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ORIGINAL ARTICLE

Risk factors of early onset type 2 diabetes mellitus in young adults ≤ 40 years old

Burhan Gunawan[1,2], Soesilowati Soerachmad[1], Liana Dewi Hendrawan[1,2], Johana Titus[1], and Vira Cendana[1]

[1]Sumber Waras Hospital, West Jakarta, Indonesia
[2]Diabetes Initiative Indonesia

burhangunawan99@gmail.com

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ABSTRACT

BACKGROUND

The global prevalence of type 2 diabetes mellitus (T2DM) in adolescents and young adults is dramatically increasing. The aim of this study was to explore numerous risk factors for the occurrence of Pre-DM or T2DM in subjects aged ≤40 years.

METHODS

A cross-sectional study was conducted involving 100 subjects (50 subjects in the Pre-DM/T2DM group and 50 subjects in the Non Pre-DM/T2DM group). Main inclusion criteria: age ≤40 years, registered in our Diabetes and Endocrine Clinic. Data extracted included demographic, lifestyle, anthropometric, psychosocial, and family history data. Statistical analysis by binary logistic regression model. Results were considered significant at $p < 0.05$

RESULTS

There were no differences in demographic variables between the two groups. Multivariate analysis showed that cigarette smoking [aOR 3.17 (95% CI: 1.11-11.28)], hypertension [aOR 2.48 (95% CI: 1.23-7.19)] obesity [aOR 5.11 (95% CI: 2.12-8.21)], history of excessive calorie intake [aOR 3.40 (95% CI: 1.54-5.55)], poor stress management [aOR 2.33 (95% CI: 1.04-3.88)], depression [aOR 5.17 (95% CI:1.63-8.26)], short sleep duration [aOR 2.72 (95% CI: 1.25-6.95)], physical inactivity [aOR 6.14 (95% CI: 1.41-9.22)], family history of T2DM [aOR 6.29 (95% CI: 2.61-9.27)], family history of hypertension [aOR 5.26 (95% CI: 2.18-8.91] were significant influential risk factors of Pre-DM/T2DM.

CONCLUSION

The most influential risk factor for the occurrence of early onset T2DM among young adults was family history of T2DM. Screening of family members of T2DM patients may lead to early intervention and reduced risk of subsequent complications.

Keywords: Pre-diabetes, type 2 diabetes mellitus, lifestyle, anthropometric, psychosocial, family history, young adults

INTRODUCTION

The incidence of diabetes and obesity is steadily increasing worldwide, while the onset is getting younger. The rising number of young people with type 2 diabetes mellitus has become of particular concern. According to International Diabetes Federation (IDF) Diabetes Atlas 2021, there were 537 million people diagnosed with diabetes, and this number is predicted to increase by 46% in 2045. In the western Pacific region, which includes Indonesia, by 2021 there were 206 million people diagnosed with diabetes. Among that number, about 35% of people were under 45 years old when diagnosed with type 2 diabetes.[1] According to Indonesian Basic Health Research 2018, the prevalence of patients with diabetes mellitus aged ≥15 years in Indonesia was 2% based on clinical diagnosis and 8.5% based on blood glucose measurement. The prevalence of diabetes in persons under 45 years of age in Indonesia is 1.4%, which steadily increases along with age.[2]

The recent increase in the incidence rates of obesity and smoking, and the presence of nutritional imbalances are the primary factors affecting the increasing incidence rate of diabetes among adolescents.[3,4] Obesity increases the risk of type 2 diabetes in children and adolescents by more than 4-fold.[4] Other potentially modifiable risk factors include reduced energy expenditure, depressed mood, and sleep-related disorder.[5] Recent evidence suggests that adolescent T2DM is an aggressive disease with some early and rapidly progressing complications, including 6.15-fold increased risk of all vascular diseases compared to adolescents without diabetes. New strategies are needed for adolescents and families to engage in sustainable lifestyle changes for better control and slower disease progression.[3,5,6]

