The prevalence of diabetes mellitus and relationship with socioeconomic status in the Indonesian population

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ABSTRACT

Background: The prevalence of diabetes mellitus is increasing globally and remains debated. Objective: This study examines the association of socioeconomic status with the prevalence of diabetes mellitus in Indonesia. Methods: This study used a cross-sectional design. Data obtained from the 2014 Indonesia Family Life Survey (IFLS), a nationally representative population survey data, which polled 30,497 individuals age 16 years and over in 13 provinces in Indonesia. Logistic regression models were used to estimate odds ratios (OR) and 95% confidence intervals (CI) for the prevalence of diabetes mellitus with socioeconomic status. Results: Education level, employment status, age, and hypertension are related to the prevalence of diabetes mellitus. According to educational level, individuals with lower education level were more likely to have diabetes mellitus than those who had a higher level of education (OR=1.42; 95% CI: 1.21-1.67), higher risk was also found in those who were unemployed (OR=1.55; 95% CI: 1.33-1.82). Besides, age and hypertension were independent factors for a higher prevalence of diabetes mellitus, age >55 (OR=4.71; 95% CI: 4.06-5.46), hypertension (OR=5.86; 95% CI: 5.00-6.87). Diabetes mellitus also show significantly higher among individuals living in urban areas compared to individuals living in rural areas (OR=2.13; 95% CI: 1.78-2.55). Conclusions: Socioeconomic status has a significant association with the prevalence of diabetes mellitus among people above 15 years old in Indonesia. The government needs to design a preventive program to control this disease by considering the risk factors that may lead to the development of diabetes mellitus in Indonesia.

KEYWORDS: diabetes mellitus; Indonesia; prevalence; socioeconomic

INTRODUCTION

Diabetes is a metabolic disease characterized by hyperglycemia due to defects in insulin secretion, insulin action, or both. Chronic hyperglycemia due to diabetes is associated with long-term damage, dysfunction, and organ failure, especially the eyes, kidneys, nerves, heart, and blood vessels (1). Diabetes mellitus is not a single disorder and its definition depends on one’s perspective. The definition of diabetes from a social point of view includes the burden that this disease poses on the economy, both in terms of expensive treatment and associated premature morbidity and mortality (2). Diabetes mellitus is a chronic disease that occurs in developed and developing countries (3). According to Global Report on Diabetes from World Health Organization records in 2014 were 422 million people in the world suffer from diabetes, and caused 1.5 million deaths in 2012 (4). A study estimates that more than 500 million people worldwide will suffer from diabetes by 2030 (5). Over the past three decades, the prevalence of diabetes in Indonesia has increased substantially. With a population of more than 200 million, Indonesia ranks among the top seventh countries in the world for the incidence and prevalence of diabetes mellitus (4). The incidence of diabetes reported by the Ministry of
Although studies in developing countries are not widely conducted and the relationship is still in doubt, so far there has been no studies that indicate high socioeconomic status related to diabetes mellitus risk.

The purpose of this study is to investigate the impact of socioeconomic status on diabetes mellitus in Indonesia. We use Indonesia, a developing country which estimated in 2020 was 8.4 million people, and became the 4th largest country with most diabetic patients (7). Second, we use a national representative survey, the Indonesian Family Life Survey was used for this study. IFLS is a unique household survey in Indonesia. The IFLS provides longitudinal data representing 80% nationally of the entire Indonesian population living in 13 of the 26 provinces. This survey collects respondents’ data on various socioeconomic and sociodemographic variables at the level of individuals, families, households and communities, and includes education and employment. The first wave of IFLS was carried out in 1993 for individuals living in 7,224 households. IFLS 3 and 4 re-interviewed the same respondents in 1997 and 2007. IFLS 5 was reported in 2014 in the same IFLS household group with a participation rate of 92% with 16,204 households and 50,148 individuals (21). For this study, we selected individuals who completed questionnaires in chronic diseases and several questionnaires relating to social, economic, and demographic information. The subjects included in this study were aged 15 and over who were Indonesian citizens based on the IFLS 4 study. This resulted in as a sample of 30,497 individuals.

