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Analysis of the causes of diabetes mellitus occurrence in the chronic disease management program

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ABSTRACT

Introduction: Chronic Disease Management Program (Prolanis) is a health service system carried out with a proactive approach whose implementation involves participants, health facilities and BPJS health for chronic disease sufferers. This study aimed to determine the factors that influence the incidence of Diabetes Mellitus in Prolanis Participants at the Pangkajene Health Center, Sidrap Regency.

Research Methodology: The type of research used is Cross-Sectional Study research, which is a study where independent variables/causal factors/physical factors and dependent variables/consequential factors/effect factors are collected at the same time which was carried out at the Pangkajene Health Center, Sidrap Regency in the period March-April 2024 with a total of 68 participants.

Result: The results of the study showed that the variables of age (ρ=0.031), obesity (ρ=0.002), diet (ρ=0.026), and genetic history (ρ=0.005) had an influence on the incidence of Diabetes Mellitus in Prolanis Participants at the Pangkajene Health Center, Sidrap Regency.

Conclusion: The age variable is the variable that most influences the incidence of Diabetes Mellitus. There is a need for early detection in people who have a genetic history of diabetes mellitus and increasing community participation in Prolanis activities to be able to monitor degenerative diseases.

Keywords: Age, Obesity, Diet, Genetic, Diabetes Mellitus.

INTRODUCTION

Chronic Disease Management Program (Prolanis) is a health service system carried out with a proactive approach whose implementation involves participants, health facilities, and BPJS health for chronic disease sufferers. Diabetes mellitus is a chronic disease that cannot be cured one hundred percent but can be controlled. Diabetes mellitus is a chronic disease that cannot be cured one hundred percent but can be controlled. Diabetes mellitus sufferers need continuous care to improve their quality of life, one of which is through promotive and preventive efforts carried out by BPJS (Puspita and Rakhma, 2018). The number of Diabetes Mellitus sufferers in Indonesia is increasing every year. Several factors can influence the causes of the increase in Diabetes Mellitus sufferers. Lack of knowledge of Diabetes Mellitus sufferers about risk factors for complications can increase the risk of complications in Diabetes Mellitus sufferers, especially in the physical condition of sufferers (Suprapto, 2024). Health education is a primary prevention that must be given to high-risk community groups. Secondary health education is provided to groups of Diabetes mellitus patients. Meanwhile, health education for tertiary prevention is given to patients with Diabetes mellitus with chronic complications (Nurhanifah *et al.*, 2023).

At the end of 2021, the International Diabetes Federation (IDF), in its 10th edition of the Atlas, confirmed that diabetes is one of the fastest-growing global health emergencies of the 21st century. In 2021, more than half a billion people worldwide will be living with diabetes, or 537 million people, to be exact, and this number is projected to reach 643 million by 2030 and 783 million by 2045. In Indonesia, it is estimated that the adult diabetes population aged 20-79 years is 19,465,100 people. Meanwhile, the total adult population aged 20-79 years is 179,720,500, so if calculated from these two numbers, it is known that the prevalence of diabetes in the age group between 20-79 years is 10.6%. In other words, if calculated in the age group 20-79 years, this means 1 in 9 people with diabetes (Saraswati, 2022). Health problems widely experienced in Indonesia today are influenced by lifestyle, diet, work area, exercise, and stress. An increase in economic income supports changes in lifestyle in society, many large work activities, and lots of fast food that are not balanced with knowledge and understanding of nutrition. A diet high in saturated fat and sugar, low in fiber, and low in micronutrients will cause obesity, overnutrition, and increased radicals that will cause degenerative diseases. One of them is diabetes mellitus (Fandinata and Ernawati, 2020).

Diabetes Mellitus (DM) is one of the health problems that continues to increase. A study shows a significant relationship between age factors and the incidence of diabetes. People aged ≥ 40 years have a risk of developing type 2 diabetes mellitus 5.812 times greater than people aged <40 years. However, no significant relationship was found between education, history of DM, and hypertension (Zhai *et al.*, 2023). A study shows that there is a relationship between diet, physical activity, and exposure to cigarette smoke with the incidence of type II DM. Modifiable risk factors that affect type II DM are diet and physical activity. People with a risky diet have an 11.8 times greater risk of developing type II DM compared to people with a non-risky diet. People with low physical activity have a 2.6 times greater risk of developing type II DM than people with high physical activity (Wijayanti, Nurbaiti, and Maqfiroch, 2020).