In 2018, the American diabetes Association (ADA) recommended a risk-based screening for prediabetes and/or T2DM in children who have overweight/obesity and have one or more other diabetes risk factors.[6] The identification of the various factors involved in the onset of diabetes motivates the need for ongoing research to achieve disease prevention.[5] The national survey in Vietnam of Phan et al.[7] with subjects aged 30-69 years (mean age 49.62 ± 0.15 years) shows that hypertension, BMI, education level, and job were associated with T2DM or Pre-DM. However, the investigators did not analyze the risk factors in the age group of <40 years. The quite similar study of Tanoey et al.[8] in Indonesian families shows that living in urban areas and having high education increased the risk of early-onset diabetes. However, the latter study was based on survey and did not explore the multifactorial risk factors in the occurrence of early-onset diabetes.

A 9-year prospective study by Yeh et al.[9] on 15,792 non-diabetic patients aged 45-64 years showed interesting results. The researchers identified that cigarette smoking was a risk factor for incident diabetes, but that smoking cessation was associated with increased risk in the short term, although the results were still inconclusive. The study by Aravinda et al.[10] on 519 T2DM subjects (mean age 53.28 years) showed that obesity, maternal history of T2DM, and consanguinity increased the incidence of early onset type 2 diabetes.

Although the increasing prevalence of diabetes among older adults is well recognized, the rising number of young people with type 2 diabetes is a more recent development and is of particular concern. An earlier onset of diabetes leads to longer lifetime exposure to hyperglycemia and consequently greater propensity for long-term complications. The upward trend of early-onset T2DM is associated with numerous different risk factors, which demonstrate the disease's multifactorial character. Also, attributable risk factors for early onset T2DM in different countries are unclear, which might limit the establishment of effective measures to deal with the problem at the global, national, and regional levels.

Our study was to explore several risk factors of T2DM (demographic, anthropometric, psychological, lifestyle, family history), exclusively in subjects under 40 years old.

METHODS

Research design

A cross-sectional study was conducted at Sumber Waras Teaching Hospital (affiliated hospital of Faculty of Medicine, Tarumanagara University), West Jakarta, Indonesia. The study period was from January 2023 to February 2024.

Research subjects

Subject selection used non-probability sampling with consecutive sampling method. The inclusion criteria were subjects aged ≤40 years and registered at the Diabetes and Endocrine Clinic of Sumber Waras Hospital. Patients were excluded if they showed characteristics of type 1 diabetes mellitus (history of diabetic ketoacidosis, regular use of insulin, symptomatic hyperglycemia), had a

history of steroid usage in the past 3 months, had developed macrovascular complications, and could not complete history taking and physical examination. Informed consent was requested from all subjects. Subjects with normal fasting blood glucose (FBG) and no history of taking antidiabetic medications were classified as non-PreDM/T2DM.

The sample size determination was based on the formula below:

$$n1=n2=\frac{(Z\alpha\sqrt{2PQ}+Z\beta\sqrt{P1Q1+P2Q2})^2}{(P1-P2)^2}$$

n1= sample size in T2DM group
n2= sample size in non-T2DM group
P1= prevalence of obesity in T2DM group =0.82 and P2= prevalence of obesity in non-T2DM group = 0.6 [11]
Zα (level of significance 0.05) = 1,96; Zß (power) = 0.842
P = ½ (P1 + P2) = 0.71; Q = 1-P = 0.29
Q1 = 1-P1 = 0.18; Q2 = 1-P2 = 0.4
The optimum sample size was 50 for each group.

Data collection

Data extracted included demographic variables (age, sex, history of living, education status, economic status, occupation), lifestyle variables (smoking, alcohol consumption, excessive nutrient intake, physical inactivity), anthropometric variables (obese history, weight, height, body mass index, waist circumference), psychosocial variables (health perception, stress management, depression, sleep duration), and family history (obesity, diabetes mellitus, hypertension, dyslipidemia). For the subjects with normal BMI, obese history was defined as history of obesity (BMI ≥25kg/m^2) in the last 6 months. Excessive calorie intake was measured based on food recall in the last 7 days. Daily calorie intake of more than standard requirement (based on sex, weight, activity, stress factor) was defined as excessive. Short sleep duration was defined as sleep at night of less than 6 hours.

