JURNAL BIOMETRIKA DAN KEPENDUDUKAN
(Journal of Biometrics and Population)

RISK FACTORS FOR DIABETES MELLITUS IN MEN OF PRODUCTIVE AGE IN INDIA (NATIONAL FAMILY HEALTH SURVEY2015-2016)

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ABSTRACT

Keywords:
Diabetes Mellitus,
Risk factors,
Men,
India

Diabetes Mellitus (DM) is a serious health problem that continues to increase and can cause morbidity and mortality in many countries. India as a country with the second highest number of DM cases in the world after China has around 77 million cases in adults aged 20-79 years and is estimated to increase by 134 million in 2045. The cause of the incidence of DM in adults is multifactorial. The purpose of this study was to determine and analyze the risk factors associated with the incidence of DM in adults aged 15-49 years in India. This quantitative study uses a cross-sectional approach. This research data source was secondary data from the 2015-2016 National Family Health Survey (NHFS-4). The study sample size was a male adult population aged 15-49 years in 157 rural and urban areas in India. The independent variables studied were age, meat consumption, alcohol consumption, fried food consumption, smoking, economic status, education level, place of residence, and employment status, while the dependent variable is the incidence of DM. The results from the chi-square show that there were relationships between age, meat consumption, alcohol consumption, fried food consumption, smoking, economic status, education level, place of residence, and the incidence of DM in adult men aged 15-49 years in India. The results of the logistic regression test showed that age, smoking habits, and economic status had a significant effect. Meanwhile, the most influential factor was the higher economic status with an OR of 0.628 times higher having type 2 diabetes.

ABSTRAK

Kata kunci:
Diabetes Mellitus,
Faktor Risiko,
Pria,
India

Diabetes Mellitus (DM) merupakan masalah kesehatan serius yang terus meningkat dan dapat menyebabkan morbiditas dan mortalitas pada populasi masyarakat di banyak negara. India sebagai negara dengan jumlah kasus DM tertinggi kedua di dunia setelah Cina memiliki sekitar 77 juta kasus pada orang dewasa usia 20-79 tahun dan diperkirakan meningkat sebesar 134 juta pada tahun 2045. Penyebab terjadinya kejadian DM pada orang dewasa adalah multifaktorial. Tujuan penelitian ini untuk mengetahui faktor risiko yang berhubungan dengan kejadian DM pada pria usia 15-49 tahun di India dengan menggunakan pendekatan cross-sectional. Sumber data yaitu data sekunder National Family Health Survey 2015-2016 (NHFS-4). Besar sampel penelitian adalah populasi pria usia 15-49 tahun di 157 wilayah pedesaan dan perkotaan di India. Variabel bebas yang diteliti adalah umur, konsumsi daging, konsumsi alkohol, konsumsi fried food, kebiasaan merokok, status ekonomi, tingkat pendidikan, tempat tinggal, status pekerjaan. Sedangkan variabel terikatnya adalah kejadian DM tipe 2. Hasil uji chi-square menunjukkan terdapat hubungan antara umur, konsumsi daging, konsumsi alkohol, konsumsi fried food, merokok, status ekonomi, tingkat pendidikan, tempat tinggal dengan kejadian DM pada pria usia 15-49 tahun di India (p<0.05). Hasil uji regresi logistik menunjukkan faktor yang berpengaruh signifikan adalah umur, kebiasaan merokok, dan status ekonomi (p<0.05).Sedangkan, faktor risiko yang paling berpengaruh adalah status ekonomi kaya dengan OR sebesar 0.628 kali lebih tinggi mengalami DM tipe 2.

INTRODUCTION

Diabetes mellitus (DM) is a metabolic disorder problem that occurs in many countries in the world. DM is known to be divided into several types, namely type 1 DM, type 2 DM, gestational diabetes, and other types of DM. The cause of DM is insulin resistance, in which there is a decrease in the insulin secretory function, little or not at all, by pancreatic beta cells (1).

According to global study data in 2015, around 415 million people suffered from DM 2015 and this number is expected to increase to 642 million in 2040 (2). Based on the International Diabetes Federation there are around 231.9 million adults aged> 20 years suffering from type 2 DM and are not aware of this condition (2).

Diabetes mellitus is often known as the silent killer because it can affect the function of every organ in the body and cause other diseases such as cataracts, heart disease, kidney disease, impotence, non-healing wounds, lung infections, blood vessel infections, strokes, and so on (3).