**METHODS**

**Study design and participants**

This cross-sectional study was used from the Indonesian Family Life Survey (IFLS). The IFLS is an ongoing social, economic, and longitudinal health survey in Indonesia. IFLS data represent 80% of the population in Indonesia, IFLS survey were conducted in 13 provinces in Indonesia. This study uses the latest data, IFLS 5, launched in late 2014 and early 2015. IFLS 5 data consists of 16,204 households and 50,148 individuals. In this study, the sample was limited to respondents with a minimum age of 15 years who answered a complete
survey about chronic diabetes mellitus. This resulted in a sample of 30,497 individuals.

**Measures**

*Diabetes mellitus.* Diabetes mellitus has been measured by two categories of items based on the classification of the International Classification of Disease and Related Health Problems 10th revision (1). In the IFLS survey, individuals were asked a questionnaire about “Has the doctor / nurse / midwife ever said that you have a condition / disease of diabetes mellitus?” Responses were recorded in two categories (1 = suffering from diabetes mellitus, 0 = not suffering from diabetes mellitus).

Over the past two decades, previous studies have documented levels of education, employment status, home ownership, age, gender, marital status, living room, smoking, sleep quality, physical activity, hypertension, and dietary fat intakes as determining factors for the prevalence of diabetes mellitus. Thus, this study examines the prevalence of diabetes mellitus by controlling for these variables.

*Socioeconomic status.* Socioeconomic status refers to the social and economic factors that reflect what positions and prestige individuals or groups hold within the structure of a society, such as educational level, employment status and income (18,22). The main indicators socioeconomic status in this study were include education, employment status, and housing ownership. In this study, education is categorized based on education standards in Indonesia, from the lowest level of elementary school to the highest level of university. In this study we added responses to unshool level education based on data available at IFLS. Most respondents have completed senior high school in the education system in Indonesia. In this study we used dummy variables to distinguish individual employment status, 1) indicating unemployed and 0) indicating being employed. We use questions in the IFLS survey that asks respondents, “What is the status of your home?” The dummy variable is used to indicate the status of home ownership, with 1) indicating own / owner and 0) leased / contracted.

*Sociodemographic.* In this study, we also used sociodemographic variables to examine its relationship with diabetes mellitus risk. Age, gender, marital status and area of residence have documented in relation to the risk of diabetes mellitus (17). Age is reclassified into five categories as follows: 1) 15 - 24 years; 2) 25 - 34 years; 3) 35 - 44 years; 4) 45 - 54 years; 5) 55 years and above, twenty-seven percent of respondents were 25-24 years old. Gender was measured using a dummy variable, 1) for female and 0) for male. Marital status is also measured using a dummy variable with 1) married and 0) un-married, the category of un-married included single / divorced / widowed, seventy-four percent of respondents are married. A dummy variable indicating place of residence with 1) urban and 0) rural. Most respondents live in an urban areas.

*Lifestyle.* Researchers have documented that lifestyle is associated with diabetes mellitus (14). The main indicators of lifestyle in this study were included smoking, sleep quality, physical activity, hypertension, and dietary fat intake.

*Smoking.* We use questions in the IFLS survey that asks “Have you ever chewed tobacco, smoked, smoked alone or smoked cigar /cigars?” the dummy variable is used by 1) indicating smoking before and currently and 0) indicating never-smoking.

*Sleep quality.* The IFLS survey asks about sleep with question “My sleep quality is very bad, fair, good, very good?” The first three categories are combined into 1) indicating good quality and 0) indicating poor quality.

*Physical activities.* We use questions that ask “Heavy activities that require hard physical effort that you have undertaken in the last 7 days. Heavy activities make you breathe much harder than usual and may include lifting, digging, plowing, aerobics, fast cycling, cycling with a load of”, dummy variables used to indicated individuals’ who engage in active activities less than 10 minutes per day in a week 1) and more than 10 minutes per day a week 0).

