

RISK FACTORS FOR DIABETES MELLITUS IN INDONESIA: ANALYSIS OF IFLS DATA 2014

*Alfiana Miranda Nur Afifah¹, Diah Indriani¹, Susy Katikana Sebayang¹, Erni Astutik¹

¹Faculty of Public Health, Universitas Airlangga, 60115 Surabaya, East Java, Indonesia

*Corresponding Author: Alfiana Miranda Nur Afifah ; Email: alfianamirandsanurafifah@gmail.com

Published by Fakultas Kesehatan Masyarakat Universitas Airlangga

ABSTRACT

Keywords:

Diabetes Mellitus,
risk factor,
IFLS 2014,
logistic regression

Diabetes Mellitus (DM) remains a public health problem that needs attention in various countries, including in Indonesia that has the 4th largest DM cases globally. The World Health Organization (WHO) estimates that, by 2030, the number of people with DM will be twice higher than the current number which is 180 million people worldwide. Diabetes mellitus can be prevented and avoided by taking control of the risk factors. The purpose of this study was to assess the risk factors of Diabetes Mellitus in Indonesia. This is a secondary data analysis of the Indonesian Family Life Survey (IFLS) 5 which was a cross sectional survey. To analyze risk factors of DM, Chi-square and logistic regression test were used. The risk factors analyzed included sex, age, marital status, history of hypertension, cholesterol levels, obesity, smoking habit, employment status, habit of consuming fast food, consumption of sweet foods, and consumption soft drinks. Significant risk factors of diabetes mellitus included age (OR = 5.28, 95% CI: 4.37 – 6.37; p value = 0.001), marital status (OR = 1.69, 95% CI: 1.36 – 2.09; p value = 0.001), history of hypertension (OR = 2.67, 95% CI: 2.25 – 3.17; p value = 0.001), cholesterol levels (OR = 4.36, 95% CI: 3.58 – 5.31; p value = 0.001), employment status (OR = 1.52, 95% CI: 1.29 – 1.80; p value = 0.001), and habit of consuming sweet foods (OR = 0.63, 95% CI: 0.48 – 0.83; p value = 0.002).

ABSTRAK

Kata Kunci:

Diabetes Mellitus,
faktor risiko,
IFLS 2014,
regresi logistik

Saat ini Diabetes Mellitus (DM) merupakan masalah kesehatan masyarakat yang butuh diberikan perhatian di berbagai negara termasuk di Indonesia. Penderita DM Indonesia menempati urutan ke-4 di dunia. World Health Organization (WHO) mempublikasikan perkiraan bahwa di tahun 2030, kemungkinan jumlah penderita DM di seluruh dunia akan berlipat ganda dari jumlah saat ini yang mencakup 180 juta jiwa. DM dapat dicegah dengan mengendalikan faktor risikonya, serta dihindari dengan mengendalikan faktor risikonya. Tujuan penelitian ini adalah guna mengidentifikasi faktor risiko DM di Indonesia. Penelitian ini adalah analisis data sekunder Indonesian Family Life Survey (IFLS) 5 yang merupakan hasil survei Cross-Sectional. Penelitian ini menganalisis faktor risiko DM dengan analisis bivariat menggunakan uji chi-square dan analisis multivariat memakai uji regresi logistik. Faktor risiko yang diuji adalah jenis kelamin, usia, status perkawinan, riwayat hipertensi, kadar kolesterol, obesitas, kebiasaan merokok, status kerja, kebiasaan mengkonsumsi fast food, kebiasaan mengkonsumsi makanan manis, dan kebiasaan mengkonsumsi minuman bersoda. Faktor risiko DM yang signifikan adalah adalah usia (OR = 5.28, 95% CI: 4.37 – 6.37; p value = 0.001), status perkawinan (OR = 1.69, 95% CI: 1.36 – 2.09; p-value = 0.001), riwayat hipertensi (OR = 2,67, 95% CI: 2,25 – 3.17; p value = 0.001), kadar kolesterol tinggi (OR = 4.36, 95% CI: 3.58 – 5.31; p value = 0.001), status kerja (OR = 1.52, 95% CI: 1.29 – 1.80; p value = 0.001), dan kebiasaan mengonsumsi makanan manis (OR = 0.63, 95% CI: 0.48 – 0.83; p value = 0.002).

