Community Research

# Epidemiology of erectile dysfunction in men with diabetes mellitus: a study in a primary health care center in Indonesia

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**ABSTRACT**

**BACKGROUND** Diabetes mellitus (DM) is one of the factors causing erectile dysfunction (ED) and may affect a person's quality of life. This study was aimed to describe the epidemiology of ED in men with DM in a primary health care.

**METHODS** The study used a cross-sectional study design conducted from January to March 2017 at the Tlogosari Kulon Health Center, Semarang. There were 122 diabetic men who were all included in the study. The data were collected using interviewer-assisted questionnaires. The status of ED was measured by the erectile dysfunction intensity scale adapted to the International Index of Erectile Function.

**RESULTS** The results showed that the prevalence of diabetic men with ED was 84.4%. Most men with ED had age of ≥46 years (91.0%), experienced work stress (88.5%), had low physical activity (93.1%), had obesity (88.0%) of which 86.3% had central obesity, smoking (84.6%), had DM >5 years (91.2%), and took antihypertensive drugs (90.0%). The fasting blood glucose level of respondents ≥126 mg/dl was 86.0%, and 91.7% had sexual desire disorder. The duration of DM and aging are contributing factors of ED in males with DM, with a *p*-value of 0.016 and 0.013, respectively.

**CONCLUSIONS** The prevalence of ED in primary health care is still high, and the determining factors were the duration of DM and aging. Public health centers are advised to undertake health promotion on the prevention of factors that can lead to sexual dysfunction in males with DM.

**KEYWORDS** diabetes mellitus, erectile dysfunction, male

Erectile dysfunction (ED) is the inability to achieve and maintain an adequate erection to have satisfactory sexual intercourse.[1] ED can affect a person's ability to form or sustain intimate relationships.[2] Diabetes mellitus (DM) has been proven as one of the causes of ED due to its microvascular and macrovascular complications in the male reproductive system. A study found that 71% of men with DM in Central Java suffered from ED.[3] Besides the higher prevalence, DM has also been known to accelerate the onset of ED by 10 to 15 years.[1] The prevalence of DM in Semarang among men was 5.6%. In 2011, Tlogosari Kulon was the health center with the highest prevalence of DM in Semarang (8.2%). From 2014 to 2016, the trend of DM cases in Semarang increased from 1.59% to 3.7% and continues to increase by 1.5%.[4]

ED in men was rarely studied, and the related risk factors remain unclear. Some studies have been conducted in several countries in patients with ED who are also diagnosed with DM; however, the results were

varied and generally ranged between 20% and 90%. The prevalence of ED in patients with DM in Indonesia is not yet known. The lack of ED data in Indonesia and the discrepancies among the findings of previous studies indicate that we need additional studies to clarify the prevalence and determining risk factors of ED in Indonesia. Some risk factors were unhealthy lifestyles and behaviors, like smoking cigarettes, drinking alcohol, and being inactive.[5]

Moreover, ED could negatively affect the patient's quality of life.[6] ED has been negatively associated with men's social interactions, emotional and psychological well-being, and partner relationships. It is important to note that ED is a treatable complication of DM. Studies demonstrated that over 95% of cases could be successfully treated.[7,8] ED is a private issue. Many men feel embarrassed to disclose and discuss the problem with their physician, or even their life-partner.[9] There were currently lack of study have been done on ED in patients with DM. Thus, this study would provide evidence regarding the sexual health in patients with DM and contribute to improve the quality of life of patients with DM, including the prevention of undesirable psychosocial consequences. This could also be used for early detection and management. Hence, this study was aimed to know the prevalence of the ED and its risk factors, particularly in a primary health care in Semarang.

## METHODS

This cross-sectional study was conducted between January and March 2017 in the Tlogosari Kulon Health Center, Semarang. Total sampling was done. The eligible criteria of this study were men with DM who registered at the Tlogosari Kulon Health Center in 2016. This health centre was chosen because it had the most cases of men with DM compared to other public health centers. The data were collected through home visits based on the respondents' addresses.