India is a developing country that has the second-highest number of DM cases in the world after China. There are around 77 million cases of DM in adults aged 20-79 years and it is estimated to increase by 134 million in 2045 (2). The increasing incidence and prevalence of DM show evidence of rapid cultural and social changes, including an aging population, increased urbanization, changes in diet, reduced physical activity, and unhealthy lifestyles (4).

Research evidence shows that the prevalence of type 2 DM is more prevalent in urban areas of southern India and ranges from 5-17% (5). The National Survey shows that the incidence of DM in the metropolitan area of India is around 11.7% in Kolkata, 6.1% in Kashmir Valley (North India), 11.6% in New Delhi (North India), and 9.3% in western India, it is lower than in southern Indian cities such as Chennai (13.5%), Hyderabad (16.6%), and Bangalore (16.6%) (6).

DM risk factors are divided into two categories, namely factors that can be changed and factors that cannot be changed. Examples of factors that can be changed are diet, alcohol consumption, smoking, physical activity, occupation, education level, body mass index (BMI), and waist circumference. Meanwhile, factors that cannot be changed are age, gender, and genetic factors (7,8).

Research shows that the causes of diabetes mellitus modifiable risk factors, such as a diet high in saturated fat, a low fiber diet, and low physical activity, which are influenced by lifestyle changes that are also closely related to socioeconomic status factors (9–11). The results of other studies also state that the incidence of type 2 DM

has a positive relationship with the welfare index, age, obesity, and family history of diabetes (12).

Type 2 DM is a disease that can occur at all ages, from children to adults aged >30 years. The prevalence of DM will continue to increase with age until old age. Based on research evidence, age has a significant relationship with type 2 DM. This is due to the aging process which causes impaired insulin secretion and apoptosis of pancreatic beta cells (13).

Research conducted in Kathmandu, Nepal, also stated that the prevalence of DM was found to be higher in men (27.1%) than in women (24.8%) (14). This is in line with other studies which state that the prevalence of diabetes affects more men than women and increases with age (15).

In Indonesia, DM is a serious health problem. The 2018 Riskesdas data regarding the prevalence of DM show that Indonesia is ranked fourth highest in the world after India, China, and the United States. According to WHO, the increasing number of type 2 DM patients in Indonesia will continue to increase significantly to 21.3 million people in 2030 (16).

Based on data from the Ministry of Health, DM disease which causes death tends to occur more in developing countries than in developed countries (16). India and Indonesia are developing countries in Asia that are experiencing increasing problems of non-communicable diseases such as type 2 DM. The similarities between these two countries are that t hey both face almost the same challenges of health problems at almost the same level of economic development (17).

Based on the description above, it is known that the prevalence of type 2 DM in developing countries, especially India and Indonesia, is very high and adults are one of the risk groups for developing type 2 DM. This study aims to determine the risk factors that cause DM disease in men aged 15-49 years in India using secondary data from *the National Family Health Survey* (NHFS-4) 2015-2016, so that people in developing countries, especially India and Indonesia, can find out the causal factors associated with DM disease and can improve people's quality of life by preventing type 2 DM disease.

METHODS

This research is a quantitative analytic research using the cross-sectional method. The data used are secondary data from *National Family Health Survey* (NHFS-4) 2015-2016. This research was conducted in 157 rural and urban areas in India with a prevalence of the population living in urban areas such as Chennai, Delhi, Hyderabad, Kolkata, Meerut, Mumbai, and Nagpur around 30-70%.

This study used a sample size of the entire male population of 112,122 people aged 15-49 years in India. Data processing was carried out using the select cases tool in the SPSS application on a computer, where missing respondent data were deleted and only complete data were analyzed. After doing data cleaning, it was found that there were 35,282 research subjects.

The dependent variable in this study was the incidence of type 2 DM. The independent variables are alcohol consumption, meat consumption, fried food consumption, cigarette consumption, employment status, economic status, education level, area of residence, and age. Men's age was divided into three categories, namely 15-24 years, 25-49 years, and >50 years. The level of education was divided into four groups, starting from not attending school, elementary, junior high, and high school. Work is divided into two categories, namely working and not working. Residences are divided into two categories, namely urban and rural areas. Economic status is divided into five groups, namely very poor, poor, medium, rich, and very rich. Cigarette consumption is divided into two categories, namely smoking and not smoking. The frequency of meat and fried food consumption was divided into four groups: never, every day, every week, and sometimes. Alcohol consumption was divided into three groups, namely every day, once a week, and < once a week.