INTRODUCTION

Currently, diabetes mellitus (DM) is a public health problem that needs attention in various countries, especially Indonesia. The World Health Organization (WHO) also estimates that by 2030 the number of people with DM is predicted to double from the current number of sufferers which includes 180 million people and Indonesia is in fourth position in the world (1). Incidents of DM in the world in 2012 were 371 million people (2). Based on the results of basic health research in 2013 there was an increase in the prevalence of DM from 2007 by 1.1% to 2.1% (3). The International Diabetes Federation (IDF) in 2017 stated that Indonesia was ranked 6th with the number of people with DM the most. IDF also predicts that, in 2035, people with DM in the world will increase to 592 million from 415 million in 2015.

The nickname 'The Silent Killer' was attached to DM. The nickname was given because DM can attack all organs of the body and cause various complaints, including strokes, blood vessel disorders, heart disease, cataracts, and others (4). The Indonesian Ministry of Health's Data and Information Center reports that DM can also increase the risk of heart failure (2.7%), stroke and myocardial infarction (5.3%), proteinuria (26.5%), peripheral arterial disease (10.9%), neuropathy (54%), leg ulcer (8.7%), angina (7.4%), amputation (1.3%), retinopathy (33.4%), kidney dialysis (0.5 %), and DM patients in general have a double risk of death compared to non-DM patients (5). As a cause of death, DM was in the sixth position in 2010 based on the WHO Global Status Report on NCD report (6). Around 1.3 million people die from diabetes and 4% of people die before the age of 70. DM also results in increased treatment and financing, which is estimated to be the cost allocated to pay for care with minimum standard of outpatient care in Indonesia, which is 1.5 billion rupiah per year (7).

The incidence of DM in a person can be avoided, delayed, or prevented through controlling the risk factors. Several risk factors for the incidence of DM in a person include age, gender, parental history of diabetes, occupation, obesity, physical activity, nutritional intake behavior, hypertension, smoking habits, and high cholesterol levels.

The risk factors of DM can be divided into two types, namely risk factors that can and cannot be controlled. Race and ethnicity, gender, age, and genetic factors are factors which cannot be controlled. Meanwhile, the risk factors that can be controlled include the pattern and lifestyle of the individual. These include obesity, lack of physical activity, nutritional intake behavior, history of hypertension, smoking habits, and cholesterol levels (8).

According to Riskesdas data in 2018, DM sufferers in Indonesia were 1.8% more female than male at 1.2% (3). A study states that there is a large relationship between DM and a person's gender (9). Other studies suggest that age affects the incidence of DM, Individuals aged 45 years have a nine times greater risk of developing DM when compared with those under 45 years of age (10). According to Riskesdas data in 2018, the largest DM sufferers are in the 55-64 age range and the population with the 45-54 age range is in the third highest order (3). A study describes that marital status has a major influence on the incidence of DM in someone (11).

Other studies have shown that people who have a history of high blood pressure are twice as likely to develop DM when compared with those who have no history of high blood pressure, although this is not statistically significant (10). High cholesterol has a correlation with the incidence of DM. High cholesterol that is suffered by an individual can cause them to be 4.19 times more likely to develop diabetes than people with normal cholesterol levels (4). According to a study, obesity in a person has a large correlation with the occurrence of DM (12). Individuals whose nutritional status is classified as "overweight" are twice as likely to contract DM when compared with those with normal nutritional status (10). Smoking habits are one of the risk factors for various diseases, including another large correlation shown by DM and smoking habits (11).

The results of a study show that there is a positive correlation between fast food consumption and a person's nutritional status (13). Individuals who eat fast food with a high frequency are 2.6 times more likely to develop obesity when compared to those who rarely eat it, where obesity is one of the risk factors for diabetes. Accustomed to consuming sweet foods also had a two-fold greater risk of causing DM when compared to those who

were not accustomed to consuming sweet foods. However, this is not statistically significant (10). Excessive consumption of soft drinks can have a relatively bad effect on health, which can cause weight gain and obesity. Not only that, excessive consumption of soft drinks also triggers the risk of faster cell aging, dry skin, DM, heart attack, cancer and stroke (14).

Research related to the analysis of the determinants of the incidence of DM in Indonesia had previously been conducted using Riskesdas data in 2013, but several risk factors, such as the habit of consuming fast food, consuming sweet foods, and the habit of consuming soft drinks, were not included in the factors analyzed in this study. This research aims to analyze several risk factors that influence the incidence of DM in Indonesia. If the risk factors studied affect the incidence of DM, this study can be useful for paramedics in taking preventive action so that it can be given early and precisely to patients with risk factors, so that the incidence of DM can be reduced. While for the benefits for the community who are the target of promotive and preventive efforts, by recognizing the risk factors for DM, it is hoped that the general public will spend more efforts to prevent DM events in a more focused manner so that the incidence of DM can be minimized.

