

## A Descriptive Study of Gestational Diabetes Mellitus in Yogyakarta

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### ABSTRACT

**Background:** Gestational Diabetes Mellitus (GDM) is a disorder of carbohydrate tolerance that increases blood sugar levels. It is first known during the second and third trimester of pregnancy. This study aims to determine the description of gestational diabetes mellitus (GDM) incidence in Sleman Yogyakarta in 2018.

**Subjects and Method:** This was a descriptive study. This study used secondary data which was written from medical records blood sugar classification  $\geq 105$  gr/dL and fasting blood sugar  $\geq 126$  gr/dL. The population was 1023. The sample was 80 which was taken by using simple random sampling technique from January-December 2018 at Minggir Primary Health Center, Tempel I Primary Health Center and Mlati 1 Primary Health Center, Sleman, Yogyakarta.

**Results:** The results of the study showed that from 80 pregnant women who examined their blood sugar levels, 47 subjects (58.8%) experienced DMG, 39 subjects (48.8%) aged  $\geq 35$  years, 50 subjects (62.5%) had preterm gestational age, 34 subjects (42.5%) had primary education (elementary/ junior high school), 47 subjects (58.8%) did not work/housewives, 54 subjects (67.5%) were parity  $\geq 2x$ , 38 subjects (47.5%) were overweight, 47 subjects (58.8%) had GDM history, 47 subjects (58.8%) had hypertension in pregnancy, and 41 subjects (51.3%) had an incomplete Ante Natal Care (ANC) examination.

**Conclusion:** It can be concluded that the incidence of GDM in Sleman is high, with characteristics of age at risk ( $\geq 35$  years), history of previous illnesses and obesity.

**Keywords:** Gestational Diabetes Mellitus, Incidence, Pregnant Women

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### BACKGROUND

Gestational Diabetes Mellitus (GDM) is a disorder of carbohydrate tolerance that results in increased blood sugar levels and first detected during the second and third trimester of pregnancy. In 2016 in the United States, GDM occurred 7% of pregnancies every year, in the UK at 3-5%, in Europe at 2-6%. Meanwhile, in India which is known for its low economy popu-

lation, GDM affects five million women every year which reaches the number 90% of cases (WHO, 2014).

In Indonesia, the prevalence of GDM is 1.9-3.6% in general pregnancies, while the prevalence in pregnant women with a family history of DM is 1.5%, 1-14% of all pregnancies have GDM, and undiagnosed ranges from 10 -25%. In fact, about 135,000 pregnant women who experience

GDM every year are 3-5%. In fact, Indonesia placed seventh rank in the number of diabetes mellitus patients in the world in 2013 (International Diabetes Federation, 2013). The prevalence of GDM in Yogyakarta is the highest prevalence compared to other cities in Indonesia with a percentage of 2.6% (Riskesdas, 2018).

According to the World Health Organization (WHO), GDM is one of Non-Communicable Diseases which is the main cause of deaths in the world (global). Even more, in some developed and developing countries, it also becomes a concern for health problems throughout which has an incidence of 15%. Not only in poor and developing countries, diabetes mellitus also affects many people in developed countries. Globally, prevalence GDM increases worldwide and varies greatly from 1% to 28% depending on population characteristics such as maternal age, socioeconomic status, race / ethnicity, Body Mass Index (BMI), screening methods, and criteria and diagnostic tests used by researchers.

Women with GDM are at high risk of excess weight gain, the occurrence of pre-eclampsia, eclampsia, caesarean section, and cardiovascular complications to maternal death, even in the world the incidence of these cases is up to 1.3%. After childbirth, GDM patients are at risk to have type 2 diabetes. Other risk factors can occur in women who are pregnant over the age of 30 years, obesity (BMI > 30), excess weight gain during pregnancy which is more than 11-12 kg, there is a family history of DM, a history of GDM in a previous pregnancy, parity, multiparity, hypertension, history of stillbirth (infant death in utero), history of childbirth with congenital abnormalities, glucosuria (excess sugar levels in the urine) during pregnancy, history of giving birth to a large baby (> 4000 grams)

Problems often occur because blood

sugar is not detected during pregnancy, especially in the second trimester. GDM sufferers are very much needed to be aware of lifestyle management by paying attention to any nutritional intake that we consume by knowing total calorie requirements according to BMI, moderate physical activity with a minimum intensity of 150 minutes / week, and weight control especially during pregnancy where body weight should not exceed 11.4 kg increase during pregnancy (Taber et al., 2016).

In Indonesia, the government in its program, namely maternal and child health (MCH) includes the Ante Natal Care (ANC) examination. In the integrated ANC, women will get more information and health education about diseases & complications in pregnancy. The Ministry of Health in the DMG control program carries out integration in controlling non-communicable diseases, namely developing and strengthen early detection activities, active diabetes screening, increase public access to early detection services. GDM control efforts become a very important goal in controlling the impact of complications that cause very heavy burdens to individuals, families and governments (Infodatin, 2014).