Health and stress management

For evaluation of the health and stress management variables, we used the Stress Questionnaire by International Stress Management Association, with a total of 25 questions (1 point per question). A cut-off score of more than 5 was considered poor health perception and stress management.[12]

Depression

For the depression variable, we used the Patient Health Questionnaire (PHQ-9), with 9 questions (0-3 points per question). A cut-off score of more than 9 was considered as indicating positive depressive symptoms.[13]

Measurements

All subjects were tested for fasting blood glucose (FBG) and blood pressure. Subjects were categorized as pre-diabetes if FBG was 100-125 mg/dL and as diabetes mellitus if FBG ≥ 126mg/dL based on ADA criteria for diagnosis of diabetes mellitus.[6] All patients were requested to fast minimally for 8 hours, based on *Perhimpunan Endokrinologi Indonesia* (PERKENI) guideline on Diagnosis of Diabetes Mellitus Type 2 2021.[14]

Outcome of the study

The primary outcome of the study was to explore the significance of independent diabetes risk factors in the occurrence of pre-diabetes or type 2 diabetes mellitus in young adults (T2DMY). The secondary outcome explored the significant independent diabetes risk factors only for newly diagnosed T2DMY. Subjects were considered to be newly diagnosed T2DM or pre-DM if there was no previous history in the medical record, or if the subjects were diagnosed at their first visit to our clinic. Patients routinely treated in our clinic were not included in this analysis.

Statistical analysis

For data normality analysis the Kolmogorov-Smirnov test was used. If the data set showed a p-value of >0.05, categorical data was presented as a percentage, while numerical data was presented as mean ± standard deviation (SD). All variables were converted into binary data. First all variables were run in simple binary logistic regression, then variables with $p<0.25$ were subjected to multivariate binary logistic regression. This analysis was done for primary and secondary outcomes. Interpretation included p value, adjusted odds ratio, and 95% confidence interval (95% CI). For statistical analysis SPSS software (version 26.00) was used. The significance level was set at $p<0.05$ for multivariate analysis.

Ethical clearance

To protect the human rights of the study participants, this study was approved by the Sumber Waras Teaching Hospital institutional review board under No. 01/RSSW/KoM.EP/EC/I/2024. Patients were

invited to participate in the study after the researchers gave them an overview of the study, following which the participants completed an informed consent form.

RESULTS

Subject characteristics

Among the total number of 100 subjects, there were 25 subjects (25.00%) between 36-40 years of age. Most of the subjects lived in an urban area (59.0%), had low education level (65.0%), and high-middle class economic status (87.0%). Pre-diabetes and diabetes was diagnosed in 35.0% and 15.0% of subjects, respectively. The percentage of overweight and obesity were 41.0% and 25.0%, respectively. Family history of diabetes mellitus was found in 31.0% of subjects. Complete characteristics of the subjects are presented in Table 1.

Primary outcome

The analysis with simple binary logistic regression for each variable showed that living in urban area [OR 1.27 (95% CI: 0.86-1.99), cigarette smoking [OR 2.97 (95% CI: 1.11-6.47)], hypertension [OR 1.48 (1.23-7.19)], obesity [OR 13.21 (95% CI: 1.43-22.12)], history of excessive calorie intake [OR 3.39 (95% CI:1.54-7.53)], poor health perception [OR 2.97 (95% CI: 0.88-4.99)], poor stress management [OR 6.73 (95% CI: 1.84-9.88)], depression [OR 2.17 (95% CI: 1.23-5.36)], short sleep duration [OR 5.73 (95% CI: 1.15-8.45)], physical inactivity [OR 8.14 (95% CI: 3.40-10.22)], family history of T2DM [OR 3.29 (95% CI:1.66-7.37)], family history of hypertension [OR 5.16 (95% CI: 1.28-8.80], and family history of dyslipidemia [OR 2.03 (95% CI: 0.91-7.93] influenced the occurrence of Pre-DM/T2DM significantly.