METHODS

This research is an analytical observational study and is a non-reactive research using secondary data analysis of the 5th Indonesian Family Life Survey (IFLS5) 2014-2015. Longitudinal surveys of households, individuals, communities and large-scale population-based facilities are the definition of the Indonesian Household Life Aspects Survey (SAKERTI) or the Indonesia Family Life Survey (IFLS). The survey was conducted five times from 1993 to 2014. The population in IFLS5 is the same as in IFLS1, i.e. all households in 27 provinces in Indonesia. Only 13 of the 27 provinces in Indonesia were selected for the IFLS survey in 1993. These provinces are South Sulawesi, South Kalimantan, NTB, Bali, East Java, DIY, Central Java, West Java, DKI Jakarta, Lampung, South Sumatra, West Sumatra, and North Sumatra. The collection of household

data by IFLS5 was carried out from September 2014 to June 2015. The Household Survey Questionnaire is a research questionnaire that is used as a guide for conducting interviews with respondents.

The population in this study is all residents spread over 13 selected provinces in Indonesia according to the IFLS5 report contained in the questionnaire book 3B, which is 34,257 respondents. The total sample is 31,074 respondents in this study with IFLS5 inclusion criteria; respondents were 15 years old and had complete study covariate data. The independent variables of this study consisted of a history of hypertension, marital status, gender, age, cholesterol levels, obesity, smoking habits, work status, habits of consuming fast food, habits of consuming sweet foods, and habits of consuming soft drinks. The age variable is the respondent's length of life in years calculated from the time of birth to the last birthday. Age was categorized into 45 years and <45 years. Gender variable was classified into male and female. Marital status was classified into married and not married.

History of hypertension and high cholesterol levels is a history of individuals who have hypertension and have high cholesterol based on the diagnosis of doctors, paramedics, or nurses. Variable history of hypertension was categorized into hypertension and not hypertension. Cholesterol levels were classified into respondents who have high cholesterol and normal cholesterol. Obesity is a condition of individuals who are overweight with a body mass index measurement of 27 kg/m^2 . Obesity variables were categorized into respondents who were obese and not obese. Smoking habits are the habits of respondents related to tobacco consumption, such as smoking or inhaling tobacco in the form of kretek cigarettes, white cigarettes, rolled cigarettes, and cigars within the last one month. Smoking habits variable are classified into non-smoking and smoking. Work status variables are categorized into working and not working.

The habit of consuming fast food, the habit of consuming sweet foods, and the habit of consuming soft drinks are the frequency of respondents consuming fast food/fast food (KFC, burgers, etc.), sweet foods (diamonds, geplak, donuts, wafers, chocolate, etc.), and fizzy drinks (Coca Cola, Sprite, etc.) in the last

seven days. Respondents are said to consume fast food and consume excessive soft drinks if they consumed them three times a week before the survey was conducted. Respondents are said to consume excessively sweet foods if they consumed sweet foods seven times a week before the survey was conducted. The dependent variable in this study is diabetes mellitus (DM). Diabetes mellitus is defined as a history of individuals who have DM from the diagnoses of nurses, paramedics, and doctors.

Data analysis in this study used a variety of bivariate analysis and multivariate analysis with computer software to facilitate data processing and interpretation. Bivariate analysis used *Chi-square*; a variable with a p value <0.05 is said to be significant and can be continued in multivariate analysis. Multivariate analysis was performed by logistic regression test. Determination of sig level variable significance in the multivariate analysis stage was carried out using *backward elimination procedures* by maintaining significant variables at p value <0.05. Before conducting multivariate analysis, a multicollinearity test was conducted to identify whether there was multicollinearity between independent variables with the decision that the VIF (Variance Inflation Factor) value of the nine independent variables showed a number below 10.

RESULT

There are missing data of 0.3% of the total data after being filtered in this study, most of which are on the variables of weight and height. So that as many as 31,074 respondents

met the criteria in this study and had complete variables to analyze, Around 672 (2.2%) respondents had DM and 30,402 (97.8%) respondents did not have DM. This study shows the proportion of respondents is more aged <45 years (70.7%), female (53.3%), with status married (72.6%), have no history of hypertension (88.3%), have normal cholesterol levels (95.9%), are not obese (80.8%), do not have a smoking habit (64.2%), working (66.9%), consuming fast food in moderation (98%), consuming sweet foods in moderation (85%), and consuming soft drinks in moderation (95.5%) (Table 1).