Data from the South Sulawesi Provincial Health Office shows that the number of people with Diabetes Mellitus in South Sulawesi is 47,830. Meanwhile, in Sidrap Regency, there are 692 people, and Makassar City is in first place with the number of people with Diabetes Mellitus as many as 15,217 people (P2P Section of the South Sulawesi Provincial Health Office, 2024). Data from the Pangkajene Health Center shows 206 people with Diabetes Mellitus, but in November 2023, only 186 were active in the Prolanis program held by the Pangkajene Health Center. This figure is a very large incidence rate, so further handling and identification of the dominant causes experienced by Diabetes Mellitus sufferers in the Pangkajene Health Center work area is needed (Puskesmas Pangkajene Kabupaten Sidrap, 2023) Diabetes Mellitus (DM) has become a public health problem and is a significant cause of mortality, morbidity, and disability in the world. To overcome DM effectively and efficiently, it is necessary to carry out targeted prevention and control programs. One way to prevent it is to know the characteristics of individuals who are at

risk of developing DM. Therefore, further research is needed on the risk factors for Diabetes Mellitus.

RESEARCH METHODOLOGY

The research design used in this study is a Cross Sectional Study, where independent variables/causal factors/physical factors and dependent variables/consequential factors/effect factors are collected simultaneously. Researchers conduct observations or measurements of variables at a particular time and there is no follow-up to the measurements taken (Adiputra, 2021). The study was conducted in the working area of the Pangkajene Health Center, Sidenreng Rappang Regency, in the period March-April 2024.

The population in this study were all prolongs participants registered at the Pangkajene Health Center, Sidrap Regency, in 2024, totaling 205 patients. To determine the sample size, this study applies the Slovin formula, which is appropriate for large populations where surveying each individual is impractical. Sampling Technique. The Slovin formula calculates a representative sample size from the total population of 205 individuals. This ensures that the sample accurately reflects the population while maintaining feasibility in data collection. The sample consisted of 68 prolanis participants registered as Prolanis participants.

Obtained directly through a survey given to respondents using a structured questionnaire. Secondary Data: Sourced from the Pangkajene Health Center, Sidenreng Rappang Regency. Research Instrument. The main instrument used for data collection was a questionnaire designed to capture respondents' perceptions, knowledge, and experiences related to the incidence of diabetes mellitus (age, obesity, diet, and genetic history) in Prolanis participants.

Data Collection Techniques. The instrument used in this study was a list of questions in the form of a questionnaire. The questions in the questionnaire will be answered by each prolanis participant who suffers from Diabetes Mellitus at the Pangkajene Health Center, Sidrap Regency. The collected data will be processed using the SPSS (Statistica Package for the Social Science) program for 25.0. Data Analysis consists of univariate analysis: Univariate analysis is carried out to obtain a general description by describing each variable used in the study, namely by looking at the frequency distribution in a table and graph form. Bivariate Analysis: Bivariate analysis is an analysis to see the effect of the independent variable on the dependent variable with the Pearson Chi-Square test at a 95% confidence level or a significance level of 10.05. Multivariate Analysis: Variables included in the multivariate analysis are variables with a p-value <0.05 in the bivariate analysis with the independent variable or variables that are substantially suspected to be closely related using the logistic regression test.

RESULT

Table 1. Respondent Characteristics (n = 68)

Characteristic	Category	Frequency (n)	Percentage (%)
Age	15-25 years	2	2.9%
	26-36 years	3	4,4%
	37-47 years	8	11,8%
	48-58 years	33	48,5%
	59-69 years	20	29,4%
	70-80 years	2	2,9%
Long illness	<5 years	46	67.7%
	6-10 years	20	29.4%
	16-20 years	1	1.5%
	>21 years	1	1.5%
Occupation	Don't have a job	5	13.3%
	Housewife	26	60.0%
	Farmer	2	26.7%
	Trader	2	13.3%
	Government employees	11	60.0%
	Retired Employee	12	26.7%

	Entrepreneurs and Others	10	14,7%
Length of Program Participation	0-24 months	46	67,6%
	25-48 months	3	4,4%
	49-72 monhts	9	13,2%
	97-120 months	10	14,7%

Respondents aged 15-25 years were 2 (2.9%), 26-36 years were 3 (4.4%), 37-47 years were 8(11.8%), 48-58 years were 33(48.5%), 59-69 years were 20(29.4%), and 70-80 years were 2(2.9%). Respondents who had been ill/suffering from chronic diseases for a long time consisted of <5 years as many as 46 (67.6%), 6-10 years as many as 20 (29.4%), 16-20 years as many as 1 (1.5%), and ≥21 years as many as 1 (1.5%). Respondents who do not have jobs are 5 (7.4%), housewives are 26 (38.2%), farmers are 2 (2.9%), traders are 2 (2.9%), ASN are 11 (16.2%), retirees are 12 (17.6%), self-employed and others are 10 (14.7%). While respondents who have been members of prolanis for 0-24 months are 46 (67.6%), 25-48 months are 3 (4.4%), 49-72 months are 9 (13.2%) and 97-120 months are 10 (14.7%).