The data of ED, sexual desire, work stress, physical activity, obesity, central obesity, smoking, duration of DM, consumption of (antidepressants, antihypertensive) drugs, and random glucose test levels were collected. ED was measured using the International Index of Erectile Function (IIEF). The IIEF-5 score is the ordinal sum of responses to five items: score of 22–25 (no ED), score of 17–21 (mild ED), score of 12–16 (mild to moderate ED), score of 8–11 (moderate ED), and score of 5–7 (severe ED).[10] In this study, diagnosis of ED was made if the IIEF-5 score was lower than 22. Work stress was measured using the International Stress Management Association (ISMA) questionnaire.[11] Work stress was classified if the score was more than 14 points, and not having stress if the score was less than 14 points. Physical activity was measured using the global physical activity questionnaire.[12] Based on the recommendation of the World Health Organization, total physical activity in metabolic equivalent of task (MET) min per week that was <600 was classified as low physical activity, 600–1,500 MET min per week was classified as moderate, and above 1,500–3,000 MET min per week was classified as vigorous physical activity.[12] While variables of aging, employment status, education, sexual desire level, consumption of hypertensive and antidepressant drugs, smoking status were asked directly to the participant answering the questionnaire, the variable of obesity was measured using a digital weight scale and a microtoise, while the variable of central obesity used metline. The variability of blood sugar levels and duration of DM was obtained from data in patients' medical records. The variable of the aging process is the slow and progressive loss of the ability of the tissue to repair itself and maintain its normal structure and function so that it cannot correct the deficiencies suffered. The variables in the category of the aging process are the clinical phase (age ≥46 years), transitional phase (age 36–45 years), and subclinical phase (age 25–35 years).[13]

Ethical clearance was obtained from the Ethics Commission of Health Research, Faculty of Public Health, Universitas Diponegoro (No: 29/EC/FKM/2017). All participants signed an informed consent to join this study. Data were analyzed with multivariate analysis. Before the data were analyzed using logistic regressions, a bivariate analysis was conducted to test the aforementioned nine independent variables. If the chi-square test showed significant ($p$<0.05), then the variable would be the predictor variable in the multivariate logistic regression model and stepwise forward and backward procedures were performed. Finally, the Hosmer-Lemeshow goodness-of-fit test showed that the final model was appropriate for the data. By leaving the least significant variable out of the model, a reduction in value was seen, so this variable was kept in the model. Also, the odds ratio (OR) was calculated.

## RESULTS

There were 133 subjects that were eligible in this study. From those, 122 subjects included in this study. Eleven people were excluded because seven people died and four people moved their residencies.

**Characteristics of subjects**

Based on the level of education, frequency distribution showed that most respondents were high school graduates (50.0%). The results showed that the proportion of sexual dysfunction in this study was 84.4%. One hundred and twenty-two respondents with ED were found in each variable. Respondents experienced the stress of work (88.5%), had low physical activity (93.1%), had obesity (88.0%), had central obesity (86.3%), and smoked (84.6%). In addition, respondents who suffered DM >5 years was 91.2%, antihypertensive drug consumption was 90.0%, fasting blood glucose levels ≥126 mg/dl was 86.0%, and impaired sexual desire 91.7%. The Table 1 also shows the association of independent variables with ED status. These results revealed that the variable of the aging process and the duration of DM were associated with the occurrence of ED among males with DM with $p$ = 0.013 and $p$ = 0.016, respectively. It means that there are difference in the proportion of clinical phase (age ≥46 years) which is higher in the incidence of erectile dysfunction compared to the transitions phase (age 36–45 years) and subclinical phase (age 25–35 years).

## DISCUSSION

Our study found that the magnitude of ED among males with DM was 84.4%, which is higher than previous studies in France (71%), Egypt (63.6%), and Jordan (62%), but lower than the previous study in Ethiopia (85.5%).[14–17] This difference may be affected by the study population, methods used in the study, and the local culture. The results of our study revealed that the duration of DM and the aging process were associated with ED. The risk factor for ED was ≥46 years old ($p$ = 0.013, OR = 1.11 (confidence interval [CI] = 1.02–1.20). The results of this study are parallel with those of other studies that showed erectile function correlated with the aging process ($p$<0.001).[18,19] The previous study found that increasing age has a 2.5 fold higher risk for ED among Brazilian males compared with the Massachusetts male aging study.[20] Another study conducted in Turkey and the University College Hospital found that the risk of erectile dysfunction was higher in the older age.[21,22] It means that age-related increase in ED due to physical and psychological factors in human decrease by time.

