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PREVALENCE OF DIABETES MELLITUS AND PROPORTION OF TYPE OF DIABETES MELLITUS CONTROL IN INDONESIA: 2023 IHS DATA ANALYSIS

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ABSTRACT

Background: *Diabetes mellitus is the mother of all diseases in Indonesia, and if left untreated, it can cause various other diseases such as heart disease, stroke, and kidney disease. Based on IHS data in 2023, the types of diabetes mellitus control available in Indonesia include dietary control, exercise, and herbal choices. Based on the analysis of IHS data in 2023, this study aimed to examine the relationship between the prevalence of diabetes mellitus based on a doctor's diagnosis and the types of diabetes mellitus control available in Indonesia.*
Methods: *This research is quantitative and cross-sectional, using aggregate data from the 2023 Indonesian Health Survey report covering 38 provinces divided into seven regions. After the normality test was met, analysis was carried out using the Pearson correlation test.*
Results: *The results showed that the proportion of DM control type (diet management) was not related to the incidence of diabetes mellitus (p = 0.07), and the proportion of DM control type (exercise) (p = 0.36), but was related to the proportion of DM control type (herbal alternatives) (p = 0.00).*
Conclusion: *This study concludes that the type of DM control (eating and exercise management) is not related to the incidence of diabetes mellitus based on a doctor's diagnosis in Indonesia. In contrast, the type of DM control (herbal alternatives) is associated with the incidence of diabetes mellitus based on a doctor's diagnosis in Indonesia.*
Keywords: *Diabetes Mellitus, Eating Management, Exercise, Herbal Alternatives, Indonesian Health Survey (IHS).*

INTRODUCTION

Non-communicable diseases (NCDs) are diseases that are not contagious and are not caused by vector transmission, viruses, and bacteria but are more caused by behavior and lifestyle. The dominance of health problems in society today is shifting from infectious diseases to non-communicable diseases (Kemenkes, 2023).

Diabetes is a chronic metabolic disease characterized by elevated blood glucose (or blood sugar) levels, which over time can lead to serious damage to the heart, blood vessels, eyes, kidneys, and nerves. The most common is type 2 diabetes, usually in adults, which occurs when the body becomes resistant to insulin or does not make enough insulin. Type 1 diabetes, formerly known as juvenile diabetes or insulin-dependent diabetes, is a chronic condition in which the pancreas produces little or no insulin on its own (World Health Organization, 2024).

WHO says around 830 million people worldwide have diabetes, the majority living in low- and middle-income countries. More than half of people living with diabetes are not receiving treatment. Both the number of people with diabetes and the number of people with untreated diabetes have been steadily increasing over the past few decades (World Health Organization, 2024).

Diabetes mellitus is a non-communicable disease that is the mother of all diseases in Indonesia. The Director of Prevention and Control of Non-Communicable Diseases of the Ministry of Health, Dr. Eva Susanti, S. Kp., M. Kes., told Mediakom on Thursday, December 14, 2023, that "Diabetes is the mother of all diseases. If not controlled, it can cause heart disease, stroke, a kidney disease

which will be even more serious, the costs will be even more severe" (Rokom, 2024)

This is supported by data from the International Diabetes Federation (IDF) which states that Indonesia is ranked fifth in the country with the highest number of diabetes sufferers with 19.5 million sufferers in 2021 and is predicted to reach 28.6 million in 2045 (IDF, 2021)

The 2018 Basic Health Research report states that nationally the prevalence of diabetes mellitus based on a doctor's diagnosis in the population of all ages is at 1.5% with a total of 1,017,290 people. With DKI Jakarta as the first province with the highest prevalence, namely, 2.6%, followed by DI Yogyakarta at 2.4%, and East Kalimantan and North Sulawesi are ranked 3rd at 2.3% (Kementrian Kesehatan RI, 2018). This has become a concern for the Ministry of Health to be able to carry out prevention and control of diabetes mellitus.