Bivariate and multivariate data analysis was performed using the SPSS 16.0 program. Bivariate analysis was used to see the relationship between one independent variable and one dependent variable using the Chi-square test. Meanwhile, multivariate analysis using multiple logistic regression tests was carried out to see the independent factors that had the greatest influence on the dependent variable. The level of confidence used in both statistical analyses was 95% (α= 5%).

RESULT

Based on NHFS-4 data, there were 35,282 respondents to be analyzed. Table 1 shows the distribution of the frequency of DM disease. The results showed that fewer male respondents had diabetes, namely 34484 people (97.7%), compared to 798 people who had DM (2.3%).

Table 1. Frequency Distribution of Diabetes Mellitus

Diabetes Mellitus (DM)	n	Percentage (%)
Yes	798	2.3
No	34482	97.7

Bivariate Analysis

Table 2 shows that the percentage of men suffering from DM was found to be more at the age of >50 years, as many as 798 people (6.3%). Research respondents who suffer from DM are known to have the most eating patterns of meat consumption every week as many as 395 people (2.5%), consumption of fried food occasionally as many as 347 people (2.3%), consumption of alcohol 1x/week 350 people (1.9%), and 347 people (2.1%) had smoking habits. The research respondents who suffered from DM were known to have had jobs as many as 706 people (2.3%), junior high school education level as many as 438 people (2.3%), lived in rural areas as many as 479 people (1.9%) and had very rich socioeconomic status as many as 250 people (4.2%).

The results of the Chi-square test showed that there was a significant relationship between age (p = 0.000), frequency of meat consumption (p = 0.000), alcohol consumption (p = 0.000), fried food consumption (p = 0.002), smoking (p = 0.005), an education level (p=0.000), area of residence (p=0.000), economic status (p=0.000) with the incidence of DM in men aged ages 15-49 years. Meanwhile, employment status (p = 0.058) did not have a significant relationship with the incidence of type 2 DM.

Table 2. Chi-Square Test Results for DM Risk Factors in Men Aged 15-49 Years

Variable	Diabetes		Not Diabetic		Amount		p values
	n	%	n	%	n	%	
Age							
15-24 years	33	0.5	6334	99.5	6367	100	0.000
25-49 years	572	2.2	25290	97.8	25862	100	
>50 years	798	6.3	2860	93.7	3053	100	
Consumption of Meat							
Never	81	2.3	3459	97.7	3540	100	0.000
Every day	26	4.0	628	96	654	100	
Every week	392	2.5	15210	97.5	15602	100	
Sometimes	299	1.9	15187	98.1	15486	100	
Alcohol consumption							
Every day	143	2.9	4738	97.1	4881	100	0.000
1x/Sunday	350	2.4	14285	97.6	14635	100	
> 1x/week	305	1.9	15461	98.1	15766	100	
Consumption of Fried Food							
Never	81	3.3	2339	96.7	2420	100	0.002
Every day	93	2.0	4631	98	4724	100	
Every week	277	2.2	12232	97.8	12509	100	
Sometimes	347	.3	15282	97.8	15629	100	
Smoke							
Yes	524	2.1	24242	97.9	10516	100	0.005
No	274	2.6	10242	97.4	24766	100	
Job-status							
Yes	706	2.3	29702	97.7	30408	100	0.058
No	92	1.9	4782	98.1	4872	100	
Education							
Ungraduated	97	1.6	6091	98.4	6188	100	0.000
Elementary School	125	2.2	5539	97.8	5664	100	
Midle School	438	2.3	18518	96.9	18956	100	
High School	138	3.1	4336	97.7	4474	100	
Residence							
Rural	479	1.9	24180	98.1	24659	100	0.000
Urban	319	3.0	10304	97.0	10623	100	
Economic Status							
Extremely poor	81	1.1	7229	98.9	7310	100	0.000
Poor	113	1.5	7538	98.5	7651	100	
Intermediate	154	2.0	7387	98.0	7541	100	
Rich	200	2.9	6647	97.1	6847	100	
Very Rich	250	4.2	5683	95.8	5933	100	

Multivariate Analysis

Multivariate analysis in this study used multiple logistic regression with the Backward Wald method. In the final model of the logistic regression test, the variables of residence and working status were excluded so that the results of the analysis showed that the risk factors for DM incidents that had a significant effect were age, smoking habits, and economic status ($p<0.05$). Meanwhile, the risk factor for the occurrence of DM that has the most influence is the economic status of the rich level with a 0.682 higher risk chance of experiencing DM. The results of the logistic regression test for risk factors for DM in men of reproductive age are presented in Table 3.