Then variables with p value <0.25 were included into multivariate binary logistic regression. The independent variables with significant results were cigarette smoking [aOR 3.17 (95% CI: 1.11-11.28)], hypertension [aOR 2.48 (95% CI: 1.23-7.19)], obesity [aOR 5.11 (95% CI: 2.12-8.21)], history of excessive calorie intake [aOR 3.40 (95% CI: 1.54-5.55)], poor stress management [aOR 2.33 (95% CI:1.04-3.88)], depression [aOR 5.17 (95% CI:1.63-8.26)], short sleep duration [aOR 2.72 (95% CI: 1.25-6.95)], physical inactivity [aOR 6.14 (95% CI: 1.41-9.22)], family history of T2DM [aOR 6.29 (95% CI: 2.61-9.27)], and family history of hypertension [aOR 5.26 (95% CI: 2.18-8.91]. Complete analysis and interpretation is shown in Table 3.

Table 1. Distribution of the sociodemographic characteristics and clinical features of the subjects (n=100)

Variables	n (%)
Age group (years)	
18-25	9 (9.0)
26-30	20 (20.0)
31-35	46 (46.0)
36-40	25 (25.0)
Sex	
Male	16 (16.0)
Female	84 (84.0)
History of living	
Urban	59 (59.0)
Rural	41 (41.0)
Education	
High level	35 (35.0)
Low level	65 (65.0)
Economic Status	
High-Middle Class	87 (87.0)
Low Class	13 (13.0)
Blood Pressure	
Hypertension Grade 1	36 (36.0)
Hypertension Grade 2	16 (16.0)
Diabetes Profile	
Pre-diabetes	35 (35.0)
Diabetes mellitus	15 (15.0)
Non-diabetic	50 (50.0)
Anthropometric Profile	
Underweight	6 (6.0)
Normoweight	28 (28.0)
Overweight	41 (41.0)
Obese grade 1	20 (21.0)
Obese grade 2	5 (5.0)
Lifestyle Variable	
Smoking History	35 (35.0)
Alcohol History	3 (3.0)
Excessive Calorie Intake History	40 (40.0)
Psychological Profile	
Good Health Perception	89 (89.0)
Good Stress Management	82 (82.0)
Depression History	22 (22.0)
Shorter sleep duration (<6 hours)	26 (26.0)
Physical Activity	
None	46 (46.0)
1-3 times/week	29 (29.0)
4-7 times/week	25 (25.0)
Family History	
Obesity	27 (27.0)
Diabetes mellitus	31 (31.0)
Hypertension	40 (40.0)
Dyslipidemia	25 (25.0)

Table 2. Risk factors for the occurrence of type 2 diabetes mellitus (T2DM) or pre-DM by simple binary logistic regression

Variable	Odds Ratio (95% CI)	p value
Sex (Female)	0.65 (0.09-1.59)	0.691
History of living (Urban area)	1.27 (0.86-1.99)	0.064*
Education (Low level)	0.79 (0.19-3.23)	0.997
Economic status (Low class)	0.35 (0.04-2.79)	0.337
Positive smoking history	2.97 (1.11-6.47)	0.038*
Positive alcohol history	1.07 (0.03-8.99)	0.524
High blood pressure (>140mmHg)	1.48 (0.35-6.28)	0.000*
High body mass index (>25kg/m2)	13.21 (1.43-22.12)	0.000*
High waist circumference (>80cm)	1.27 (0.04-1.91)	0.002*
Positive obese history	0.81 (0.19-3.42)	0.886
Excessive calorie intake history	3.39 (1.54-7.53)	0.000*
Poor health perception	2.97 (0.88-4.99)	0.108*
Poor stress management	6.73 (1.84-9.88)	0.04*
Positive depression history	2.17 (1.23-5.36)	0.001*
Shorter sleep duration (<6 hours)	5.73 (1.15-8.45)	0.003*
Physical inactivity	8.14 (3.40-10.22)	0.002*
Family history of obesity	0.11 (0.01-0.89)	0.251
Family history of diabetes mellitus	3.29 (1.66-7.37)	0.000*
Family history of hypertension	5.16 (1.28-8.80)	0.000*
Family history of dyslipidemia	2.03 (0.91-7.93)	0.036*