*Hypertension.* Hypertension also has a determining effect on diabetes mellitus in developed and developing country. We measure hypertension by asking “Did your doctor / nurse / midwife ever say that you have hypertension?”. Responses are recorded in two categories 1) suffering from hypertension, 0) not suffering from hypertension. The percentage of respondents who suffer from hypertension is 12 %.
Gender has not significantly related to diabetes mellitus. People who live in rural areas are less likely to face diabetes mellitus compared to people who live in urban areas. According to bivariate analysis, there is no significant relationship between smoking behaviour with diabetes mellitus. Thus, sleep quality, physical activity, hypertension, and dietary intake all showed significant association with diabetes mellitus.

DISCUSSION

Using nationally representative data, we assessed the socioeconomic determinant and other related factors on prevalence of diabetes mellitus in the Indonesian population. According to previous studies, there has been an increasing trend in the prevalence of diabetes mellitus in Indonesia. Diabetes mellitus had become a global health problem. The highest prevalence of diabetes mellitus is found in developing countries. The main findings show that socioeconomic status according to education level, employment status, and home ownership was related to prevalence of diabetes mellitus among individuals aged 16 years and over. Our findings support previous studies (23,24). However, the findings of the this study do not support the previous studies (25).

There are several possible explanations of how socioeconomic status affects the prevalence of diabetes mellitus. First, improving education tends to reduce the risk of diabetes mellitus. This finding has been explained in several previous studies (8,9). Level of education is one of the factors determining a person’s behavior. Our analysis showed that diabetes mellitus mostly affected those with low level of education compared to people with moderate and high levels of education. Conversely, individuals with low levels of education are more likely to get diabetes mellitus than individuals with high levels of education (26). Higher educational level provides individuals with more knowledge for understanding health risk factor, improving individuals’ health choices, and earning power, which give better access and quality of health care, and may reduce the risks of diabetes mellitus (27,28). In addition, low educational level may simply reflect unhealthy behaviours, such as smoking, poor sleep quality, physical inactivity, which in turn lead to
Table 1. Characteristic of the study sample: Indonesia Family Live Survey 2014

| Characteristics     | IFLS samples | Diabetes mellitus | Bivariate correlation n | %  | %  |          |
|---------------------|--------------|-------------------|-------------------------|----|----|----------|
| Education           |              |                   |                         |    |    |          |
| Elementary school and unschool | 10,434       | 34.21             | 291                     | 42.54 |    | -0.01*   |
| Junior high school  | 5,696        | 18.68             | 96                      | 14.03 |    |          |
| Senior high school  | 10,032       | 32.90             | 173                     | 25.29 |    |          |
| Graduate and upper  | 4,335        | 14.21             | 124                     | 18.12 |    |          |
| Employment          |              |                   |                         |    |    |          |
| Unemployed          | 9,616        | 31.53             | 284                     | 41.52 |    | 0.03*    |
| Employed            | 20,881       | 68.47             | 400                     | 58.48 |    |          |
| Home ownership      |              |                   |                         |    |    |          |
| Owner               | 22,835       | 74.88             | 572                     | 83.62 |    | 0.03*    |
| Leased / contracted | 7,662        | 25.12             | 112                     | 16.37 |    |          |
| Age (years)         |              |                   |                         |    |    |          |
| 15 – 24             | 6,771        | 22.20             | 12                      | 1.75  |    | 0.15*    |
| 25 – 34             | 8,502        | 27.88             | 62                      | 9.06  |    |          |
| 35 – 44             | 6,592        | 21.62             | 106                     | 15.40 |    |          |
| 45 – 44             | 4,472        | 14.66             | 212                     | 30.99 |    |          |
| > 55                | 4,160        | 13.64             | 292                     | 42.69 |    |          |
| Gender              |              |                   |                         |    |    |          |
| Female              | 16,267       | 53.34             | 369                     | 53.94 |    | 0.00     |
| Male                | 14,230       | 46.66             | 315                     | 46.06 |    |          |
| Marital status      |              |                   |                         |    |    |          |
| Married             | 22,739       | 74.56             | 571                     | 83.47 |    | 0.03*    |
| Un-married          | 7,758        | 25.44             | 113                     | 16.53 |    |          |
| Place of residence  |              |                   |                         |    |    |          |
| Urban               | 17,981       | 58.96             | 514                     | 75.14 |    | 0.04*    |
| Rural               | 12,516       | 41.04             | 170                     | 24.86 |    |          |
| Smoking             |              |                   |                         |    |    |          |
| Before and current  | 11,134       | 36.51             | 246                     | 35.96 |    | -0.00    |
| Never smoking       | 19,363       | 63.49             | 438                     | 64.04 |    |          |
| Sleep quality       |              |                   |                         |    |    |          |
| Poor                | 3,619        | 11.87             | 101                     | 14.77 |    | 0.01*    |
| Good                | 26,878       | 88.13             | 583                     | 85.23 |    |          |
| Physical activity   |              |                   |                         |    |    |          |
| Heavy activity <10 minutes/days a week | 23,741 | 77.85 | 592 | 86.55 |
| Heavy activity >10 minutes/days a week | 6,756 | 22.15 | 92 | 13.45 |
| Hypertension        |              |                   |                         |    |    |          |
| Yes                 | 3,671        | 12.04             | 293                     | 42.84 |    | 0.14*    |
| No                  | 26,826       | 87.96             | 391                     | 57.16 |    |          |
| Dietary fat intake  |              |                   |                         |    |    |          |
| Above median fat intake | 14,339 | 47.02 | 325 | 47.51 |
| Below median fat intake | 16,158 | 52.98 | 359 | 52.49 |