Conducting early detection is needed to determine as early as possible the case of GDM so that it can be handled appropriately. O'Sullivan and Mahan proposed that pregnant women with 24-28 weeks gestation should do a screening at the initial examination in the 24th week until the 28th week of pregnancy because GDM rarely occurs in the early weeks of pregnancy. The pregnancy hormone will peak in the third trimester. Conducting an examination since the beginning of ANC care and is repeated at 26-28 weeks of pregnancy is recommended by PERKENI (Indonesian Endocrinology Association).

Regulation of the Indonesian Minis-

ter of Health No.87 of 2014 concerns on health services in period of pre-pregnancy, pregnancy, childbirth, the post-partum, and providing contraception services and sexual health services. Article 6 states that pregnant women must have at least vital signs examined, and a nutritional status check and article 7 states that pregnant women should do supporting examination such as blood sugar and routine urine checks.

The Integrated Disease Survey (STP) of Puskesmas in Yogyakarta in 2016 showed that DM cases (9,473 cases) were ranked in the fourth of the top 10 diseases in Yogyakarta. In 2017, there were 5,161 new cases of DM and belong to the top 10 diseases in Yogyakarta. Based on STP of puskesmas in 2017, the number of diabetes cases was 8,321 cases. The results of the STP of Puskesmas show that DM was the fourth of most common diseases in Yogyakarta in 2017 with 8,321 cases.

Yogyakarta Health Department reported the data per Indicator from January to December 2018, that from 5 districts, Sleman was the highest number with DM incidence with 6349 cases, Kulon Progo with 3163 cases, Yogyakarta City 2784 cases, Gunung Kidul 2426 cases while the lowest was Bantul with 607 cases. Data of pregnant women with blood sugar levels > 105 gr / dL obtained that Sleman was the highest with 90 pregnant women, Kulon Progo 62 pregnant women, Yogyakarta City 48 pregnant women, Gunung Kidul 20 pregnant women, and Bantul 10 pregnant women. From the data of the Sleman District Health Office in 2018, it was found that total DM sufferers had reached 1013 cases. And from the data of several Puskesmas (primary health center) such as Puskesmas of Minggir, Mlati 1, Tempel 1, and Puskesmas of Sleman reported that there were 80 cases of pregnant women with DM

inpregnancy.

## SUBJECTS AND METHOD

### 1. Study Design

This was an descriptive study with a retrospective approach.

### 2. Population and Sample

The population was 1023. The sample was 80 which was taken by using simple random sampling technique.

### 3. Study Variables

The dependent variables were age, age pregnancy, education, occupation, BMI, parity, previous medical history and hypertension in pregnancy.

### 4. Operational Definition of Variables

Operational definitions of this study include the incidence of GDM with blood sugar levels >105 mg/dL, Age of pregnant women (<20 years and >35 years), gestational age at term (36 weeks), preterm (<36 weeks), and post-term (>38 weeks). weeks), the last education is divided into high level (PT), Intermediate (SMK/SMA), Basic (SD/SMP), Employment, namely not working and working, Parity is divided into 2 namely Primipara (1 time giving birth), Multipara (<2 times of giving birth), BMI including Underweight (BMI <18.5 kg/m<sup>2</sup>, Normal (BMI 18.5-22.9 kg/m<sup>2</sup>, Overweight (BMI 23-24.9 kg/m<sup>2</sup>), Obesity (BMI ≥25 kg/m<sup>2</sup>), previous medical history, hypertension in pregnancy, and Ante Natal Care Examination (ANC) with complete (>4) and incomplete (<4) classifications.

### 5. Study Instruments

This study employed secondary data from medical records from January-December 2018 at Minggir Primary Health Center, Tempel I Primary Health Center and Mlati 1 Primary Health Center, Sleman, Yogyakarta in which blood sugar was classified <105 gr/dL and fasting blood sugar was >126 gr/dL.

## 6. Data analysis

Univariate analysis was carried out to get a picture of each variable being studied. The data presentation was carried out by narrating by combining the results of observations so that it could be seen how many DMG incidences were.

## 7. Research Ethics

The research ethics include inside informed consent, identity confidentiality, and ethical clearance carried out after passing the ethical review and received permission from Minggir Primary Health Center, Tempel I Primary Health Center and Mlati 1 Primary Health Center, Sleman, Yogyakarta.

## RESULTS

### 1. Sample Characteristics

The table shows that majority of GDM was 47 pregnant women (58,8%), and women without DMG were 33 pregnant women

(41,3%). The most age category of >35 years old with 39 pregnant women (48.8%), the gestational age was mostly in the preterm category with 50 (62.5%), education background dominated at the level of basic education (elementary / junior high) as many as 34 (42.5%), and the majority of pregnant women were un-employee 47 (58.8%).

In term of nutrient status, 38 pregnant women (47,5%) were classified overweight, 36 of them (45,0%) were normal, and 3 pregnant women (3,8%) belonged to obesity and underweight status. Medical history was indicated that 47 pregnant women (58,8%) had history, mostly had hypertension (58,8%). Based on above table, most of pregnant women had incomplete *Ante Natal Care* (ANC) as many as 41 women (51,3%). Meanwhile, 39 pregnant women (48,8%) had complete ANC ( $\geq 4$ ).