*Considered p value <0.25

Table 3. Risk factors for the occurrence of type 2 diabetes mellitus (T2DM) or pre-DM by multivariate binary logistic regression

Variable	Adjusted Odds Ratio (95% CI)	p value
History of living (Urban area)	0.47 (0.05-1.30)	0.073
Positive smoking history	3.17 (1.11-11.28)	0.025*
High blood pressure (>140mmHg)	2.48 (1.23-7.19)	0.000*
High body mass index (>25kg/m^2)	5.11 (2.12-8.21)	0.000*
High waist circumference (>80cm)	3.17 (2.04-5.91)	0.000*
Excessive calorie intake history	3.40 (1.54-5.55)	0.000*
Poor health perception	2.17 (1.08-3.89)	0.028*
Poor stress management	2.33 (1.04-3.88)	0.025*
Positive depression history	5.17 (1.63-8.26)	0.000*
Shorter sleep duration (<6 hours)	2.72 (1.25-6.95)	0.023*
Physical inactivity	6.14 (1.41-9.22)	0.000*
Family history of diabetes mellitus	6.29 (2.16-9.27)	0.000*
Family history of hypertension	5.26 (2.18-8.91)	0.000*
Family history of dyslipidemia	2.03 (0.51-3.63)	0.074

*Considered significant (p value <0.05)

Secondary outcome

The sub-analysis was carried out by excluding T2DM subjects who had received therapy. The aim of this sub-analysis was to compare only those subjects who were newly diagnosed with pre-diabetes or diabetes mellitus at the time this study was conducted. The analysis with simple binary logistic regression showed that low education level [OR 1.22 (95% CI: 0.19-2.27)], low economic status [OR 1.35 (95% CI: 0.14-2.73)], cigarette smoking [OR 1.27 (95% CI: 0.11-2.47)], hypertension [OR 4.48 (95% CI:

1.40-6.28)], obesity [OR 5.21 (95% CI: 1.43-10.12)] , excessive calorie intake [OR 3.39 (95% CI: 1.54-5.57)], poor stress management [OR 6.13 (95% CI: 1.74-10.18)], depression [OR 4.67 (95% CI: 1.53-8.34)], short sleep duration [OR 6.73 (95% CI: 1.15-10.15)], physical inactivity [OR 5.15 (95% CI: 1.41-8.82)], positive family history of T2DM [OR 6.29 (95% CI: 1.66-9.67)], family history of hypertension [OR 3.16 (95% CI: 0.78-5.80)], and family history of dyslipidemia [OR 2.03 (95% CI: 0.61-8.13)] significantly influenced the occurrence of pre-DM/T2DM. Complete analysis interpretation is shown in Table 4.

The multivariate binary logistic regression was done only for variables with p value <0.25. The independent variables with significant results were cigarette smoking [aOR 3.47 (95% CI: 1.21-5.17)], hypertension [aOR 4.88 (95% CI: 1.12-7.34)], obesity [aOR 5.12 (95% CI: 1.42-9.33)], history of excessive calorie intake [aOR 4.20 (95% CI: 1.14-8.17)], poor stress management [aOR 3.13 (95% CI: 1.14-6.28)], depression [aOR 4.67 (95% CI: 1.43-7.84)], short sleep duration [aOR 5.23 (95% CI: 1.25-8.25)], physical inactivity [aOR 6.24 (95% CI: 1.81-9.12)], family history of T2DM [aOR 6.29 (95% CI: 1.97-9.77)], and family history of hypertension [aOR 4.16 (95% CI: 1.48-7.10)]. Complete analysis and interpretation is shown in Table 5.

