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Prevalence of Gestational Diabetes Mellitus Risk in Multigravida Pregnant Women Using D3MG Application

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ABSTRACT

Background: Pregnant women have a risk of exposure to gestational diabetes mellitus. The first step that can be done is to detect the risk of gestational diabetes mellitus. The aim study to access the description of the prevalence of gestational diabetes mellitus risk.
Method: The study design was descriptive with a cross sectional approach. This involved 70 pregnant women who were selected by purposive sampling. Data collection using the D3MG application.
Results: The prevalence of gestational diabetes mellitus risk were BMI ≥ 30 kg/m^2 as 2.7% (OR = 5.600; 95% CI = 1.729 – 18.141), family history 8.6% (OR = 7.308; 95% CI = 0.806 – 66.231), history giving birth to dead babies and abortion 20%(OR = 0.304; 95% CI = 0.204 – 0.451), low physical activity before pregnancy 54.3%(OR = 2.718; 95% CI = 1.016 – 7.268), low physical activity during pregnancy 95.7% (OR = 4.148; 95% CI = 1.053 – 16.343), eating habits – sugary foods 4.3% (OR = 2.621; 95% CI = 0.226 – 30.328), eating habits and foods containing high cholesterol 2.9% (OR = 0.426; 95% CI = 0.324 – 0.562), and the duration of poor sleep 24.3% (OR = 6.319; 95% CI = 1.799 – 22.203). Pregnant women who are at low risk of exposure gestational diabetes mellitus 55.7% and high risk 44.3%.
Conclusion: There are pregnant women who have a low risk of exposure gestational diabetes mellitus detected by the application D3MG, however preventive efforts must continue to be done to prevent the occurrence of gestational diabetes mellitus and improve fetal well-being.
Keyword: gestational diabetes mellitus, Multigravida, m-health
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INTRODUCTION

A healthy and normal pregnancy is a dream for every woman in the world. However complications during pregnancy can occur. One complication in pregnancy is gestational diabetes mellitus (Alfadhli, 2015). Gestational diabetes mellitus occurs the first time during pregnancy and before pregnancy is never diagnosed with diabetes. This situation is characterized by abnormal blood sugar levels (Mack and Tomich, 2017).

Gestational diabetes mellitus occurs because the body is unable to digest glucose properly. During pregnancy metabolic activity increases which can cause hyperglycemia. Hyperglycemia occurs due to pancreatic β-cell dysfunction which results in chronic insulin resistance during pregnancy, therefore the need to maintain glucose balance in the body (Plows et al., 2018).

It is estimated that in 2019, there will be 20.4 million or 15.8% of pregnant women with hyperglycemia. 83.6% are gestational diabetes mellitus, 7.9% are diabetes detected before pregnancy, and 8.5% are type 1 and type 2 diabetes (Internation Diabetes Federation, 2019). The incidence of gestational diabetes mellitus in Asia is 11.5%, Southeast Asia and East Asia 10%(Lee et al., 2017)(Nguyen et al., 2018). Indonesia is a state of Southeast Asia. Based on the results of Soewondo & Pramono's research, the prevalence of gestational diabetes mellitus in Indonesia is 1.9% to 3.6% (Soewondo and Pramono, 2011).

Some risk factors of gestational diabetes mellitus are maternal age (Wang et al., 2016)(Hosseini et al., 2018)(Zheng et al., 2019)(Meharry et al., 2019), BMI> 30 kg / m^2 (Amiri et al., 2018)(Gracelyn and N., 2016)(Zheng et al., 2019)(Wang et al., 2016)(Meharry et al., 2019), family history of diabetes (Lin et al., 2016), history of previous gestational diabetes mellitus (Teh et al., 2011), history of abortion (A. Khalil, 2017), history of macrosomia (Rajput et al., 2014)(Liu et al., 2016)(Boghossian et al., 2017), history of gestational hypertension (Lee et al., 2017) (Meharry et al., 2019), history of preeclampsia (Lee et al., 2017), history of childbirth with congenital malformations (Anand et al., 2017), lipid levels increase from the first trimester to the third trimester (Farias et al., 2016), ethnicity (Wang et al., 2016), FPG and TG levels in early pregnancy (Zheng et al., 2019), and multigravida (Alharthi et al., 2018) (Schmidt et al., 2019). Furthermore, growing evidence suggests that hypertriglyceridemia (Ryckman et al., 2015) (Ghodke et al., 2017) and menarche are associated with gestational diabetes mellitus (Wang et al., 2019).