Table 2. Analysis of the Influence of Age, Obesity, Diet, and Genetic History on the Incidence of Diabetes Mellitus in Prolanis Participants at the Pangkajene Health Center, Sidrap Regency (n = 68)

Variabel	Diabetes Mellitus		Penyakit Kronik Lainnya		Total		*ρ*
	n	%	n	%	n	%	
Age							
Risky	35	77,8	10	22,2	45	100%	0,031
No Risky	12	52,2	11	47,8	23	100%	
Obesity							
Risky	30	85,7	5	14,3	35	100%	0,002
No Risky	17	51,5	16	48,5	33	100%	
Dietary habit							
Risky	39	76,5	12	23,5	51	100%	0,026
No Risky	8	47,1	9	52,9	17	100%	
Genetic History							
There is	35	81,4	8	18,6	43	100%	0,005
There is not	12	48,0	13	52,0	25	100%	
Amount	47	69,1	21	30,9	68	100	

Bivariate analysis of 45 respondents who have a risky age, there are 35 (77.8%) respondents who suffer from diabetes mellitus and 10 (22.2%) respondents who suffer from hypertension/other chronic diseases. From 23 respondents who have an age that is not at risk, there are 12 (52.2%) respondents suffer from diabetes mellitus, and 11 (47.8%) respondents suffer from hypertension/other chronic diseases. Pearson Chi-square statistical analysis shows a ρ value of 0.031 <ρ standard 0.05 with the interpretation that age affects the incidence of Diabetes Mellitus in Prolanis Participants at the Pangkajene Health Center, Sidrap Regency. 35 respondents have bodies in the obesity category, 30 (85.7%) respondents suffer from diabetes mellitus, and 5 (14.3%) respondents suffer from hypertension/other chronic diseases. Meanwhile, from 33 respondents who have a body in the category of non-obese/normal, 17 (51.5%) respondents suffer from diabetes mellitus, and 16 (48.5%) respondents suffer from hypertension/other chronic diseases. Pearson Chi-square statistical analysis shows a ρ value of 0.002 <ρ standard 0.05 with the interpretation that there is an effect of obesity on the incidence of Diabetes Mellitus in Prolanis Participants at the Pangkajene Health Center, Sidrap Regency.

Bivariate analysis of 51 respondents who had a risky pattern, there were 39 (76.5%) respondents who suffered from diabetes mellitus and 12 (23.5%) respondents who suffered from hypertension/other chronic diseases. From 17 respondents who had a non-risky diet, there were 8 (47.1%) respondents suffered from diabetes mellitus, and 9 (52.9%) respondents suffered from hypertension/other chronic diseases. Pearson Chi-square statistical analysis showed a ρ value of 0.026 <ρ standard 0.05 with the interpretation that diet influenced the incidence of Diabetes

Mellitus in Prolanis Participants at the Pangkajene Health Center, Sidrap Regency. While from 35 respondents who had a genetic history/family members who suffered from DM, there were 35 (81.4%) respondents who suffered from diabetes mellitus and 8 (18.6%) respondents who suffered from hypertension/other chronic diseases. Meanwhile, from 25 respondents who had a genetic history/family members suffering from DM, there were 12 (48.0%) respondents who suffered from diabetes mellitus and 13 (52.0%) respondents who suffered from hypertension/other chronic diseases. Pearson Chi-square statistical analysis showed a ρ value of 0.005 <ρ standard 0.05 with the interpretation that genetic history influences the incidence of Diabetes Mellitus in Prolanis Participants at the Pangkajene Health Center, Sidrap Regency.