A disturbance occurred in the hypothalamus-hypophysis-gonadal axis that supports testosterone levels. With increasing age, there is also a reduction in testicular activity that will affect hormone regulation from the hypothalamic-pituitary feedback system. The aging process is closely correlated with ED in people with DM. The older a person gets, the higher the risk of ED. The aging process causes the reduction of nitric oxide synthesis. The decrease in nitric oxide can lead to endothelial function disorders that can cause ED in older men.[23] It has been established in over 80% of ED cases caused by organic factors, that common vascular alterations play important roles in severe endothelial dysfunction.[24] In the aging process, there is a decrease in several sex hormones, specifically testosterone and dehydroepiandrosterone, and an increase associated with luteinizing hormones (LH), follicle-stimulating hormone, and sex hormone-binding globulin (SHBG). The relationship between testosterone and ED depends on the level of gonadotropin. Testosterone is associated with ED only in men with high LH levels. Also, SHBG levels increase with age, and SHBG is the primary carrier of sex hormones in human plasma. When SHBG levels are low, there will be an increase in the production of androgen hormones in the adrenal glands, which have a weak (or even a threshold) effect on erectile function. Besides, the interaction between androgen deficiency and endothelial dysfunction in people with DM can cause ED.[13–22]

The results showed respondents with ED who were suffering >5 years with DM ($p$ = 0.016, OR = 3.34 [CI = 1.25–8.89]). The longer a person has DM, the greater the risk of experiencing ED. These results are parallel with those of previous studies showing an association between the duration of DM and the occurrence of ED with an adjusted OR of 3.97.[17] It was stated that men who were living with DM for more than 10 years were four times more likely experienced erectile dysfunction as compared with those who are living with it for 5 years and less. Bacon et al[25] found that a man with type 2 DM had an increasingly greater risk of ED with increased duration since his diagnosis (trend test $p$<0.001) (relative risk = 1.7, 95% CI = 1.1–2.7, for men diagnosed >20 years previously). Roth et al[26] found

**Table 1.** The association of independent variables with the status of erectile dysfunction

| Variables | Males with DM, n (%) (N = 122) | Sexual function, n (%) | | *p* |
|---|---|---|---|---|
| | | Dysfunction | Normal | |
| The aging process | | | | **0.013*** |
| Clinical phase | 111 (91.0) | 96 (86.5) | 15 (13.5) | |
| Transitions phase | 9 (7.4) | 6 (66.7) | 3 (33.3) | |
| Subclinical phase | 2 (1.6) | 1 (50.0) | 1 (50.0) | |
| BMI | | | | 0.425 |
| Obesity | 25 (20.5) | 22 (88.0) | 3 (12.0) | |
| Central obesity | 51 (41.8) | 44 (86.3) | 7 (13.7) | 0.939 |
| Normal | 62 (50.8) | 52 (83.9) | 10 (16.1) | |
| Underweight | 35 (28.7) | 29 (82.9) | 6 (17.1) | |
| Blood sugar level | | | | 0.328 |
| High | 107 (87.7) | 92 (86.0) | 15 (14.0) | |
| Normal | 15 (12.3) | 11 (73.3) | 4 (26.7) | |
| Duration of DM | | | | **0.016*** |
| >5 years | 57 (46.7) | 52 (91.2) | 5 (8.8) | |
| 1–5 years | 56 (45.9) | 46 (82.1) | 9 (16.0) | |
| <5 years | 9 (7.4) | 5 (55.6) | 4 (44.4) | |
| Stress of work | 52 (42.6) | 46 (88.5) | 6 (11.5) | 0.153 |
| Physical activity | | | | 0.615 |
| Low | 29 (23.8) | 27 (93.1) | 2 (6.9) | |
| Moderate | 61 (50.0) | 47 (77.0) | 14 (23.0) | |
| High | 32 (26.2) | 29 (90.6) | 3 (9.4) | |
| Impaired sexual desire | 24 (19.7) | 22 (91.7) | 2 (8.3) | 0.814 |
| Consumption antidepressants or antihypertensives drugs | 30 (24.6) | 27 (90.0) | 3 (10.0) | 0.987 |
| Smoking | 39 (32.0) | 33 (84.6) | 6 (15.4) | 0.773 |
| Education | | | | 0.303 |
| Elementary School | 25 (20.5) | 25 (100.0) | 0 (0.0) | |
| Junior High School | 19 (15.6) | 17 (89.5) | 2 (10.5) | |
| Senior High School | 61 (50.0) | 46 (75.4) | 15 (24.6) | |
| Higher Education | 17 (13.4) | 15 (88.2) | 2 (11.8) | |
| Occupation | | | | 0.169 |
| Farmer | 4 (3.3) | 4 (100.0) | 0 (0.0) | |
| Construction workers | 5 (4.1) | 5 (100.0) | 0 (0.0) | |
| Driver | 15 (12.3) | 14 (93.3) | 1 (6.7) | |
| Government employee | 11 (9.0) | 10 (90.9) | 1 (9.1) | |
| Non-government employee | 7 (5.7) | 5 (71.4) | 2 (28.6) | |
| Trader | 4 (3.3) | 4 (100.0) | 0 (0.0) | |
| Unemployment | 17 (13.9) | 15 (88.2) | 2 (11.8) | |
| Retired | 22 (18.0) | 19 (86.4) | 3 (13.6) | |
| Entrepreneur | 37 (30.3) | 27 (73.0) | 10 (27.0) | |