The majority of DM patients occurred in individuals aged 45 years (76%), male (53.9%), married (83.8%), had no history of hypertension (56.8%), had high cholesterol levels normal (73.1%), not obese (70.8%), no smoking habit (64%), work (59.2%), consume fast food in moderation (98.4%), consuming sweet foods in moderation (91.4%), and consuming soft drinks in moderation (98.1%) (Table 1). Bivariate analysis showed that age, marital status, history of hypertension, high cholesterol levels, obesity, work status, habit of consuming sweet foods, and habit of consuming fizzy drinks were all associated with the incidence of DM significantly (p value <0.05). After conducting a multivariate analysis with a candidate selection approach, it obtained eight independent variables (age, marital status, history of hypertension, high cholesterol levels, obesity, work status, habit of consuming sweet foods, and habit of consuming fizzy drinks) which could be included in the multivariate analysis because they are large; p value <0.05 (Table 2).

Table 1. Risk Factors for Diabetes Mellitus in Indonesian Society Using IFLS5 Data 2014 – 2015

Variable	Diabetes mellitus						p value
	Yes		Not		Total		
	n	%	n	%	n	%	
Age							
45 years old	511	5.6	8,603	94.4	9,114	29.3	0.001*
<45 years old	161	0.7	21,799	99.3	21,960	70.7	
Gender							
Woman	310	2.1	14,203	97.9	16,561	53.3	0.79
Man	362	2.2	16,199	97.8	14,513	46.7	
Status							
Marry	563	2.5	21,983	97.5	22,546	72.6	0.001*
Not married	109	1.3	8,419	98.7	8,528	27.4	

Variable	Diabetes mellitus						p value
	Yes		Not		Total		
	n	%	n	%	n	%	
History of Hypertension							
Yes	290	8	3,351	92	3,641	11.7	0.001*
Not	382	1.4	27,051	98.6	27,433	88.3	
High cholesterol							
Yes	181	14.2	1,092	85.8	1,273	4.1	0.001*
Not	491	1.7	29,310	98.4	29,801	95.9	
Obesity							
Yes	196	3.3	5,770	96.7	5,966	19.2	0.001*
Not	476	1.9	24,632	98.1	25,108	80.8	
Smoking habit							
Yes	242	2.2	10,875	97.8	11,117	35.8	0.93
Not	430	2.2	19,527	97.8	19,957	64.2	
Employment status							
Not	274	2.7	9,999	97.3	10,273	33.1	0.001*
Yes	398	1.9	20,403	98.1	20,801	66.9	
Fast food consumption							
Excessive	11	1.8	609	98.2	620	2	0.60
No Excess	661	2.2	29,793	97.8	30,454	98	
Sweet food habits							
Excessive	58	1.2	4,608	98.8	4,666	15	0.001*
No Excess	614	2.3	25,794	97.7	26,408	85	
Consumption of fizzy drinks							
Excessive	13	0.9	1,373	99.1	1,386	4.5	0.002*
No Excess	659	2.2	29,029	97.8	29,688	95.5	

The results of the logistic regression analysis in Table 2 show that age, marital status, history of hypertension, high cholesterol levels, work status, and habit of consuming sweet foods have influence on the incidence of DM significantly (p value < 0.05). Individuals aged 45 years are likely to be affected by DM 5.3 times greater than individuals aged < 45 years (OR = 5.28, 95% CI: 4.37-6.37; p value = 0.001). Married individuals are more likely to be affected by DM 1.7 times greater than that of unmarried individuals (OR = 1.69, 95% CI: 1.36-2.09; p value = 0.001). Individuals with a history of hypertension are likely to be affected by DM 2.7 times higher when compared with individuals without a history of hypertension (OR = 2.67, 95% CI: 2.25-3.17; p value = 0.001). Individuals who have high cholesterol

levels are likely to be affected by DM 4.4 times greater than individuals with normal cholesterol levels (OR = 4.36, 95% CI: 3.58-5.31; p value = 0.001). Individuals who do not work are likely to be affected by DM 1.5 times greater than working individuals (OR = 1.52, 95% CI: 1.29-1.80; p value = 0.001). The habit of consuming sweet foods in individuals (OR = 0.63, 95% CI: 0.48-0.83; p value = 0.002) has a negative relationship to the incidence of DM.