Prevention and control of diabetes mellitus in Indonesia is carried out so that healthy individuals remain healthy, people who have risk factors can control their risk factors so as not to get diabetes and people who already suffer from DM can control their disease so that complications or premature death do not occur. Diabetes prevention efforts are carried out through education, early detection of NCD risk factors, and management according to standards.

Prevention of type 2 diabetes mellitus is primarily aimed at people who are at risk of developing type 2 DM. The goal is to slow down the onset of type 2 DM, maintain the function of insulin-producing cells in the pancreas, and prevent or slow down the onset of heart and blood vessel disorders. Risk factors for type 2 DM are divided into modifiable and non-modifiable factors. Prevention efforts are made by reducing modifiable risks (Kemenkes, 2013). Prevention of type 2 DM in people at risk is basically by changing lifestyles that include exercise, weight loss, and diet management. Based on an analysis of a group of people with intensive lifestyle changes, diabetes prevention is most related to weight loss. According to research, a 5-10% weight loss can prevent or slow the onset of type 2 DM. It is also recommended to have a healthy diet, consisting of complex carbohydrates, containing little saturated fat, and high in soluble fiber. Calorie intake is aimed at achieving the ideal body weight (Kemenkes, 2013).

In the 2023 Indonesian Health Survey (IHS) report, types of DM control include diet, exercise, and herbal alternatives (Kemenkes BKPK, 2023). Research on the relationship between the incidence of diabetes mellitus and DM control has existed before, some of which have discussed diet and physical activity. Research at the Manggis 1 Health Center showed a significant relationship between diet and physical activity with blood sugar levels in patients with type 2 diabetes mellitus at the Manggis 1 Health Center (Astutisari et al., 2022) Research in the Internal Medicine Polyclinic of Dr. Rasidin Padang Hospital also showed the same results regarding the relationship between diet and physical activity with the incidence of DM, namely, there is a relationship between diet and physical activity with the incidence of DM (Dafriani, 2017). Therefore, the author is interested in conducting the same research by adding another type of control, namely herbal alternatives.

This study aims to describe the proportion of DM control types (dietary management, exercise, and herbal alternatives) based on 7 regions of Indonesia, describe the prevalence of DM based on doctor's diagnosis at all ages in 7 regions of Indonesia, and analyze the relationship between the incidence of Diabetes Mellitus based on doctor's diagnosis and the proportion of DM control types in Indonesia. The results of this study are expected to provide a basis for more appropriate interventions in dealing with DM incidence in Indonesia.

METHODS

This study is a quantitative study with a cross-sectional design to identify the relationship between the proportion of DM control types and the incidence of Diabetes Mellitus in the population of all ages based on a doctor's diagnosis in Indonesia, the independent variable is the prevalence of diabetes mellitus based on the doctor's diagnosis, while the dependent variable is the proportion of the type of DM control (diet, exercise, and herbal alternative arrangements). This study uses aggregate data from the 2023 Indonesian Health Survey (IHS) Report. This 2023 IHS Report can be accessed by age by downloading it at the following link: https://www.badankebijakan.kemkes.go.id/SKI-2023-dalam-angka/. Indonesian Health Survey (IHS) 2023 is a national-scale evaluation activity with a cross-sectional, non-interventional, and observational design. This design allows researchers to measure the proportion of DM control types in the population of all ages based on a doctor's diagnosis at a certain point in all provinces in Indonesia.

The population in this study were residents of all ages diagnosed with DM in all provinces in Indonesia. The sample in this study were residents of all ages in 38 provinces in Indonesia, which are grouped into seven regions, namely Sumatra, Java-Bali, NTB-NTT, Kalimantan, Sulawesi, Maluku, and Papua. This study used a sampling technique in the form of a total population, which covered 514 districts/cities and involved 586 randomly selected households. The number of residents of all ages diagnosed with DM based on a doctor's diagnosis was 877,531 people.