DISCUSSION

Our main analysis shows that the risk factors influencing the occurrence of pre-diabetes/diabetes mellitus before the age 40 years are cigarette smoking, hypertension, obesity, excessive calorie intake history, poor stress management, depression, short sleep duration, physical inactivity, family history of T2DM, and family history of hypertension. These results are consistent with the study by Tanoey et al.[8] on 31.610 participants under 40 years of age that showed a significant relationship between higher BMI and early-onset adult diabetes risk. The study also indicated that high education level and urban residential area in childhood posed a higher risk for young adults. The systematic analysis by Xie et al.[15] also stated that early onset type 2 diabetes is attributed to three main categories of risk factors: behavioral (poor diet, smoking, low physical activity), environmental, and high body mass index. Early-onset T2DM is strongly associated with obesity, metabolic syndrome features, insulin resistance, family history of T2DM, and an earlier start of insulin therapy.[5]

Table 4. Risk factors for secondary outcome (excluding treated type 2 DM subjects by simple binary logistic regression (n=36)

Variable	Odds Ratio (95% CI)	p value
Sex (Female)	0.75 (0.19-5.61)	0.610
History of living (Urban area)	0.39 (0.16-1.09)	0.307
Education (Low level)	1.22 (0.19-2.27)	0.235*
Economic status (Low class)	1.35 (0.14-2.73)	0.202*
Positive smoking history	1.27 (0.11-2.47)	0.222*
Positive alcohol history	0.72 (0.03-3.99)	0.761
High blood Pressure	4.48 (1.40-6.28)	0.008*
High body mass index (> 25kg/m^2)	5.21 (1.43-10.12)	0.003*
High waist circumference (>80cm)	3.27 (1.04-6.91)	0.007*
Obese history	2.81 (1.19-4.42)	0.021*
Excessive nutrition intake history	3.39 (1.54-5.57)	0.003*
Poor health perception	2.97 (0.28-30.99)	0.624
Poor stress management	6.13 (1.74-10.18)	0.014*
Positive depression history	4.67 (1.53-8.34)	0.003*
Shorter sleep duration (<6 hours)	6.73 (1.15-10.15)	0.000*
Physical inactivity	5.15 (1.41-8.82)	0.003*
Family history of obesity	0.11 (0.01-0.90)	0.370
Family history of diabetes mellitus	6.29 (1.66-9.67)	0.000*
Family history of hypertension	3.16 (0.78-5.80)	0.240*
Family history of dyslipidemia	2.03 (0.61-8.13)	0.031*

*Considered p value <0.25

Table 5. Risk factors for secondary outcome (excluding treated type 2 DM subjects by multivariate binary logistic regression (n=36)

Variable	Adjusted Odds Ratio (95% CI)	p value
Education (Low level)	1.32 (0.24-3.17)	0.435
Economic status (Low class)	1.25 (0.15-3.53)	0.312
Positive smoking history	3.47 (1.21-5.17)	0.032*
High blood pressure	4.88 (1.20-7.38)	0.000*
High body mass index (>25kg/m^2)	5.12 (1.42-9.33)	0.000*
High waist circumference (>80cm)	4.27 (1.02-6.80)	0.001*
Obese history	3.71 (1.14-5.62)	0.011*
Excessive nutrition intake history	4.20 (1.14-8.17)	0.002*
Poor stress management	3.13 (1.14-6.23)	0.024*
Positive depression history	4.67 (1.43-7.84)	0.002*
Shorter sleep duration (<6 hours)	5.23 (1.25-8.25)	0.001*
Physical inactivity	6.24 (1.81-9.12)	0.000*
Family history of diabetes mellitus	6.29 (1.97-9.77)	0.000*
Family history of hypertension	4.16 (1.48-7.10)	0.014*
Family history of dyslipidemia	1.03 (0.71-3.23)	0.231

*Considered significant (p value <0.05)

Our results show that obesity (high BMI, high waist circumference) were the independent variables for the premature occurrence of T2DM. Currently a global pandemic of overweight and obesity is emerging. Although the causes of obesity in adolescents are complex, it is clear that there are factors driving the increase of T2DMY. The increasing consumption of calorie-dense foods and sugar-rich drinks, and decreased physical activity are the main contributors amongst teenagers. Lack of physical activity is associated with increased risk of obesity, metabolic syndrome, hypertension, insulin resistance, and type 2 diabetes. Other risk factors are lifestyle preference for energy dense food, sedentary habit, and lack of availability or affordability of healthier options. Socio-economic deprivation is another risk factor for obesity and type 2 diabetes.[5,15-18]