*p < 0.05

the occurrence of diabetes mellitus. Employment status is related to the development of diabetes mellitus (17). Our analysis show the higher risk of diabetes mellitus among the unemployed respondent than among the employed ones. Individuals who do not work have a higher risk of diabetes than individuals who do work. Previous studies noted that males and females who do not work have a risk of diabetes mellitus (17,29).
Table 2. Odds Ratios (95% confidence intervals) for prevalence of diabetes mellitus: Indonesia Family Life Survey 2014

| Characteristics                  | Odds Ratio | Confidence Interval | p     |
|----------------------------------|------------|---------------------|-------|
| Education                        |            |                     |       |
| Junior high school and upper     | Ref        |                     |       |
| Elementary school and un-school  | 1.42       | 1.21 – 1.67         | 0.000 |
| Employment                       |            |                     |       |
| Employed                         | Ref        |                     |       |
| Unemployed                       | 1.55       | 1.33 – 1.82         | 0.000 |
| Housing ownership                |            |                     |       |
| Leased / contracted              | Ref        |                     |       |
| Owner                            | 1.73       | 1.40 – 2.14         | 0.000 |
| Age                              |            |                     |       |
| ≤ 45                             | Ref        |                     |       |
| ≥ 45                             | 2.61       | 2.22 – 3.06         | 0.000 |
| Sex                              |            |                     |       |
| Male                             | Ref        |                     |       |
| Female                           | 1.02       | 0.87 – 1.20         | 0.747 |
| Marital status                   |            |                     |       |
| Un-married                       | Ref        |                     |       |
| Married                          | 1.74       | 1.41 – 2.15         | 0.000 |
| Place of residence               |            |                     |       |
| Rural                            | Ref        |                     |       |
| Urban                            | 2.13       | 1.78 – 2.55         | 0.000 |
| Smoking                          |            |                     |       |
| Never                            | Ref        |                     |       |
| Before and currently             | 1.02       | 0.87 – 1.82         | 0.765 |
| Quality of sleep                 |            |                     |       |
| Good                             | Ref        |                     |       |
| Poor                             | 1.29       | 1.02 – 1.60         | 0.017 |
| Physical activity                |            |                     |       |
| Heavy activity >10 minutes/days a week | Ref |     |       |
| Heavy activity <10 minutes/days a week | 1.85 | 1.48 – 2.33 | 0.000 |
| Hypertension                     |            |                     |       |
| Not suffering                    | Ref        |                     |       |
| Suffering                        | 5.86       | 5.00 – 6.87         | 0.000 |
| Dietary fat intake               |            |                     |       |
| Below median fat intake          | Ref        |                     |       |
| Above median fat intake          | 1.29       | 1.06 – 1.57         | 0.007 |