The data used in this study are secondary data from the 2023 Indonesian Health Survey (IHS) Report, which was conducted in the period from August to October 2023. This survey collects health information, including data on doctor's diagnosis, namely diabetes mellitus (DM), and data on types of DM control in the population of all ages. The research variable is the proportion of types of DM control in the population of all ages which include dietary management, exercise, and herbal alternatives.

This research instrument uses a questionnaire developed by the IHS 2023 team, which includes information related to individual interview information, individual information, respondent identity, and non-communicable diseases. The prevalence of DM based on a doctor's diagnosis at all ages is calculated using the formula: the population of all ages who have been diagnosed with DM by a doctor divided by the respondents interviewed multiplied by 100%. The proportion of types of DM control in all ages based on a doctor's diagnosis is calculated using the formula: each type of DM control (dietary management, exercise, herbal alternatives) divided by the population of all ages who have been diagnosed by a doctor multiplied by 100%. The data collection process was carried out by means of direct interviews with respondents from each household selected as a sample.

Data analysis was performed using the SPSS version 25 application. Univariate analysis was performed to describe the characteristics of each variable, using the middle and variance measures (mean, standard deviation, minimum value, and maximum value). To analyze the relationship between the prevalence of Diabetes Mellitus based on a doctor's diagnosis and the type of DM control variables (dietary management, exercise, and herbal alternatives), bivariate analysis was performed, using the Pearson correlation test, after the assumption of data normality was met, if not met, bivariate analysis using the spearman test.

The implementation of the 2023 Indonesian Health Survey (IHS) has obtained ethical approval from the Health Research Ethics Commission HK.01.07/MENKES/156/2023, to ensure that

all research procedures meet the ethical standards applicable in health research in Indonesia.

RESULTS AND DISCUSSION

Table 1 shows that the proportion of DM control types in dietary management is highest in the Papua regional area, namely in the South Papua province (94.7%) and the proportion of DM control types in dietary management is lowest in the Java-Bali regional area, namely in the West Java province (73.4%). The proportion of DM control types in sports is highest in the Papua regional area, namely in the Papua province (59.7%) and the proportion of DM control types in sports is lowest in the Papua regional area, namely in the Papua Mountains province (24.2%). The proportion of DM control types in herbal alternatives is highest in the Papua regional area, namely in the Central Papua province (62.0%) and the proportion of DM control types in herbal alternatives is lowest in the Java-Bali regional area, namely in the DI Yogyakarta province (20.4%). Nationally, the proportion of DM control types in Indonesia is consecutively dietary management (85.0%), exercise (40.7%), and herbal alternatives (36.7%).

The results of this study indicate that there are significant differences in the proportion of types of DM control (dietary management, exercise, and herbal alternatives) and the incidence of diabetes mellitus based on doctor's diagnoses between regions in Indonesia. In general, the proportion of dietary management in Indonesia is at a higher level than the proportion of exercise and the proportion of herbal alternatives. The proportion of dietary management nationally is at 81.4%, the proportion of exercise is 41.7% and the proportion of herbal alternatives is at the lowest level, which is 29.2%.

Table 1. Distribution of the Proportion of types of DM control

Region	Dietary Management			Exercise			Herbal Alternatives		
	Min	**Max**	$\underline{X}$ ± **SD**	**Min**	**Max**	$\underline{X}$ ± **SD**	**Min**	**Max**	$\underline{X}$ ± **SD**
Sumatera	81.1	91.0	86.2 ± 3.3	27.8	48.2	39.1 ± 7.0	28.2	44.0	37.2 ± 4.5
Jawa and Bali	73.4	90.2	82.2 ± 5.0	40.1	53.6	44.9 ± 5.2	20.4	29.7	24.4 ±3.9
Nusa Tenggara	87.3	87.4	87.4 ± 0.1	41.6	43.5	42.6 ± 1.3	36.6	39.9	38.2 ± 2.3
Kalimantan	74.4	89.3	81.8 ± 6.2	29.5	46.6	37.7 ± 8.0	32.5	44.4	37.0 ± 4.5
Sulawesi	81.4	90.4	84.6 ± 3.5	32.9	39.5	35.7 ± 2.5	26.5	48.4	38.8 ± 7.6
Maluku	85.1	90.7	87.9 ± 4.0	31.4	40.0	35.7 ± 6.1	37.4	43.9	40.7 ± 4.6
Papua	80.6	94.7	87.4 ± 5.4	24.2	59.7	47.3 ±13.2	27.7	62.0	45.9 ± 13.5
Indonesia	**73.4**	**94.7**	**85.0 ± 4.7**	**24.2**	**59.7**	**40.7 ± 8.1**	**20.4**	**62.0**	**36.7 ± 9.3**

