ORIGINAL ARTICLE

Predictor Risk of Diabetes Mellitus in Indonesia, based on National Health Survey

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ABSTRACT

Introduction: Diabetes mellitus which is estimated to continue to increase over time becomes a problem that needs to be immediately addressed by various related stakeholders. Knowing the risk factors associated with diabetes mellitus is considered the right way to minimize the number of diabetes in the world, especially Indonesia. Analysis of secondary data on the Indonesian Family Life Survey is expected to be the basis for taking appropriate policies in Diabetes Mellitus intervention in Indonesia. **Methods:** Cross sectional design based on secondary data from the Indonesian Family Life Survey V was conducted in this study to find the most influential risk for diabetic mellitus in Indonesia. Binary logistic regression analysis was used to simplify analyzing information from 30133 respondents aged > 18 years spread across 13 Provinces in Indonesia. The selection of respondents was based on the completeness of the information in the dataset provided by RAND as the dataset provider. The variables were analyzed in this study, included diabetes mellitus, cholesterol levels, gender, hypertension, overweight and age. **Results:** High cholesterol, hypertension and overweight were risks associated with diabetes mellitus in Indonesia. Of the three risks, overweight was the most significant risk (p = 0,000; OR 2,200; 95% CI 1,655 – 2,295). **Conclusion:** Striving for healthy living behaviours and periodic screening programs can reduce overweight rates because they can be detected quickly.

Keywords: Diabetes Mellitus, Non-Communicable Disease, Indonesia, National Health Survey

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INTRODUCTION

Non-communicable diseases are burden for each country on the global level. It has been proven that 63% of deaths in the world are caused by non-communicable diseases, and predicted to continue to increase by 15% until 2020 (1, 2). Among these deaths, there are three highest diseases that cause death, namely cardiovascular disease, diabetes mellitus and chronic respiratory infections (3, 4). It should be noted that diabetes mellitus is a disease that occurs a lot in the 21st century and it is predicted that by 2030 the number of diabetes mellitus in the world will amount to 552 million (5). Diabetes mellitus occurs due to a disruption in the body's metabolism so that blood sugar levels in the body become excessive (6).

Indonesia, as one of the developing countries in the world, experiences three double health burdens, namely infectious diseases, non-communicable diseases and re-emerging diseases. At present, in Indonesia is in a shifting phase from the period of infectious diseases to the period of non-communicable diseases, most of them are diabetes mellitus. The problem of diabetes mellitus in Indonesia has been happened since 1980 until now. The number of people with diabetes mellitus in Indonesia is estimated at around 10 million people with a prevalence rate of 6.2% (7) and this disease is one of the causes of death in Indonesia (8, 9) . So this causes Indonesia to occupy the top ten with the highest rate of diabetes mellitus in the world in 2013 (10).

Diabetes mellitus is caused by several factors including gender, age, education level, family income, family history of diabetes mellitus, family history of hypertension, unhealthy behaviuor, one of which is drinking alcoholic beverages, smoking, lack of physical activity, consumption of excessive oily foods and the frequency of eating fewer vegetables. In addition, people at risk for diabetes mellitus can be seen from several biomedical signs of the body which include hypertension, waist circumfrence, body mass index, fasting blood glucose and total cholesterol (11).

Therefore, this study aimed to determine the significant factor that increased risk of diabetes mellitus in Indonesia by Indonesian Family Life Survey V. The Indonesian Family Life Survey is a logitudinal study of individuals and households conducted by RAND institutions from 1993 to the last survey in 2014. Information from each respondent was obtained through random selection at the household level. This survey does not focus on non-communicable diseases, but overall the survey covers reproductive health, household conditions, children's health, the state of the home environment and general conditions of individual health. However, some of the risk variables for diabetes mellitus can be found in this survey (12). By knowing the risk factors to approach predictor model, the program can be done with proper intervention by the various stakeholders.

MATERIALS AND METHODS

This study used cross sectional method, utilized secondary data obtained from the data Indonesian Family Live Survey (IFLS) V 2014. The survey was conducted in 13 provinces in Indonesia collected at the level of individuals, communities and households (12). IFLS is a longitudinal study that examines the socio-economic and health characteristics of the population (13). The sample of IFLS data is more than 30,000 people, the sample can represent 83% of the population in Indonesia (14). This IFLS study was carried out since 1993 and was completed in 2015. During the study, five sections were conducted (13). Although this study is longitudinal, we limit it only to section five (IFLS V) which is done only at > 18 years of age. This study included 30133 respondents who were selected based on the age and completeness of the data in the survey dataset. The research variables included in this study included diabetes mellitus, cholesterol, gender, hypertension, overweight and age.

Diabetes Mellitus Status

Data on the variables of diabetes mellitus were taken based on information provided in the Indonesian Family Live Survey V questionnaire on the US book part US18aC (15). In this section, information about respondent's diabetes mellitus was measured by asking for a history of the activity of taking diabetes mellitus who recommended by health workers. Respondents who took the medicine could be concluded that suffer from diabetes mellitus. The status of diabetes mellitus in this study was divided into two ordinal scale categorical namely suffering from diabetes mellitus and not suffering from diabetes mellitus.