Based on Table 2, it can be seen that the OR value for the age variable is 5.28. These results show that the age variable has the greatest effect compared to other variables. No multicollinearity was found between variables and the six variables significantly affect DM and can have a real effect on the model.

Table 2. Risk Factors for Diabetes Mellitus in Indonesian Society Using IFLS5 Data 2014 – 2015

	Variable	OR	CI	p value
Age	45 years	5.28	4.37 – 6.37	0.001*
	< 45 years (ref)			
Status	Marry	1.69	1.36 – 2.09	0.001*
	Not Married (ref)			
History of hypertension	Yes	2.67	2.25 – 3.17	0.001*
	No (ref)			
High cholesterol	Yes	4.36	3.58 – 5.31	0.001*
	No (ref)			
Employment status	Yes	1.52	1.29 – 1.80	0.001*
	No (ref)			
Sweet food habits	Excessive	0.63	0.48 – 0.83	0.001*
	No Excess(ref)			

DISCUSSION

The proportion of patients with DM in this study amounted to 714 people (2.2%); when compared with the 2018 Riskesdas report (2%), the proportion is slightly higher (3). This study found that the risk factors for DM are age, marital status, history of hypertension, high cholesterol levels, work status, and sweet consumption habits.

The results of both bivariate and multivariate analysis showed that there was a large correlation between DM and age. The relationship is positive and indicates that individuals aged >45 are exposed to DM more than individuals aged <45 years. The results of Riskesdas in 2018 also support this. The results of the report stated that people who suffered DM the most are aged 65-74 years and 55-64 years. The World Health Organization also states that after an individual is in their 40s, their blood glucose levels gradually increase by one to two milligrams per year when fasting. In addition, blood glucose levels will also increase by 5.6 to 13 milligrams percent two hours after eating. That way, the incidence of DM will increase according to the age of the individual (15).

The results of the research carried out did not differ from previous studies, which stated that there was a significant relationship between age and the occurrence of DM (4). Likewise other research which states that the age group of 45 years and over is a group that has a risk of contracting DM (9). The age factor can affect the decline in all body system functions so that, as a person ages, it will cause

a condition of insulin resistance which results in unstable blood sugar levels, triggering the occurrence of insulin resistant DM (7). A study showed that people aged >45 years are at risk of nine times the incidence of DM compared to the age group <45 years (10).

Marital status is related to a person's health status. Marriage protection theory states that, by getting married, a person can earn additional income that helps fund their healthcare costs (11). However, in another study, it was stated that economic changes can lead to changes in individual lifestyles, including eating patterns that tend to keep the concept of balanced food away and choosing fast food, so that it has a negative impact on health (16). This study obtained the results that marital status has a positive relationship to the occurrence of DM. This means that individuals who have married status are at risk of developing DM greater than people who have unmarried status. The following research is also supported by research which states that there is a correlation between marital status and development of DM (11). However, it is different from other studies which state that there is no relationship between marital status and the incidence of DM in someone (17). Support from partners provides motivation and facilities in implementing a healthy lifestyle and can exchange opinions and information regarding the occurrence of DM (18).

Hypertension is an important risk factor in the incidence of DM. Hypertension and diabetes, which are health problems that are closely related to both, need to be given more attention and treatment (19). This study

found a large and positive correlation between the occurrence of DM and a history of high blood pressure. Individuals with a history of high blood pressure are more likely to develop DM when compared to those without a history of high blood pressure. The distribution of sugar in cells is not optimal until cholesterol and sugar accumulation in the blood occurs. All of that is caused by high blood pressure. When compared with individuals with normal blood pressure, blood pressure exceeding 120/90 mmHg has two times the risk of developing DM (7).

This study contradicts the results of studies which state that high blood pressure does not have a significant correlation with the occurrence of DM (10,20). A study states that there is a significant correlation between the occurrence of DM and blood pressure (21). Research shows that individuals who have high blood pressure also have a 1.9 times more risk of contracting DM compared to people without a history of hypertension. Hypertension affects the incidence of DM. This is because there are thickened arteries and causes the diameter of the blood vessels to narrow, so the process of transporting glucose in the blood is disrupted (4).