Table 3. DM Risk Factors in Men of Productive Age

Variable	Betas	p values	OR (Odds Ratio)	95% CI
Age				
25-49 years	-2.516	0.000	0.081	0.055-0.118
>50 years	-1.090	0.000	0.336	0.283-0.400
Consumption of Meat				
Every day	0.353	0.006	1.424	1.107-1.828
Every week	-0.281	0.022	0.755	0.594-0.959
Sometimes	-0.128	0.128	0.880	0.747-1.037
Alcohol consumption				
Every day	0.273	0.011	1.313	1.066-1618
1x/Sunday	0.130	0.112	1.138	0.971-1.334
Consumption of Fried Food				
Every day	-0.079	0.546	0.924	0.716-1.193
Every week	0.647	0.003	1,910	1.252-2.913
Sometimes	0.212	0.008	1,236	1.056-1.448
Smoke				
Yes	-0.181	0.002	0.835	0.717-0.972
Education				
Elementary School	-0.366	0.017	0.693	0.513-0.937
Midle School	-0.032	0.817	0.968	0.738-1.272
High School	-0.051	0.627	0.950	0.774-1.167
Economic Status				
Extremely poor	-1.196	0.000	0.302	0.227-0.402
Poor	-0.974	0.000	0.378	0.296-0.482
Intermediate	-0.696	0.000	0.499	0.401-0.620
Rich *	-0.383	0.000	0.682	0.560-0.831

(* significant effect $p < 0.05$)

DISCUSSION

The increasing prevalence of DM in India is caused by social and cultural changes such as increased urbanization, the introduction of Western lifestyles that affect the consumption of junk food, and also the development of transportation (6).

The high prevalence of DM in India is also supported by the fact that there has been a cultural shift in consumption patterns which initially consumed a lot of animal protein and was dominated by cereals, vegetables, fruit, and dairy products, changing to a Western diet such as junk food (18).

Unhealthy eating patterns such as the consumption of junk food, fried foods, and sweet drinks cause an imbalance in the intake of carbohydrates and other nutrients in the body. High sugar content exceeds capacity causing the pancreas to work overload and result in type 2 DM (19).

Meat and fried food are types of food sources that contain high levels of trans fat, saturated fat, and cholesterol. A side effect of high-fat consumption is decreased levels of adiponectin in the blood which is responsible for increasing insulin sensitivity. Low adiponectin levels increase the incidence of DM and obesity in patients (20).

The results of the Chi-square test in the study showed that there was a significant relationship between alcohol consumption and the incidence of DM. Alcohol can affect glucose metabolism by inhibiting the process of gluconeogenesis and glycogenolysis which triggers hypoglycemia.

This hypoglycemia condition triggers excessive consumption of foods including carbohydrates, which can cause an increase in blood glucose levels in DM patients (21). Meanwhile, other studies have reported that certain categories of alcohol consumption with moderate to high frequency reduce the risk of DM disease. This is evidenced by the

results of a cohort study of 8,423 male workers in Japan for eight years that moderate to high-frequency alcohol consumption has no significant relationship with type 2 DM (22).

The results of this study indicate that there is a significant relationship between smoking and the incidence of diabetes in men in India. Smoking habits increase the risk of 0.835 higher suffering from diabetes than non-smokers. This is because the nicotine content in cigarettes increases the formation of free radicals which cause inflammation and reduce insulin sensitivity (23).

WHO data show that more than 1 million adults die every year in India due to the use of tobacco cigarettes, which is around 9.5% (24) and the results of a survey by the Global Adult Tobacco Survey (GATS) in 2016-2017 showed that the consumption of tobacco cigarettes in men was around 42.4% and women 14.2% (25).

A meta-analysis of studies in America and Europe showed that the incidence of DM due to smoking was found to be higher in men (11.7%) than in women (2.4%). Smokers have a 1.37 times higher risk of developing type 2 DM compared to non-smokers (26).