Cholesterol Level Status

Information about cholesterol status in respondents was taken from the Indonesian Family Live Survey V questionnaire in the US section US18aD (15). Information was taken by asking respondents about their history of taking cholesterol medicines who recommended by health workers. Respondents who take the medicine concluded that they had high cholesterol levels. Cholesterol variables in this study were divided into two ordinal scale categories namely high and normal cholesterol.

Age

Information about age in this study was taken from the Indonesian Family Life Survey V questionnaire in book K section AR09 which asked about the age of each household member when the data collection took place. In the dataset, the age is numerical, but for the purposes of data analysis, age was converted into ordinal scale categorical data. Age categories of respondents were divided into age > 40 years and <40 years. At the age of 40 years there had been a decline in organ function, physiological systems with related anatomical and ulstrastructural changes (16).

Hypertension status

Information about hypertension status in respondents was taken through the Indonesian Family Life Survey V questionnaire in the US book section US18aB. This information regarding consumption of hypertension medicines consumed by respondents who recommended by health workers. So that it could be concluded that respondents who consumed medicines can the respondents suffer from hypertension. The status of hypertension in this study was divided into two ordinal scale categories, namely hypertension and not hypertension.

Overweight

Body mass index is a measure of public health to determine overweight/obesity status based on anthropometric measurements in humans consisting of height and weight (17). Determination of overweight status by dividing body weight (kg) by height (m2) (18,19). Measuring height and weight in the Indonesian Family Life Survey V was done by measuring the anthropometry of the body. Measurement of body weight using weight scales and height measurements using a height meter. In measuring body weight and height, respondents were asked to remove footwear so that the measurement results could be correct. Information on height and weight was in the US Book questionnaire sections US06 and US04. This study divided the overweight status into two ordinal scale categories namely overweight/obesity and non-overweight (20). In this study, the standard size of respondents for the country of Indonesia was said to be overweight if the body mass index was above 24.0 Kg / m2 (21) .

Gender

Information about gender is obtained from the Indonesian Family Life Survey V questionnaire in book K section AR07 by asking family members. Gender was divided into two nominal categories, male and female.

Statistical analysis

Research data were analyzed using the help of computer software applications. Univariate analysis was conducted to describe the research variables, while bivariate analysis used Chi-Square analysis to see the relationship and magnitude of risk (22) through the calculation of Odds Ratio (OR) (23) between the variables of cholesterol, gender, hypertension, overweight and age on diabetes mellitus. Multivariate analysis using binary logistic regression analysis to get the adjusted odds ratio value (24) related to diabetes mellitus. Binary logistic regression was used as a tool to minimize multivariate analysis errors when the analysis takes place, so that it can produce a value that is close to accurate (25).

Ethical clearance

The ethics of this research have been approved by the RAND institution and have been reviewed by the ethics body of Gadjah Mada University, Indonesia.

RESULTS

A total of 30133 respondents entered the criteria for this study, which in Table I explained that respondents who had diabetes mellitus as much as 0.8%, had high cholesterol as much as 0.8% and suffered from hypertension by 7.9%. In table I also explains most of the respondents were female (53.1%). Based on 2007 WHO standard overweight Indonesian people (21), Most respondents have a non-overweight (78.3), the average overweight 21.03 kg / m^2 and aged <40 years (59.3); the average is 26.05 years old.

Table 1: Frequency distribution of research variables (n = 30133)

Variables	n (%)	Mean
Status of diabetes mellitus		
Suffering from diabetes mellitus	229 (0.8)	
Not suffering from diabetes mellitus	29904 (99.2)	
Cholesterol level status		
High cholesterol	236 (0.8)	
Normal cholesterol	29897 (99.2)	
Gender		
Man	14118 (46.9)	
Women	16015 (53.1)	
Hypertension status		
Hypertension	2371 (7.9)	
Not hypertension	27762 (92.1)	
Overweight		
Overweight/ Obesity	6536 (21.7)	21.03 Kg / m^2
Non-overweight	23597 (78.3)	
Age		
≥ 40 years old	12275 (40.7)	26.05 years
<40 years	17858 (59.3)	

Table II explains the related chi-square analysis of the relationship between the variables of cholesterol level status, gender, hypertension status, overweight and age on diabetes mellitus. The results of the analysis show that there were variables that have a significant relationship to diabetes mellitus; between the status of cholesterol level (p = 0,000, OR 47,453; 95% CI 33,727 - 66,765), hypertension (p = 0,000, OR 3,951, 95% CI 2,920 - 5,347) and overweight (p = 0,000, OR 3,377, CI 95% 2,602 - 4,383). While the other variables were not significantly associated with diabetes mellitus, including gender (p = 0.925) and age (p = 0.664).