Gestational diabetes mellitus can cause long-term complications in mother and child (A et al., 2019). Among them, cesarean delivery, infants with Appearance, Pulse, Grimace, Activity, Respiration (APGAR) scores in one minute less than seven, respiratory distress, obesity, impaired glucose metabolism, and cardiovascular disease, and macrosomia (Hosseini et al., 2018) (McIntyre et al., 2019). Moreover, large pregnancies can occur for gestational age, infants with high adiposity, shoulder dystocia, cesarean section and preeclampsia (Farrar, 2016)(Liu et al., 2016). The risk of exposure type 2 diabetes mellitus in subsequent pregnancies, about three to six years after birth is greater in mothers with a history of gestational diabetes mellitus. The risk of obesity in children is higher in mothers with hyperglycemia (Internation Diabetes Federation, 2019).

Gestational diabetes mellitus is called the silent killer because most women do not know that they suffer or are at risk of exposure diabetes mellitus during pregnancy. Efforts have been made by the government to require pregnant women to carry out integrated antenatal care as a first step to prevent various diseases during pregnancy. On the integrated antenatal care examination form there is a systemic disease check sheet, one of which is a risk factor for gestational diabetes mellitus filled by a health worker and a temporary blood sugar check is performed if the mother is indicated by diabetes Mellitus, and there is no Standard Operating Procedure (SOP) on diabetes prevention and management frictional Mellitus. Moreover, data and reporting on the

incidence of gestational diabetes mellitus have not been comprehensively recorded at the Primary Health Care or Health Office so that to know the certainty the incidence of gestational diabetes mellitus is still difficult to predict.

Based on these problems, every pregnant woman must make early detection of the risk of gestational diabetes mellitus. This can be done early in pregnancy before 24 weeks of age with early detection based on risk factors for gestational diabetes mellitus. The reality that occurs, this detection has not been done by many mothers for various reasons. For example, distant health services, integrated antenatal care examination time that is not in accordance with the working hours of the mother so the mother must ask for permission one day, the mother is lazy to wait for a long time because the antenatal care examination can take up to an hour or more.

Researchers make a recent innovation in the world of health by utilizing mobile health technology (m-health) in the form of a smartphone to help mothers make early detection of the risk of gestational diabetes mellitus independently through the D3MG Application. The advantages of using m-health care cheaper, improve the quality of health services, prevention, better use of emergency response systems such as emergency care in midwifery, coordination, management and supervision of human resources, telemedicine diagnostics, short message services, decision making, and patient safety systems (Davey and Davey, 2014). The study results show, antenatal diabetes care contributes to improving maternal and fetal health (Stogianni et al., 2019)

D3MG application is an application to detect the chances of a pregnant woman to be at risk for gestational diabetes mellitus. The benefits of using the D3MG application aside from being able to be used independently by pregnant women, can be used by health workers in detecting the risk of gestational diabetes mellitus and data and reporting can be comprehensively recorded so that it can find out the incidence of mothers at risk of gestational diabetes mellitus. The aim study to access the description of the prevalence of gestational diabetes mellitus risk.

METHOD

Descriptive research with a cross-sectional approach conducted for two months at the Primary Health Care district of Gunungkidul, Yogyakarta Province, Indonesia. Empirical data on the incidence of gestational diabetes mellitus is not written in the report, but based on statements from several midwives at the Primary Health Care there were several cases of gestational diabetes mellitus in Gunungkidul district. This research involved humans as research subjects and was approved by the ethics committee of the is Universitas 'Aisyiyah Yogyakarta.

Sampling

This study involved 70 pregnant women who came to visit Primary Health Care. Samples were taken by purposive sampling according to inclusion criteria. Inclusion criteria were pregnant women over the age of 25 years, multigravida, physically and mentally healthy, and pregnant women who can read and write. Exclusion criteria were pregnant women who had been diagnosed with diabetes mellitus before marriage and pregnant women with Human Immunodeficiency Virus (HIV) and severe infections.

Collection Data

Data is collected using the D3MG application. The researcher installed the respondent's cellphone. If the respondent does not have a cellphone or does not carry a cellphone, the researcher provides a cellphone to fill in the data. Then the respondent fills in identity and conducts risk detection by answering questions containing risk factors for gestational diabetes mellitus in the D3MG application. After all questions have been answered, there will be a risk of an opportunity to exposure gestational diabetes mellitus. Are mothers at high or low risk? The data that has been collected is analyzed using a frequency distribution.