This result illustrates the vast difference between the three types of DM control and the type of control that is still rarely applied is herbal alternatives and exercise while dietary management has been widely implemented. Even so, the balance of the three types of DM control has a significant impact on the incidence of diabetes mellitus in Indonesia. The proportion of types of DM control (dietary management, exercise, and herbal alternatives) are all highest found in the Papua region, while the proportion of dietary management and the lowest herbal alternatives are found in the Java and Bali regions, while the lowest proportion of exercise is found again in the Papua region, precisely in the Papua mountainous province. This shows that there is inequality in the implementation of DM control between regions, the highest and lowest proportion of sports are all found in the Papua region, and only different provinces from one region can show very significant inequality.

Table 2 shows that the highest prevalence of Diabetes Mellitus is in the Java and Bali regional areas (3.1%) and the lowest prevalence of DM is in the Papua regional area

(0.2%). The national prevalence rate of Diabetes Mellitus in Indonesia is at an average of 1.4%. Table 2 shows the highest incidence of diabetes mellitus based on doctor's diagnosis was found in the Java and Bali regions with a percentage of 3.1% while in the Papua region, the incidence of diabetes mellitus was in the lowest position with a percentage of 0.2%.

Table 2. Distribution of Diabetes Mellitus Prevalence Based on Doctor's Diagnosis

Region	Minimum	Maximum	$\underline{X} \pm$ SD
Sumatera	0.9	2.1	1.4 ± 0.3
Jawa and Bali	1.7	3.1	2.2 ± 0.6
Nusa Tenggara	0.7	1.3	1.0 ± 0.4
Kalimantan	1.2	2.3	1.6 ± 0.4
Sulawesi	1.0	2.1	1.5 ± 0.4
Maluku	0.6	0.9	0.8 ± 0.2
Papua	0.2	1.2	0.9 ± 0.4
Indonesia	**0.2**	**3.1**	**1.4 ± 0.6**

This shows that there are several factors that can influence the incidence of diabetes mellitus based on a doctor's diagnosis, namely the factor of access to fast food which is more widely available, the factor of low physical activity, and the wrong lifestyle factor. This difference is what creates the inequality between the Java Bali and Papua regions which have a very significant percentage difference.

DM can occur at any age, whether in children, adults, or the elderly, but is more common in adults over 45 years of age (Veridiana & Nurjana, 2019). DM is one of the non-communicable diseases that tend to increase both globally and nationally and has been threatening since a young age. Morbidity and mortality due to DM tend to increase in almost all countries including Indonesia. DM is known as a silent killer because sufferers are often unaware and when it is discovered after complications occur (Veridiana & Nurjana, 2019).

Table 3 shows that the proportion of DM control types (dietary management) is not related to the incidence of diabetes mellitus (p-value 0.074), and the proportion of DM control types (exercise) (p-value 0.359), but is related to the proportion of DM control types (herbal alternatives) (p-value 0.0001).