The results of the Chi-square study stated that there was a relationship between the area of residence and the incidence of DM. Changes in modern lifestyles in urban areas contribute to the increase in the incidence of

Another study in Thailand also showed that the prevalence of DM had a significant relationship with the population aged 55-64 years in 2010 and 65 years in 2012 (31). This study stated that there was no relationship between work status and DM. Meanwhile, research evidence shows that people who work and have a high workload have 1.15 times the risk of suffering from type 2 DM.

The results of this study stated that there was a significant relationship between low levels of education and type 2 DM. Respondents with a junior high school level of education had a 0.968 times higher risk of suffering from diabetes than elementary and high school education levels.

According to the theory of the links between education and health, a low level of education limits a person's opportunity to have access to health facilities and a healthy lifestyle. Meanwhile, higher education makes a person a job, income, high economic status, strong self-

DM. In line with the results of previous studies using secondary data NHFS-3 that male respondents living in urban areas (2.0%) are more at risk of experiencing DM than those in rural India (1.0%) (27).

Another study in China showed that DM was more common in urban communities (8.1%) than in rural areas (4.1%). However, when it is associated with the death rate due to DM, it is found more in rural areas (28).

Urban communities are usually exposed to a lot of various information so awareness and education about DM disease are easier than in rural communities. In addition, limited access to health facilities, poverty, food insecurity, poor sanitation, and low literacy are contributing factors to the high death rate from DM in rural communities.

Based on the results of the Chi-Square test, there is a significant relationship between age and the incidence of type 2 DM. The age group >50 years has a 0.336 times higher risk of developing type 2 DM than the age group <50 years. The aging process that occurs causes a decrease in electrical activity in the pancreatic beta cell channels that are sensitive to adenosine triphosphate (ATP). This can affect the process of insulin secretion and blood glucose levels (29). Changes in body function, especially the pancreas, have led to an epidemic of diabetes (30).

control, and access to knowledge about healthy lifestyles that are more and more open (32).

Other research states that a low education level has 1.43 times the risk of suffering from DM regardless of the nutritional status of the respondents, namely normal, overweight, and obese (33). This is not in line with previous research in India based on NHFS-3 data that participants with a higher education level had a 1.87 times higher risk of developing type 2 DM than those without education (27).

Based on the theory of socioeconomic status and health, the existence of knowledge, money, prestige, and networking resources owned by high socioeconomic groups makes them more liable toward risk factors that cause disease (34). Meanwhile, the limited knowledge and income possessed by individuals from the lower classes make them tend to have unhealthy lifestyles such as unbalanced diet patterns, low physical activity,

and smoking habits which can lead to the risk of type 2 DM (35).

However, other studies have shown that economic status has a significant relationship with type 2 DM. The most influential factor is the rich socioeconomic status with a 0.682 higher chance of suffering from DM than middle to poor socioeconomic status. In line with previous research using NHFS-4 data in India, it showed that individuals from rich socioeconomic statuses had a 4.04 times risk of suffering from DM than individuals from very poor economic status groups (36).

Based on expert opinion in the book *Introduction to Human Nutrition*, socioeconomic status has a relationship with lifestyle, where an increase in socioeconomic status results in an increase in lifestyle, especially in food choices (37). There is a change in people's diet that is far from the concept of balanced nutrition due to socioeconomic changes and people's appetites. In addition, the development of social media and the ease of accessing food has made people from the upper socioeconomic class tend to choose foods high in calories and saturated fat, increasing the body's cholesterol and blood sugar levels.

In addition, the ease of transportation nowadays makes walking activities less frequent and they have more sitting habits than workers from lower social status who tend to have jobs with more physical activity. This can cause the risk of obesity and lead to degenerative diseases such as heart disease, high cholesterol, and type 2 DM.

CONCLUSIONS AND SUGGESTIONS

Conclusion

The results of this study indicate that there is a significant relationship between the consumption of meat, fried food, alcohol, smoking habits, age, area of residence, education level, and socioeconomic status with the incidence of type 2 DM. The most influential risk factor for type 2 DM is social status and a rich economy.

Suggestions

There is a need to provide counseling to the community that involves the government and cross-sectors such as health centers, health offices, and village officials in India regarding how to prevent, risk factors, and how to deal with type 2 DM. The public needs to be given education about type 2 DM disease to reduce inequality knowledge among the rich, middle, and poor socioeconomic circles.

ACKNOWLEDGMENTS

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