Table 3. Multivariate logistic regression analysis of factors associated with The Incidence of Diabetes Mellitus in Prolanis Participants at the Pangkajene Health Center, Sidrap Regency

Variable	B	Std. Err	Exp (B)	Sig
Age	0.345	0,104	3,310	0,002
Obesity	0,245	0,159	1,542	0,128
Dietary habit	0,239	0,114	2,106	0,039
Genetic History	0,162	0,162	0,998	0,322
Constant	-0,037	0,259	-0,142	.888

The multivariate analysis shows that educational background and HR competence levels Overall, the variables that the Regression test has analyzed, were found with the interpretation that the exp (B) value of age was 3.310, indicating that the older and more at-risk the age, the risk of diabetes mellitus will increase by 3.310 times. Likewise with obesity, increasing body weight/BMI in the obesity category will increase the risk of diabetes mellitus by 1.542 times. If there is a family member who suffers from diabetes mellitus, the risk will be passed on to other family members by 0.998 times. A risky/unhealthy diet will provide a risk of 2.106 times for suffering from diabetes mellitus or other chronic diseases. Age has the strongest influence among other variables on the incidence of Diabetes Mellitus in Prolanis Participants at the Pangkajene Health Center, Sidrap Regency.

DISCUSSION

Age

Diabetes mellitus is one of the non-communicable diseases that has shown an increase until now. Factors that can cause type 2 diabetes mellitus include age, gender, and hypertension. People aged >45 years have a 9 times risk of developing type 2 DM compared to people aged <45 years, and this is statistically significant. Someone aged >45 years has an increased risk of developing DM and glucose intolerance due to degenerative factors, namely decreased body function to metabolize glucose. However, this condition is caused not only by age factors but also by the length of time the sufferer survives (Gunawan and Rahmawati, 2021).

The results of the study showed that out of 45 respondents who were at risk (≥45 years), there were 35 (77.8%) respondents who suffered from diabetes mellitus and 10 (22.2%) respondents who suffered from hypertension/other chronic diseases. Out of 23 respondents who were not at risk (<45 years), there were 12 (52.2%) respondents who suffered from diabetes mellitus and 11 (47.8%) respondents who suffered from hypertension/other chronic diseases. Pearson Chi-square statistical analysis showed a ρ value of 0.031 <ρ standard 0.05 with the interpretation that age affects the incidence of Diabetes Mellitus in Prolanis Participants at the Pangkajene Health Center, Sidrap Regency.

Type 2 Diabetes Mellitus is the most common DM in society, usually occurring at 30 years and above. In type 2 DM, the pancreas can still produce insulin, but the insulin produced is poor and cannot function properly to insert glucose into cells so it can cause glucose in the blood to increase (Ayuni, 2020).

A study shows that those aged 55-59 years mostly have an Overweight body mass index, doing moderate and heavy activities. While at the age of 60-64 years most have an obesity body mass index I, doing light activities. The highest prevalence of obesity occurs in the age group 55

- 64 years. In the elderly category, the body will experience a decrease in muscle mass and hormonal changes, so there is a decrease in metabolism. In this age category, there tends to be a decrease in the function of body organs due to the degenerative process (aging), which can encourage non-communicable diseases (Putri *et al.*, 2022).

Obesity

Obesity is a very high accumulation of fat in the body. Calories entering the body are higher than physical activity to burn them, so fat accumulates and increases the risk of type 2 DM. Obesity criteria are BMI ≥25 kg/m2 or waist circumference ≥80cm for women and ≥90 cm for men (Nuraisyah, 2018).

The study results showed that bivariate analysis of 35 respondents who had bodies in the obesity category, 30 (85.7%) respondents suffered from diabetes mellitus, and 5 (14.3%) respondents suffered from hypertension/other chronic diseases. From 33 respondents who had bodies in the non-obese/normal category, 17 (51.5%) respondents suffered from diabetes mellitus, and 16 (48.5%) respondents suffered from hypertension/other chronic diseases. Pearson Chi-square statistical analysis showed a ρ value of 0.002 <ρ standard 0.05 with the interpretation that there was an effect of obesity on the incidence of Diabetes Mellitus in Prolanis Participants at the Pangkajene Health Center, Sidrap Regency. Obesity is when a person's body has too high a fat content. Too high a fat content in the body can cause various health problems. One of the risks faced by obese people is Diabetes Mellitus. There is a relationship between obesity and the incidence of body weight measurement of respondents studied; on average, they are obese, making it possible for someone to experience Diabetes Mellitus. Factors that cause obesity can be caused by poor diet or a lack of someone to pay attention to activities such as exercise, which can cause Diabetes (Basu *et al.*, 2023).

Obesity causes the response of pancreatic beta cells to increased blood glucose to decrease; insulin receptors in cells throughout the body, including in the muscles, decrease in number and are less sensitive. Obesity can also be associated with a monotonous diet and lifestyle. Insulin resistance increases with obesity, which can block glucose uptake into muscles and fat cells so that blood glucose increases (Putri *et al.*, 2022).