Table 3. Relationship between the prevalence of Diabetes Mellitus and the proportion of types of DM control in Indonesia

Diabetes Mellitus Incidence	Proportion of DM Control Types		
	Dietary Management	Exercise	Herbal Alternatives
Beta	-2.331	2.121	-8.538
Costans	88.343	37.662	49.017
Correlation Coefficient (r)	-0.293	0.153	-0.538
p-value	**0.074**	**0.359**	**0.0001**

Based on the beta coefficient value on the proportion of DM control types (dietary management and herbal alternatives) shows that the higher the level of proportion of DM control types, the lower the incidence of diabetes mellitus, while the proportion of DM control types (exercise) shows that the higher the level of proportion of DM control types, the lower the incidence of diabetes mellitus. The high proportion of DM control types (herbal alternatives) is strongly related to the low incidence of diabetes mellitus (r = -0.538).

DM control with Dietary Management

The proportion of dietary management in Table 2 shows the highest percentage found in the Papua region with a figure of 97.4%, which is inversely proportional to Table 1 showing the lowest percentage in the Papua region with a figure of 0.2%. This shows a relationship between dietary regulation and the incidence of diabetes mellitus in the region. However, this is not in line with the results of the analysis that has been carried out as a whole (nationally). Table 3 shows that there is no significant relationship between the prevalence of diabetes mellitus and the proportion of DM control with Dietary Management (p-value 0.07> 0.05). This raises the argument that a doctor's diagnosis is less accurate than direct blood sugar measurements, which makes the results of the analysis very different from reality. In contrast to the research of Faradilla et al., this study emphasizes the importance of

a good diet and balanced physical activity in preventing and managing diabetes mellitus. With the results of this study, a poor diet can increase the risk of DM up to 0.23 times compared to individuals who have a good diet (Faradilla Diwanta, Suci Maghfirah, 2024).

Research conducted by Nurlaili et al on the relationship between the four pillars of type 2 DM control with average blood sugar levels showed that most respondents with appropriate dietary arrangements had an average blood sugar level of <160 mg/dl, which was 50.9%. Most respondents with inappropriate dietary arrangements had an average sugar level of ≥160 mg/dl, which was 22.7%. Based on the statistical test conducted, $\rho = 0.002$ ($\rho < \alpha$) was obtained, which means that this study has a relationship between dietary arrangements obtained with average random blood sugar (Putri & Isfandiari, 2013).

The wrong diet is 9.5 times more at risk of developing type 2 diabetes compared to the right diet. This statement was revealed by a study by Yessica and Dewi in 2021 which examined the relationship between diet and the incidence of diabetes mellitus, with the results of the study showing a significant relationship between Diet and the incidence of Type 2 Diabetes Mellitus at the Namorambe Health Center, Deli Serdang Regency in 2021 (Tarihoran & Silaban, 2022).

Controlling normal blood sugar levels requires good and correct DM diet management with the recommended 3J diet control (Amount, Schedule, and Type) so that blood sugar levels can be controlled. (Susanti & Bistara, 2019). The solution to lowering blood sugar levels is to increase physical activity and change diet. (Faradilla Diwanta, Suci Maghfirah, 2024). The results of the study conducted with 90 respondents showed that there is a relationship between diet and blood glucose levels in type II Diabetes mellitus sufferers (Kurniasari et al., 2021).

DM control with Exercise

Table 2 on the proportion of sports also shows the highest percentage found in the Papua region with a figure of 59.7%, which is inversely proportional to Table 1 showing the lowest percentage in the Papua region with a figure of 0.2%. Table 3 shows that there is no significant relationship between the prevalence of diabetes mellitus and the proportion of DM control with exercise (p-value 0.36> 0.05). This shows many differences with several studies that state that there is a relationship between sports and the incidence of diabetes mellitus. Yora and Silvia's research shows that physical exercise can lower blood glucose levels because physical exercise will increase glucose use by active muscles. One of the physical exercises is leg gymnastics (Nopriani & Silvia Ramadhani Saputri, 2021). This also shows that the doctor's diagnosis is less accurate, because it only diagnoses from clinical symptoms that are similar to symptoms of other diseases, thus increasing the risk of misdiagnosis. The doctor's diagnosis without blood sugar measurement laboratory tests is very inaccurate and different from the reality. And this discrepancy may also be caused by differences in the intensity and type of exercise performed as well as other factors such as a person's genetics.