The results of this study found a positive correlation between the occurrence of DM with high cholesterol levels, where individuals who have high cholesterol levels are more likely to suffer from DM. The results of this study are supported by a study which states that the occurrence of lipoxysity is caused by an increase in fatty acids due to high cholesterol levels (4). If this happens, it can also result in damage to the beta cells of the pancreas that causes DM to occur. As for a study that supports this study, individuals with severe dyslipidemia have a greater chance of developing DM when compared with those who have normal cholesterol level (11).

Based on the analysis between the occurrence of DM and obesity, the prevalence of DM with people who are not obese is higher than those who are obese. Together with other variables, BMI or Body Mass Index has a significant correlation with DM with p value = 0.001 in bivariate analysis. The influence of obesity with the incidence of DM can be caused by a combination of unhealthy behavior, namely unhealthy eating patterns and lack of activity (9). However, in a multivariate analysis, obesity did not affect the incidence of

DM. A study showed that people who are obese also have a 7.14 times higher risk of developing DM due to reduced physical activity and high consumption of carbohydrates, fats, and proteins as risk factors for obesity (4).

The results showed that there was a significant correlation between work status and the incidence of DM. Individuals who do not work are more likely to be infected by DM than working. This may be because the level of physical activity can be influenced by a person's job (4). According to a study, the type of work variable is correlated with sports activities and a person's physical activity (7). Physical activity has an effect on increasing insulin. This causes a decrease in blood sugar levels. If insulin is not sufficient to carry out the transformation of glucose into energy, then diabetes is likely to occur.

This study is also supported by stating that individuals who do not have jobs have a 1.5 times greater risk of contracting DM when compared to people who have jobs (16). The results of this study are contrary to various studies which state that there is no large correlation between employment status and the incidence of DM (17). Other research also stated that the analysis between the occurrence of DM and work status was not large because in the percentage between those who did not work and those who worked there was no balance (9). Most of the respondents were the group that does not have a job and have a female gender.

The results of this study show that there is a negative correlation between the occurrence of DM and the habit of consuming sweet foods. Individuals who consume sweet foods are less likely to suffer from diabetes. The same results were reported by stating that there was a negative relationship related to the habit of consuming sweet foods with the incidence of DM (22). This may be because respondents who have DM have changed their diet to low sugar consumption in the last seven days. Therefore, the results of the analysis of these variables need to be interpreted with caution.

The following study shows different results from other studies which state that those who are accustomed to consuming sweet drinks and foods have twice the risk of contracting DM when compared to those who are not accustomed to consuming sweet drinks

or foods, although this is not statistically significant (10). Individuals who are accustomed to consuming sweet foods are correlated with a person's healthy lifestyle, where a person's diet has a relationship with the incidence of DM, because a healthy diet is one of the crucial elements when balancing body levels in a stable condition and does not have the risk of triggering DM (7).

The results of this study contribute in the form of basic information to develop knowledge about risk factors for DM events in Indonesia, both controllable and uncontrollable. Multivariate analysis showed that the controllable risk factors were the individual's pattern and lifestyle including a history of hypertension, cholesterol levels, and a person's habit of consuming sweet foods. Healthy and clean lifestyle is one of the efforts to reduce the risk of incidence of DM in someone, one of which is setting a balanced diet and doing enough physical activity. Early detection activities and regular check-ups are also important to check for possible early detection of DM. Health policy planning also needs to be carried out in order to understand the socioeconomic impact of DM and the provision of adequate facilities for primary prevention is important.

CONCLUSIONS AND SUGGESTIONS

Conclusion

Incidence prevalence of DM in Indonesia tends to increase every year. Based on IFLS5 data, 2.2% of Indonesian people have diabetes. The conclusions obtained from this study are that the variables that have a significant effect on the incidence of DM are age, marital status, history of hypertension, high cholesterol levels, work status, and the habit of consuming sweet foods. Individuals aged >45 years, have a history of hypertension, and have high cholesterol levels have a higher chance of developing DM.

Suggestion

The results of this study can identify several risk factors for DM, and three of them, namely a history of hypertension, high cholesterol levels, and the habit of consuming sweet foods, are risk factors that can be controlled. The researcher hopes that the

Indonesian people can prevent it by implementing a healthy and clean lifestyle and doing regular check-ups so that DM can be minimized and avoided. Health services are also expected to put more emphasis on promotive and preventive activities against DM both through individual and community education activities. Education and counseling can be provided related to programs to stop smoking habits, physical exercise, healthy diet, and weight loss. Individuals who have a history of hypertension or high cholesterol levels can make behavioral changes and lifestyle modifications that focus on the use of saturated fat and reducing cholesterol intake, losing weight, and increasing physical activity. Suggestions for further researchers are to continue this research by assessing the other risk factors of DM, such as physical activity, education level, fruit/vegetable consumption behavior, and so on using the same or different data sources. It is recommended for the RAND Corporation and survey meters to add to the completeness of the research data. That way, the quality of research results using IFLS data sources can increase.