Dietary habit

Factors that also affect the health of the elderly are unhealthy eating habits that were carried out in the past so that at this time they have an impact on their susceptibility to various diseases. The decline in physiological function affects decreasing physical activity so that the possibility of obesity is greater (Putri *et al.*, 2022)

The results showed that out of 51 respondents who had a risky pattern, there were 39 (76.5%) respondents who suffered from diabetes mellitus and 12 (23.5%) respondents who suffered from hypertension/other chronic diseases. Out of 17 respondents who had a non-risky diet, there were 8 (47.1%) respondents who suffered from diabetes mellitus and 9 (52.9%) respondents who suffered from hypertension/other chronic diseases. Pearson Chi-square statistical analysis showed a ρ value of 0.026 <ρ standard 0.05 with the interpretation that diet influenced the incidence of Diabetes Mellitus in Prolanis Participants at the Pangkajene Health Center, Sidrap Regency.

Eating patterns in cities have shifted from traditional eating patterns that contain a lot of carbohydrates and fiber, vegetables, and fruits to Westernized eating patterns and low fiber (Chen *et al.*, 2024). The composition of food high in fat, salt, and low in fiber in fast food has recently been very popular among Indonesians, especially teenagers (Thiagarajah, Ng and Ahmad Bustami, 2024). Teenagers who have high social activities tend to show interaction with peers. In big cities, groups of teenagers often eat together at eateries that provide fast food. Fast food comes from Western countries with high fat and calorie content. If consumed in large quantities every day, it can cause obesity. Obesity, another nutritional problem, can cause the risk of diabetes (Manuntung, 2019).

Gene History

Genetic factors have been proven in several studies that someone who has a genetic history of suffering from type 1 Diabetes Mellitus is at higher risk than someone who does not have a

history of type 1 Diabetes Mellitus. This means that type 1 Diabetes Mellitus is more likely to be inherited or inherited. Diabetes Mellitus is a hereditary disease that is polygenic or multi-factor genetic, which means that it is not just one gene but the interaction between genes. However, the risk of type 1 Diabetes Mellitus sufferers is certainly highest if one of their parents suffers from Diabetes Mellitus compared to parents who do not (Hossain, Al-Mamun and Islam, 2024).

The results of the study showed that out of 35 respondents who had a genetic history/had family members suffering from DM, there were 35 (81.4%) respondents who suffered from diabetes mellitus and 8 (18.6%) respondents who suffered from hypertension/other chronic diseases. Out of 25 respondents who had a genetic history/had family members suffering from DM, there were 12 (48.0%) respondents who suffered from diabetes mellitus and 13 (52.0%) respondents who suffered from hypertension/other chronic diseases. Pearson Chi-square statistical analysis showed a ρ value of 0.005 <ρ standard 0.05 with the interpretation that genetic history influences the incidence of Diabetes Mellitus in Prolanis Participants at the Pangkajene Health Center, Sidrap Regency.

A study showed that a p-value of 0.000 (p <0.05) was obtained, which means that genetic history has a relationship with the occurrence of DM. The OR value of 4.215 means that genetics have a 4 times greater risk of suffering from DM. Genetic history is one of the concerns in the factors that cause DM because DM is the result of the interaction of genetic factors, and environmental exposure to genetic factors will be susceptible (Sibagariang *et al.*, 2024).

The risk of Diabetes Mellitus will increase two to six times if parents or siblings have this disease. Approximately 50% of Type 1 DM patients have parents who also suffer from DM, and more than a third of patients have siblings who also suffer from DM, so genetic factors (heredity) play a very important role. The family has a vital role for the next generation, this is because various diseases can occur due to family history. Family history of the disease can be a detector for people who have family with diabetes mellitus (Monod *et al.*, 2023). Family history has a relationship with respondents who suffer from diabetes mellitus. This can be seen from the respondents who suffer from diabetes mellitus, the majority of respondents who have a family history of diabetes mellitus, although there are still respondents who suffer from diabetes mellitus caused by other factors such as unhealthy diet, lack of physical activity, smoking habits, and lack of (Enyew *et al.*, 2023).

CONCLUSION

This study found that age, obesity, diet, and genetic history influence the incidence of Diabetes Mellitus in Prolanis Participants at the Pangkajene Health Center, Sidrap Regency. Age is the variable that has the most decisive influence among other variables. Ages >45 years have a high risk of suffering from diabetes mellitus. An unhealthy diet for a long time will provide a high risk of obesity and diabetes mellitus. Family members who have a history of diabetes mellitus will have a significant influence on passing on diabetes mellitus genetically.

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Conflict of interest

There are no potential conflicts of interest relevant to this article.

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