In a study on the relationship between the four pillars of type 2 DM control with average blood sugar levels conducted by Nurlaili et al., they took blood samples from long-term patients with Diabetes Mellitus who routinely checked their random blood sugar levels for three consecutive months at the Pacarkeling Health Center in Surabaya, totaling 53 respondents with several independent variables, one of which was exercise. This study showed that most respondents who exercised had an average blood sugar level of <160 mg/dl, which was 50.9%. Most respondents who did not exercise had an average sugar level of ≥160 mg/dl, which was 18.8% with a p-value of 0.017. This shows that

there is a relationship between exercise and average random blood sugar levels (Putri & Isfandiari, 2013).

A decrease in average blood sugar levels can occur with a regular walking exercise program. In this study, walking in the elderly has a significant effect on blood sugar levels in type 2 diabetes mellitus (Hasanuddin et al., 2020). The American Diabetes Association states that regular physical activity has a major impact on blood glucose and overall health in patients with type 2 diabetes (Rahmadiya & Dahlia, 2022).

Regular physical activity can control blood sugar levels. Light activity has a greater chance (3.198 times) than moderate activity (1.933 times) of getting DM when compared to people who do heavy activity. Research conducted by Nyoman et al. stated that the more intense the physical activity, the less likely it is to get DM (Veridiana & Nurjana, 2019).

DM Control with Herbal Alternatives

In Table 2, the proportion of DM control types (herbal alternatives) shows the highest percentage found in the Papua region with a figure of 62.0%, which is inversely proportional to Table 1 showing the lowest percentage in the Papua region with a figure of 0.2%. This shows a relationship between dietary regulation and the incidence of diabetes mellitus in the region. In line with this, the results of the analysis have been carried out as a whole (nationally). Table 3 shows that there is a significant relationship between the prevalence of diabetes mellitus and the proportion of DM control with Herbal Alternatives (p-value 0.00 <0.05). Different from the two previous types of DM control, herbal alternatives are strongly negatively related to the incidence of diabetes mellitus in Indonesia. This statement leads to the implementation of DM control with herbal alternatives according to the incidence of diabetes mellitus based on a doctor's diagnosis. The research at the Palimanan Health Center, Cirebon Regency in 2024 is in line with the results of this analysis which states that there is a significant effect between Moringa leaf tea on reducing random blood sugar levels (GDS) in diabetes mellitus patients (Rakhmawati & Futriani, 2024).

Research at Arjawinangun Regional Hospital, Cirebon Regency show the relationship between diabetes control behavior and blood glucose levels of outpatients with diabetes mellitus, showed that there was a relationship between the regularity of drug consumption and the blood glucose levels of respondents (Anani et al., 2012). The behavior of regular consumption of anti-diabetic drugs by respondents is one of the efforts to control blood glucose control or complications that can arise. If DM patients are not compliant in carrying out the treatment program recommended by doctors, nutritionists or other health workers, it can worsen their condition (Anani et al., 2012).

CONCLUSION

This study concludes that the method of obtaining data on the incidence of diabetes mellitus greatly influences the results of the analysis, where in this study the incidence of diabetes mellitus based on a doctor's diagnosis shows that dietary regulation is the most widely applied method of controlling diabetes mellitus (DM) in Indonesia compared to exercise and herbal alternatives. The prevalence of DM was not significantly related to DM control through dietary management and exercise, but DM prevalence was significantly related to DM control through herbal alternatives. Regional differences in the implementation of DM control and the incidence of this disease indicate the need for a more specific approach in its management strategy. These findings emphasize the importance of a balance of control methods and diagnostic accuracy in overcoming DM in Indonesia. For further researchers, it is hoped that they will be better

and try to analyze the relationship between the incidence of diabetes mellitus based on blood sugar measurements and the type of DM control in Indonesia in order to obtain more accurate results.

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CONFLICT OF INTEREST

All authors declared that there was no conflict of interest.

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