D3MG Application

D3MG application is an application for early detection of the risk of gestational diabetes mellitus based on risk factors. This application can predict a woman at low or high risk for diabetes mellitus during pregnancy. The D3MG application has passed the system feasibility test stage using black-box testing. black-box testing due diligence is a test carried out on the functions or processes in the application as well as testing of material risk factors for gestational diabetes mellitus in obstetrics and psychiatric experts. The test results found that all features and functions or processes of using the application have all been tested and functioning properly with the results of the feasibility test 54.1% (the system feasibility category including the category is quite feasible 41% - 60%).

RESULT

This study involved 70 pregnant women. The last education of mothers is an elementary school (14%), Junior High School (31.4%), Senior High School 38.6%, Diploma (1.4%), and bachelor (8.6%). Housewife occupation is the most frequently found work in this study 85.7%, employees, and farmers (3%), civil servants (2.9%), teachers, and entrepreneurs (1%). Family income per month is less than 1.6 million 75.7% and more than 1.6 million 24.3% (Table 1)

Table 1: Characteristics of Respondents

Characteristics of Pregnant Women	(n= 70)	(%)
Mother's Education		
Elementary School	14	20.0
Junior High School	22	31.4
Senior High School	27	38.6
Diploma	1	1.40
Bachelor	6	8.60

Characteristics of Pregnant Women		(n= 70)	(%)
Mother's Occupation			
Civil	Servants	2	2.90
Entrepreneur		1	1.40
Teacher		1	1.40
Employee		3	4.30
Farmer		3	4.30
Housewife		60	85.7
Family income (per mounth)			
< 1.6 million		53	75.7
≥ 1.6 million		17	24.3

Table 2 presents the risk factors for gestational diabetes mellitus. Mothers who have a Body Mass Index (BMI) > 30 kg / m^2 risk 5.6 times to exposure diabetes mellitus during pregnancy. The results present that 72.9% of mothers had a normal BMI and 27.1% were classified as obese. Mothers who have a family history of diabetes mellitus 8.6%. While mothers who have no family history of diabetes mellitus 91.4%. The risk of exposure gestational diabetes mellitus is 7 times.

Mothers with a history of giving birth to a deceased baby or a history of abortion have a risk of exposure gestational diabetes mellitus 0.3 times. 20% of mothers have experienced this and 80% have never. Other risk factors assessed are maternal physical activity before and during pregnancy. Physical activity in the form of light exercise such as morning walks every day for 30 minutes, gymnastics, and cycling. Poor physical activity before pregnancy 2.7 times the risk of exposure gestational diabetes mellitus. The percentage of physical activity before pregnancy is active (45.7%) and inactive (54.3%). While mothers who have poor or inactive activities during pregnancy are four times more likely to exposure gestational diabetes mellitus. 21.4% of mothers have good physical activity and 78.6% of mothers never exercise.

Risk factors that can trigger an increase in blood sugar levels during pregnancy are eating habits - sugary foods. 4.3% of mothers often eat sweet foods and 95.7% never or rarely eat sugary foods. These bad habits can lead to a risk of exposure gestational diabetes mellitus by 2.6 times. Eating habits of foods containing high cholesterol can also trigger gestational diabetes mellitus with a risk of 0.4 times. This study also assessed the duration of maternal sleep at night with a duration of sleep at night which is less than 7 hours at risk of exposure gestational diabetes mellitus by 6.3 times. Mothers have a normal duration of sleep (8-9 hours) of 75.7% and less than 7 hours of 24.3%.

The results did not show a history of gestational diabetes mellitus in a previous pregnancy, a history of giving birth to a large baby, a history of giving birth to a baby with congenital abnormalities or disabilities, a history of preeclampsia, a history of polycystic ovary syndrome (PCOS), and smoking. It can be concluded that bad habits before or during pregnancy can lead to gestational diabetes mellitus. Moreover, medical history must also be considered so that it can prevent disease early.

Table 2: Risk Factor of Gestational Diabetes Mellitus

Variables	(n=109)	(%)	OR	95%CI
BMI				
Normal	51	72.9	5.600	1.729 – 18.141
Obesity	19	27.1		
Family history				
Yes	6	8.60	7.308	0.806 – 66.231
Not	64	91.4		
History of gestational diabetes mellitus			-	-
Yes	0	0		
Not	70	100		
A history of giving birth to a big baby			-	-
Yes	0	0.00		
Not	70	100		
A history of giving birth to a dead baby	14	20.0	0.304	0.204 – 0.451
Yes	56	80.0		
Not				
Abortion history			0.304	0.204 – 0.451
Yes	14	20.0		