We found that psychological problems and mental illness may influence the earlier onset of diabetes. Poor stress management, depression, and short sleep duration have a great impact on treated and newly diagnosed T2DM patients. Considering the concept of health as a set of biological, psychological, social, cultural, economic, and spiritual factors, it should be recognized that mental health has a great influence on the human body. These results are consistent with the study of Gafarov et al.[19] that found that the presence of depression and a low level of social connections increased the incidence of type 2 diabetes. Depression increased the risk of type 2 diabetes by 1.8 times, which demonstrated the independent effect of depression in T2DM.

Our analysis shows that family history of non-communicable disease (T2DM, hypertension) has significant impact on the onset of T2DM. There is an inverse association between the strength of a family history of T2DM and age of onset of T2DM. The age of onset of diabetes is reduced by 1.7 years for every 10% increase in the number of family members affected by diabetes. Younger subjects with T2DM have a stronger and different genetic predisposition than older subjects. The high prevalence of parental T2DM in subjects diagnosed with T2DMY may reflect a stronger genetic predisposition.[5,20]

Early onset type 2 diabetes is increasingly prevalent and has a major impact on the burden of the disease.[8] This fact constitutes a worrisome signal because early-onset diabetes has a greater impact on comorbidities and quality of life due to longer duration of the disease and more aggressive disease course.[8,21.22] Patients with T2DMY have the highest excess risk and hazard ratio for heart failure, coronary heart disease, and death.[23] Strati et al.[24] stated that mortality and lifetime risk for developing microvascular complications is increased in early-onset T2DM due to rapid progression of insulin resistance and beta cell dysfunction.

The prospective study of TODAY Study Group [25] about the long-term complications in youth-onset type 2 diabetes with a total of 500 participants (mean age 26.4 ± 2.8 years), showed that the cumulative incidence of hypertension was 67.5%, of dyslipidemia 51.6%, diabetic kidney disease 54.8%, neurological disease 32.4%, and retinal disease 13.7%. Recent studies also found inverse associations of age at T2DM diagnosis with all-cause mortality and complications.[23,26,27] Moreover, additional complications such as subclinical hearing impairment, infertility, and depression were also found in young patients with T2DM.[11,29]

Numerous modifiable and non-modifiable risk factors have been reported that may induce the early onset of T2DM. This evidence strengthens the support for preventing/delaying the onset of T2DM in younger adults.

This study has several limitations; the first is the fact that this is not a large-scale and multi-center study. Second, without the inclusion of more objective laboratory data there is the possibility of bias during data extraction.

This study brings the evidence to support early screening for T2DM in high-risk patients with obesity, hypertension, sedentary lifestyle, and positive family history of metabolic disease. This study also supports the evidence that patients with psychological problems and mental illness need greater attention and early screening for T2DM. Comprehensive prevention, diagnosis, and management of early-onset T2DM may delay the occurrence of progressive complications. For the future, understanding how various risk factors interact with each other will be crucial. With a better understanding of the risk factors, the focus could shift towards identifying pre-diabetic individuals and implementing interventions to prevent the onset of T2DM.

CONCLUSION

This study demonstrated that the most influential risk factor of early-onset T2DM was family history of T2DM in young adults. Comprehensive cardiometabolic screening is needed for high-risk patients and family members, as well as for individuals with mental illness. Early onset diabetes has a higher impact on comorbidities and quality of life of the individuals.

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Autor Contributions

BG, SS, LD, JT conceptualized the study design, as well as reviewed the manuscript. BG, VC supervised the data collection, data analysis, interpretation of findings, and reviewed the drafts. All authors have read and approved the final version of the manuscript prior to submission.

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Conflict of Interest

The authors affirm that there is no conflict of interest in this study.

Data Availability Statement

The data that support the study findings are available at Sumber Waras Hospital Medical Record Database. For further inquiries, please contact the corresponding author.

Declaration of Use of AI in Scientific Writing

Nothing to declare.

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