Table II: Correlation between cholesterol level status. gender. hypertension status. overweight and age to diabetes mellitus (n = 30133)

Variables	Status of diabetes mellitus		p value *	OR ** (95% CI)
	Sick n (%)	Painless n (%)		
Cholesterol status				
High cholesterol	52 (22.0)	184 (78.0)	0.000	47.453 (33.727 - 66.765)
Normal cholesterol	177 (0.6)	29720 (99.4)		
Gender				
Man	108 (0.8)	14010 (99.2)	0.925	-
Women	121 (0.8)	15894 (99.2)		
Hypertension status				
Hypertension	57 (2.4)	2314 (97.6)	0.000	3.951 (2.920 - 5.347)
Not hypertension	172 (0.6)	27590 (99.4)		
Overweight				
Overweight/obese	110 (1.7)	6426 (98.3)	0.000	3.377 (2.602 - 4.383)
Non-overweight	119 (0.5)	23478 (99.5)		
Age				
≥ 40 years old	97 (0.8)	12178 (99.2)	0.664	-
<40 years	132 (0.7)	17726 (99.3)		

*Significance p ≤ 0.05; ** Crude OR; OR: Odds Ratio; CI: Confidence Interval

The results of the binary logistic regression analysis (Table III) stated that the overweight variable was the most influential variable in the occurrence of diabetes mellitus in Indonesia according to Indonesian Family Life Survey V. OR value Adjusted overweight variable was true value after controlling for all variables.

Table III: Gold Model Binary Logistic Regression Analysis on contribution of cholesterol levels, hypertension and overweight status to diabetes mellitus (n = 30133)

Variables	OR *	95% CI	p value**
Cholesterol status			
High cholesterol	31,384	21,883 – 45,009	0,000
Normal cholesterol	Reference		
Hypertension status			
Hypertension	2,253	1,610 – 3,152	0,000
Not hypertension	Reference		
Overweight			
Overweight/ Obese	2,200	1,655 – 2,925	0,000
Non-overweight	Reference		

* Adjusted OR; **Significance p ≤ 0,05 OR: Odds Ratio; CI: Confidence Interval

DISCUSSION

The prevalence of diabetes mellitus in Indonesia needs special attention from the Ministry of Health of the Republic of Indonesia because Indonesia ranks second after Singapore in the Southeast Asia region (26). From the findings of this study in multivariate analysis, the causes of diabetes in Indonesia were due to overweight, hypertension and high cholesterol. But among the three risks that affect the diabetes mellitus, overweight the most influential risk causing diabetes mellitus in Indonesia. This was in line with the research conducted by Hasbullah which states that in its study meta-analysis there was a relationship between overweight and the incidence of diabetes mellitus in the world (27).

Overweight indicates a buildup of fat in the body, this accumulation of fat can lead to insulin resistance (28). This condition was caused by a decrease in the hormone insulin to reduce blood sugar levels in the body. High blood sugar levels in the body can cause damage to the pancreatic organs (29).

Besides overweight, there were other risk factors that increase the risk of sociodemography including age, sex, education level, income and history of hypertension in the family; body behavioural factors and clinical factors including blood glucose levels and hypertension (11, 29). High cholesterol levels were a risk for other non-communicable diseases (31) . While high hypertension was an invisible deadly disease where the incidence of high hypertension will occur several years later (31, 32). So that all these risk factors and other risk factors together could cause diabetes mellitus (34) .

Temporality was a limitation in this study because information about independent and dependent variables were taken at one time, so this research can only explain the size of the association between variables without being able to explain the role of the variable whether as an exposure variable or outcome variable (35). The misclassification bias of this study occurred due to errors in determining groups in numerical variables (overweight and age) in this study. So that the bias of misclassification can cause the estimated adjusted OR to be underestimated and overestimate (35, 36). Information bias also had the opportunity to occur in the variables of diabetes mellitus, hypertension and cholesterol, which take information through the process of asking respondents about the history of taking the medicine. Opportunities for respondents to subjectively answer were very high, this could be result in the information provided being false or not actual information (37).

The Indonesian Family Life Survey is not a survey that focuses on non-communicable diseases only, so there is very little information about risk factors for diabetes mellitus. This causes many variables in this survey not to be included in the risk criteria for diabetes mellitus. Only variable cholesterol status, gender, hypertension status, overweight and age can be included in the risk criteria for diabetes mellitus. The lack of information about other risk variables for diabetes mellitus can result in poor information because other risk variables still have links that affect the risk of diabetes mellitus. Other risk variables are not explored in this IFLS survey cannot be analyzed in this study (37).

CONCLUSION

High cholesterol, hypertension and overweight were variables that affect diabetes mellitus, but of the three risks, overweight was the most significant cause. There needs to be an effort made by the Government and other health institutions to minimize the risk of diabetes mellitus. Efforts to reduce the risk of this disease can be either a policy or a massive movement of healthy life. In addition, maximizing the health screening function regularly can be a cheap, easy effort to detect signs of risk of diabetes mellitus in everyone.

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