No	56	80.0		
History of giving birth to a baby with a congenital / disability			-	-
Yes	0	0		
Not	70	100		
History of preeclampsia				
Yes	0	0	-	-
Not	70	100		
History of Polycystic Ovarian Syndrome (PCOS)	0	0	-	-
Yes	70	100		
Not				
Cigarette smoking				
Yes	0	0	-	-
Not	70	100		
Physical activity before pregnancy				
Active	32	45.7	2.718	1.016 – 7.268
Not Active	38	54.3		
Physical activity during pregnancy				
Active	15	21.4	4.148	1.053 – 16.343
Not Active	55	78.6		
Eat sugary food				
Yes	3	4.30	2.621	0.226 – 30.328
Not	67	95.7		
Eat foods containing high cholesterol			0.426	0.324 – 0.562
Yes	2	2.90		
No	68	97.1		
Sleep duration at night				
8-9 hours	53	24.3	6.319	1.799 – 22.203
< 7 hours	17	75.7		

Table 3: Distribution Frequency Risk of Gestational Diabetes Mellitus

	(n=109)	(%)
Low risk	39	55.7
High risk	31	44.3

Table 3 presents the classification risk of gestational diabetes mellitus. Mothers classified as low risk 55.7% and high risk 44.3%. So, it can be concluded that most mothers have a low risk of exposure diabetes mellitus. This is influenced by the health history and habits of healthy mothers.

DISCUSSION

The result presents lower risk of exposure gestational diabetes mellitus. Even though mothers are at low risk for exposure gestational diabetes mellitus, mothers must remain vigilant for gestational diabetes mellitus by taking into account the risk factors that can be triggers for the chance of exposure gestational diabetes mellitus.

The highest risk factor for gestational diabetes mellitus in this study is family history. Pregnant women who have a family with gestational diabetes mellitus have a seven times greater risk than mothers who do not have a family history of diabetes mellitus. This is in line with research (Larrabure-Torrealva et al., 2018). Women who have families with diabetes mellitus are twice as likely to exposure diabetes mellitus during pregnancy.

Family history of diabetes including risk factors for gestational diabetes mellitus that must be considered so that early prevention can be done (Zokaie et al., 2012)(Gracelyn and N., 2016)(Geraghty et al., 2017)(Spracklen et al., 2014)(Cosson et al., 2017)(Zhao et al., 2018). In line with the research of Alharti, et al., Multigravida and a history of previous pregnancy diabetes mellitus were the two biggest risk factors for gestational diabetes mellitus (67.7%), compared to lack of knowledge, work in the medical field, be educated, and have a history of chronic illness (Alharthi et al., 2018).

Risk factors for gestational diabetes mellitus which were also assessed were sleep duration. The results showed the risk of gestational diabetes mellitus on sleep duration was 6.3 times. Most of the mother's sleep duration is normal. However, there are some mothers who have a short sleep duration of fewer than seven hours. This happens because the mother often urinates at night, making her feel uncomfortable which

makes it difficult to sleep. Sleep duration of fewer than seven hours at night can affect glucose metabolism, especially during pregnancy (Reutrakul et al., 2018). Poor sleep duration in early pregnancy and mid-pregnancy is associated with the development of risk of diabetes mellitus exposure during pregnancy (Xu et al., 2018). Another factor that also needs to be considered is maternal BMI in pregnant women. The results showed that most of the BMI of pregnant women's were normal. However, there are 19 pregnant women classified as obese. This can lead to mothers at risk for gestational diabetes mellitus. Obesity during pregnancy influences the incidence of gestational diabetes mellitus (Makgoba et al., 2012). Obesity during pregnancy influences the incidence of gestational diabetes mellitus. The risk of pregnant women exposure gestational diabetes mellitus is one time in obese pregnant women (Zhu et al., 2017). This is the same as research Gracelyn, et al., the risk of pregnant women with a BMI ≥ 30 kg / m^2 is four times (Gracelyn and N., 2016).

Sports activities, obesity, or overweight of pregnant women do not have a significant effect on the incidence of gestational diabetes mellitus (Amiri et al., 2019). The results of this study say differently, mothers who have a low physical activity before and during pregnancy are at risk of exposure diabetes mellitus twice and four times. Although the physical activity of the mother before and during pregnancy is low as mothers who rarely exercise, some mothers say during pregnancy feel lazy, do not want to do something. However, there are mothers who before pregnancy like to exercise such as gymnastics, cycling, and playing volleyball every afternoon and during pregnancy continue to exercise like a morning walk every day for 30 minutes. Women who have a low physical activity before becoming pregnant can double the risk of exposure diabetes mellitus during pregnancy (Amiri et al., 2018). Therefore, even though there are no restrictions on pregnancy except pregnant women in poor conditions such as asthma, heart disease, and others that can worsen the situation if the mother is a too high activity during pregnancy.