ACKNOWLEDGMENT

The author is grateful to surveyMeters, which makes it easy to collect the data needed for research. Thanks are also due to the Faculty of Public Health, Airlangga University, which has given permission and assignments to the authors to conduct research and write this journal.

REFERENCES

1. Ramadany AF, Pujarini LA, Candrasari A. Hubungan Diabetes Melitus dengan Kejadian Stroke Iskemik di RSUD Dr. Moewardi Surakarta Tahun 2010. *Biomedika* [Internet]. 2013;5(2):11–16. Available from: <https://doi.org/10.23917/biomedika.v5i2.264>
2. Fatimah RN. Diabetes Melitus Tipe 2. *J Major* [Internet]. 2015;4(5):93–101. Available from: <https://juka.kedokteran.unila.ac.id/index.php/majority/article/view/615>

3. Indonesian Ministry of Health. Hari Diabetes Sedunia Tahun 2018 [Internet]. RI KK, editor. Pusat Data dan Informasi Kementerian Kesehatan RI. Jakarta Selatan; 2019. p. 1–10. Available from: <https://pusdatin.kemkes.go.id/download.php?file=download/pusdatin/infodatin/infodatin-Diabetes-2018.pdf>
4. Trisnawati SK, Setyorogo S. Faktor Risiko Kejadian Diabetes Melitus Tipe II di Puskesmas Kecamatan Cengkareng Jakarta Barat Tahun 2012. *J Ilm Kesehat* [Internet]. 2013;5(1):6–11. Available from: <https://fmipa.umri.ac.id/wp-content/uploads/2016/06/YUNI-INDRI-FAKTOR-RESIKO-DM.pdf>
5. Indonesian Ministry of Health. Keputusan Menteri Kesehatan Republik Indonesia Nomor HK.01.07/MENKES/603/2020 Tentang Pedoman Nasional Pelayanan Kedokteran Tata Laksana Diabetes Melitus Tipe 2 Dewasa [Internet]. Kementerian Kesehatan RI 2020 p. 1–183. Available from: https://yankes.kemkes.go.id/view_unduh/14/kmk-no-hk0107menkes6032020
6. Indonesian Ministry of Health. Diabetes Melitus Penyebab Kematian Nomor 6 di Dunia: Kemenkes Tawarkan Solusi CERDIK Melalui Posbind [Internet]. Kementerian Kesehatan RI. 2013. p. 1. Available from: <https://www.kemkes.go.id/article/view/2383/diabetes-melitus-penyebab-kematian-nomor-6-di-dunia-kemenkes-tawarkan-solusi-cerdik-melalui-posbindu.html>
7. Isnaini N, Ratnasari R. Faktor Risiko Mempengaruhi Kejadian Diabetes Mellitus Tipe Dua. *J Kebidanan dan Keperawatan Aisyiyah* [Internet]. 2018;14(1):59–68. Available from: <https://doi.org/10.31101/jkk.550>
8. Indonesian Ministry of Health. Infodatin-Diabetes [Internet]. Pusat Data dan Informasi Kementerian Kesehatan RI: Situasi dan Analisis Diabetes. Jakarta Selatan; 2014. Available from: <https://pusdatin.kemkes.go.id/download.php?file=download/pusdatin/infodatin/infodatin-diabetes.pdf>
9. Prasetyani D, Sodikin. Analisis Faktor yang Mempengaruhi Kejadian Diabetes Melitus (DM) Tipe 2. *J Kesehat Al-Irsyad* [Internet]. 2017;10(2):1–9. Available from: <http://jka.stikesalirsyadclp.ac.id/index.php/jka/article/view/76>
10. Wicaksono RP. Faktor-Faktor yang Berhubungan dengan Kejadian Diabetes Melitus Tipe 2 (Studi Kasus di Poliklinik Penyakit dalam Rumah Sakit Dr. Kariadi) [Internet]. 2011. Available from: <http://eprints.undip.ac.id/37123/>
11. Idris H, Hasyim H, Utama F. Analysis of Diabetes Mellitus Determinants in Indonesia: A Study from the Indonesian Basic Health Research 2013. *Acta Med Indones* [Internet]. 2017;49(4):291–8. Available from: <https://pubmed.ncbi.nlm.nih.gov/29348378/>
12. Pitrida G. Faktor Resiko Kejadian Diabetes Melitus terhadap Pasien yang Datang Berobat ke Klinik Asri Wound Medan Tembung Tahun 2019. *Koleks KTI D3 Keperawatan* [Internet]. 2020;1–12. Available from: <http://repo.poltekkes-medan.ac.id/jspui/handle/123456789/2126>
13. Sitorus CE, Mayulu N, Wantania J. Hubungan Konsumsi Fast Food, Makanan/Minuman Manis dan Aktifitas Fisik dengan Kadar Gula Darah dan Status Gizi Mahasiswa Fakultas Kedokteran Universitas Sam Ratulangi. *Indones J Public Heal Community Med* [Internet]. 2020;1(4):10–17. Available from: <https://ejournal.unsrat.ac.id/index.php/ijphcm/article/view/31025>
14. Mutaqin ZZ. Dinamika Aspek Kesehatan dan Ekonomi dalam Kebijakan Pengendalian Minuman Berkarbonasi di Indonesia. *Qual J Kesehat* [Internet]. 2018;12(1):26–37. Available from: <http://ejournal.poltekkesjakarta1.ac.id/index.php/adm/article/view/27>
15. Fanani A. Hubungan Faktor Risiko dengan Kejadian Diabetes Mellitus. *J Keperawatan* [Internet]. 2020;12(3):371–378. Available from: <http://download.garuda.kemdikbud.go.id/>