DM=diabetes mellitus; BMI=body mass index

*Multivariate logistic regression model and stepwise forward and backward

that the variables of DM duration were significantly and independently associated with ED among men with DM in the multivariate model: current hemoglobin A1c (HbA1c) value ≥7.9% (OR = 2.11, 95% CI = 1.43–3.11, $p$<0.001), a 5-year increase in the patient's age (OR = 1.26, 95% CI = 1.15–1.39, $p$<0.001), disease duration ≥9 years (OR = 2.11, 95% CI = 1.42–3.10, $p$<0.001), and the interaction term between DM duration and HbA1c (OR = 2.50, 95% CI = 1.16–5.38, $p$ = 0.02). It was mentioned that the prevalence of ED increased more steeply with diabetes duration among men with HbA1c values equal to or above the median. The previous study also reported that men who had DM for >10 years had ED more than those who had history of <5 years.[27] This was because the duration of DM was associated with prolonged hyperglycemia that leads to the formation of advanced glycosylation end products (AGEs). These AGEs are highly toxic and destroy all body proteins, including nerve cells; they result in diabetic neuropathy. In men, the total testosterone level and high SHBG are positively related to the duration of DM. The duration of DM and the diagnosis of ED showed that male patient, which diagnosed with DM at younger age, tend to experience ED earlier than the older one. The longer a person has DM, the more severe the degree of ED. This is because the duration of DM is associated with prolonged hyperglycemia, which causes the formation of AGEs. The formation of AGEs and sorbitol causes the synthesis and function of nitric oxide (NO) to decrease. This low NO coupled with low myoinositol in nerve cells results in diabetic neuropathy.[13] The duration of DM and other microvascular complications (retinopathy, neuropathy, and nephropathy) is a predictor of ED.[28] The aging process is also associated with the production of AGEs, and DM is characterized by an increase in the production of AGEs. AGEs increase free radicals and inhibit endothelial function so that NO levels decrease and ED occurs. Also, the aging process that occurs in men with DM is due to changes in collagen from the corpora cavernosa. At the molecular level, changes in apoptosis and transforming growth factor beta are also related to the penis. Some of these changes affect the mechanism involved in vasodilation, so the vasoconstriction of blood vessels and peripheral nerves of the reproductive organs causes disruption of flow to the corpora thereby disrupting their erectile ability.[13]

The limitation of this study is that some information might be biased for certain variables, such as sexual desire level and smoking status, because these variables were asked directly to the participants answering the questionnaires, at their houses, in the evening, when their spouses were also at home. Therefore, respondents might have been reluctant to be honest about their smoking habits and level of sexual desire. It is also possible that interviews conducted in the afternoon or evening after working hours affected respondents' answers because of fatigue.

In conclusion, the prevalence of ED in primary health care remains high, and the risk of ED is increased by the duration of suffering from DM for more than five years and the aging process. It is recommended to prevent the incidence of DM in its subclinical stages by introducing several lifestyle interventional trials that aim to ameliorate modifiable risk factors, including diet, exercise, and not smoking, to reduce the incidence of DM, weight retention, and other obesity-related morbidities.

**Conflicts of Interest**

The authors affirm no conflict of interest in this study.

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