Women who have the habit of exercising before and during pregnancy such as swimming, cycling, a marathon can reduce the risk of diabetes mellitus during pregnancy (van Poppel et al., 2014). This is the same as research Ming, et al., during pregnancy, mothers can still exercise and have physical activity as usual before pregnancy because it can reduce the risk of exposure gestational diabetes mellitus and can maintain a balance of glucose metabolism in the body (Ming et al., 2018). Moreover, the physical activity of the mother before and during pregnancy, things to note are the habit of eating sugary foods and foods that contain high cholesterol during pregnancy at risk of exposure gestational diabetes mellitus twice and 0.4 times. Higher micronutrient intake, lower risk in gestational diabetes mellitus (Looman et al., 2019).

Gestational diabetes mellitus risk can be predicted by a pre-pregnancy body mass index (BMI) (Zheng et al., 2019)(Meharry et al., 2019). Therefore, pregnant women must be able to manage their diet properly and fulfill their needs. This can be the first step in preventing diabetes mellitus during pregnancy or other diseases.

pregnant women who have an unbalanced pattern of consumption such as consuming fruits and eating Sugary foods excessively have a 3-fold risk of exposure gestational diabetes mellitus (Ming et al., 2018). This is in line with research Mijatovic-vukas, et al., pregnant women who consume excessive meat can increase the risk of gestational diabetes mellitus (Mijatovic-Vukas et al., 2018). Moreover, in this study there were mothers who had a history of abortion and gave birth to a baby in a state of death with a risk of exposure chronic diabetes mellitus 0.3 times despite being classified as low risk, however, the mother must remain vigilant. In women who have high-risk cases for gestational diabetes mellitus in pregnancy it is highly recommended to reduce overweight and obesity (Muche et al., 2019).

Preventive efforts need to be done to reduce risk and make people aware, especially pregnant women, about gestational diabetes mellitus. Preventive efforts that can be done using the D3MG application. The D3MG application can be used by pregnant women independently to detect their risk of exposure to diabetes mellitus during pregnancy and after knowing the results, the mother can consult with health workers so that the health welfare of mothers and children is maintained. This is in line with research Moreira, et al., applying machine learning algorithms to data extracted from first-trimester health records to predict the risk of gestational diabetes mellitus at 24-28 weeks reaching AUC 0.86 and an accuracy of 62.2%. There are other studies, the ANN (RBFNetwork) based approach is an excellent predictor for gestational diabetes mellitus. This research provides a comprehensive decision-making model that can improve the care provided for women who are at risk of gestational diabetes mellitus (Moreira et al., 2018). The new national guidelines (NGL) also show screening tests correctly at 24 and 28 weeks of pregnancy (Lacaria et al., 2015).

Women with gestational diabetes mellitus are more effectively given solutions through m-health because they are young, still of reproductive age and generally technically educated. They are usually highly motivated to engage with health professionals and improve health to care for the exposure fetus. What's more, this intervention is short and time-limited. So that it can reduce the number of outpatients and provide cost savings for health care. Ultimately reducing the number of hospital visits.

The D3MG application has passed the black box testing due diligence with 54.1% and 45.9% worthy test results. This shows high usage and excellent adherence to the system. The combination of digital health technology can lead to systems that can be used successfully. In addition, it facilitates the provision of health promotion regarding diet and lifestyle that encourages behavioral changes so as not to be exposed to gestational diabetes mellitus. The early detection system created by Mackillop, et al., demonstrates the ability of the system to enable communication between health professionals / among clinical team members is very important (Mackillop et al., 2014). Research related to early detection of gestational diabetes mellitus was also carried out in India and Israel. This decision analysis tool (GeDiForCE) is very effective and cost-effective (Marseille et al., 2013).

CONCLUSION

The D3MG application has passed the black box testing due diligence with 54.1% and 45.9% worthy test results. Based on the results of the study found there are pregnant women who are at low risk of exposure gestational diabetes mellitus 55.7% while high risk 44.3%, however, preventive efforts must continue to be done to improve the welfare of mothers and babies. In addition, in collaboration with media and health personnel, government agencies and the community in an effort to introduce D3MG applications to detect the risk of gestational diabetes mellitus.

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DECLARATION OF COMPETING INTEREST

None declared

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