16. Mongisidi G. Hubungan Antara Status Sosio-Ekonomi dengan Kejadian Diabetes Melitus Tipe 2 di Poliklinik Interna Blu RSUP Prof. Dr. R. D. Kandou Manado. *J Kesehat Masy* [Internet]. 2015;2(1):1–8. Available from: <http://fkm.unsrat.ac.id/wp-content/uploads/2015/02/Jurnal-Gabby-Mongisidi.pdf>
17. Manik CM, Ronoatmodjo S. Hubungan Diabetes Melitus dengan Hipertensi pada Populasi Obesitas di Indonesia (Analisis Data IFLS-5 Tahun 2014). *Epidemiol Kesehat Indones* [Internet]. 2019;3(1):19–24. Available from: <https://journal.fkm.ui.ac.id/epid/article/view/3164>
18. Retnowati N, Satyabakti P. The Correlation between Family Support with the Quality of Life of Patients with Diabetes Mellitus. *J Berk Epidemiol* [Internet]. 2015;3(1):57–68. Available from: <http://dx.doi.org/10.20473/jbe.V3I12015.57-68>
19. Nainggolan O, Kristanto A, Edison H. Determinan Diabetes Melitus Analisis Baseline Data Studi Kohort Penyakit Tidak Menular Bogor 2011. *Bul Penelit Sist Kesehat* [Internet]. 2013;16(3):331–339. Available from: <http://ejournal.litbang.kemkes.go.id/index.php/hsr/article/view/3471>
20. Widodo D, Retnaningtyas E, Fajar I. Faktor Risiko Timbulnya Diabetes Mellitus pada Remaja SMU. *J Ners* [Internet]. 2012;7(1):37–46. Available from: <https://ejournal.unair.ac.id/JNERS/article/viewFile/3997/2711>
21. Sirait AM, Sulistiowati E, Sihombing M, Kusuma A, Idayani S. Incident and Risk Factor of Diabetes Mellitus in Adults at Bogor. Prospective Cohort Study Risk Factors Non Communicable Diseases. *Bul Penelit Sist Kesehat* [Internet]. 2015;18(2):151–160. Available from: <https://doi.org/10.22435/hsr.v18i2.4315.151-160>
22. Nur A, Fitria E, Zulhaida A, Hanum S. Hubungan Pola Konsumsi dengan Diabetes Melitus Tipe 2 pada Pasien Rawat Jalan di RSUD Dr. Fauziah Bireuen Provinsi Aceh. *Media Penelit dan Pengemb Kesehat* [Internet]. 2016;26(3):145–150. Available from: <https://doi.org/10.22435/mpk.v26i3.4607.145-150>