*p < 0.05

Other main finding shows that the results are not a significant prevalence of diabetes mellitus in females. Both males and females have same level of risk of developing diabetes mellitus. These findings indicate there is no difference in the prevalence of diabetes mellitus between males and females. Confirming previous studies, males and females have a similar risk of diabetes mellitus (30,31). Marital status is related to diabetes mellitus. Result from our bivariate analysis show that the highest proportion of diabetes mellitus was found among married respondents, compared to those who were un-married. Our finding show that an association between marital status and development of diabetes mellitus. Married individuals were more likely to develop the diabetes mellitus than those who had never married. This support previous studies that found greater number of diabetes mellitus case on who had never married (17). Another important finding was that the prevalence
of diabetes mellitus is higher in individuals living in rural areas. Our statistical analysis found a significant association between living area and the development of diabetes mellitus. This finding suggests that environmental factors play a role in the development of diabetes mellitus. This finding confirms previous findings which noted that there is a high risk of diabetes mellitus in urban areas compared to rural areas (32,33), this finding contradict previous studies that have found that the risk of diabetes mellitus is higher in rural areas (33).

The most interesting finding was that age and incidence of hypertension can be important factors in the prevalence of diabetes mellitus in Indonesia. The effect of age has been widely documented in previous studies (17,34). Diabetes risk shows a trend that increases significantly with age. Individuals that aged 35-44 have a higher risk on diabetes mellitus, and this association increases with age. Individuals that over the age of 55 are five times more at risk of developing diabetes mellitus. The older the age, the higher risk to develop diabetes mellitus. Hypertension is the strongest factor of diabetes mellitus, our finding shows a higher risk of diabetes mellitus in individuals with symptoms of hypertension. Hypertension was also associated significantly with the development of diabetes mellitus. Previous studies have reported that diabetes and hypertension can develop one after another in the same individual (35,36). Our finding also indicate negative effect of sleep quality on diabetes mellitus. Confirming previous studies, our finding demonstrate that a decrease in sleep quality can increase the risk diabetes, this finding of sleep quality consistently and significantly predict the risk of the developing diabetes (37-40).

Another explanation that might underlie the relationship between SES and gestational diabetes is dietary fat intake. Excessive dietary fat intake has the potential to increase diabetes mellitus. The average dietary fat intake of each individual is three to four times a week. Previous studies have reported a high prevalence of diabetes mellitus in people who consume excess fat (41,42). In contrast, previous studies have shown that controlling the consumption of fatty foods tends to reduce the risk of diabetes mellitus (42,43). The benefits of physical activity for diabetes mellitus have been reported in previous studies in both developed and developing countries (44-46). Physical activity can help reduce blood sugar levels in diabetics. Physical activity, especially in high and moderate intensity, can help reduce body fat level and the risk of diabetes mellitus (47). This finding support previous study (48,49). Our finding also indicate the harmful effects of smoking on prevalence of diabetes mellitus but not significantly. These findings reveal that there is no difference in the prevalence of diabetes mellitus in individuals who smoke and do not smoke. This finding contradict with previous studies (50). Therefore, in order to reduce the risk of diabetes mellitus strong determination needed to change one’s lifestyle for become more healthy and active.

This study has a number of limitations. This study uses a cross-sectional data design. Thus, the long-term prevalence of diabetes mellitus in individuals is not observed. The next weakness is that it does not include income indicators in socioeconomic status measures. Income is an important indicator of socioeconomic status that is not examined. Previous studies included the level of education and income of individuals as the main key indicators of measurement of socioeconomic status.

CONCLUSIONS

This study indicated that socioeconomic status has been associated with diabetes mellitus. The prevalence of diabetes mellitus tends to increase every year in Indonesia. Those with low educational level, unemployed, house owner, old age, female, married, living in urban areas, smoking, poor sleep quality, light physical activity, hypertension, and excessive dietary fat intake were vulnerable to diabetes mellitus. The government needs to design a preventive program to control this disease by considering the risk factors that may lead to the development of diabetes mellitus in Indonesia. Future studies are expected to examine the effect of socioeconomic status on the risk of diabetes mellitus with long-term study and measure socioeconomic status with more complete indicators including individual income.

Declaration of conflicting interests

The authors declare that they have no conflict of interest in this study.
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