Type 2 DM in adolescents with obesity and a family history of DM so that prevention can be carried out early.

For future studies, it is recommended that subsequent researchers, so that they can be used as one of the sources of referral for subsequent research, can use different research methods and variables in order to obtain more accurate results in describing the target population.

DECLARATION OF CONFLICTING INTERESTS
The authors declared no potential conflicts of interest

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