**Tabel 1. Frequency of GDM incidence at Sleman Yogyakarta in 2018**

GDM Incidence	Frequency (N)	Percentage (%)
GDM	47	58.8
Not GDM	33	41.3
Total	80	100

**Tabel 2. Characteristics of Pregnant women**

Pregnant Women Characteristics		Frequency (N)	Percentage (%)
Age	<20 years	4	5.0
	20-34 years	37	46.3
	$\geq 35$ years	39	48.8
Pregnancy Age	Aterm	10	12.5
	Preterm	50	62.5
	Postterm	20	25.0
Education	Higher Education	15	18.8
	High School (SMK/SMA)	31	38.8
	Primary (SD/SMP)	34	42.5
Occupation	Employes/Work	33	41.3
	Unemployed	47	58.8
Total		80	100

**Tabel 3. GDM Respondent based on Parity at Sleman Yogyakarta in**

Parity	Frequency (N)	Percentage (%)
Primipara (1x)	26	32.5
Multipara ( $\geq 2x$ )	54	67.5
Total	80	100

**Tabel 4. GDM Respondent based on Body Mass Index (BMI)**

Body Mass Index (BMI)	Frequency (N)	Percentage (%)
Underweight: $<18.5 \text{ kg/m}^2$	3	3.8
Normal: $18.5\text{-}22.9 \text{ kg/m}^2$	36	45.0
Overweight: $23\text{-}24.9 \text{ kg/m}^2$	38	47.5
Obesity: $\geq 25 \text{ kg/m}^2$	3	3.8
Total	80	100

**Tabel 5. GDM Respondent based on Medical History**

Medical History	Frequency (N)	Percentage (%)
With history	47	58.8
Without history	33	41.3
Total	80	100

**Tabel 6. Frequency of Antenatal Care**

Antenatal Care (ANC)	Frequency (N)	Percentage (%)
Complete ANC ( $\geq 4$ )	39	48.8
Incomplete ANC ( $<4$ )	41	51.3
Total	80	100

## DISCUSSION

Based on table 1, it can be seen that the majority of pregnant women with GDM were 47 subjects (58.8%), and there were 33 subjects who did not experience GDM (41.3%). Globally, prevalence of GDM is increasing worldwide and varies greatly from 1% to 28% depending on population characteristics such as maternal age, socioeconomic status, race /ethnicity, BMI, screening methods, and criteria and diagnostic tests used by researchers. incidence of GDM occurred due to several factors, one of which was genetic factors, excessive eating patterns and an increase in weight gain during pregnancy that could cause high blood sugar levels (Lawrence, Wall, & Bloomfield, 2019).

GDM varies across countries including identification of pregnant women du-

ring the first and second trimesters. Also, it was influenced by several factors, one of which is genetic. The impact of this Gdm will be noticeable after a few years. If left untreated, it will result in a rise in the incidence of GDM. Women with GDM are at an increased risk of weight gain, hypertension, eclampsia, cesarean delivery, and cardiovascular problems that can result in maternal death. Additionally, it occurs in 1.3 percent of women worldwide (Farrar, 2016).

The research shows that pregnant women were dominated in the age category of  $>35$  years old with as many as 39 pregnant women. Women during pregnancy is one of the factors that determines the level of risk of pregnancy and childbirth. In a healthy reproductive age, it is known that the safe age for pregnancy and childbirth is



20 to 30 years old. Maternal deaths in pregnant and childbirth women under the age of 20 are in fact 2 to 5 times higher than age 20 to 29 years. Maternal deaths increase when women in the age of 30 to 35 years old. Pregnant women over the age of 40 had a 1.5-fold increased chance of getting DMG compared to pregnant women under the age of 28. Increased levels of insulin resistance intolerance, as well as increased circulation of adipokines involved in metabolic processes, all have a significant impact on the emergence of GDM in pregnant women (Cahyani and Kusumaningrum, 2017).

The subjects were mostly in the high risk age range were <20 years or >35. In the age of <20 years, the state of the reproductive organs is not ready to accept pregnancy. This will increase the occurrence of pregnancy poisoning. Meanwhile, women aged 35 years or older are susceptible to various diseases such as hypertension and eclampsia. This is due to changes in the uterine tissue and birth canal which is no longer flexible. The results of this study are in line with the results of other studies found that the age of pregnant women  $\geq 35$  years at risk of 4.05 times to suffer from GDM compared to pregnant women aged <35 years old. Pregnancies at too young and too old age are included in the criteria for high-risk pregnancies, both of which play a role in increasing morbidity and mortality in both mother and fetus (Putri et al., 2018).

Dominant category of pregnancy is in the preterm category as many as 50 pregnant women (62.5%), then followed by the postterm category as many as 20 pregnant women (25%), and the least one in at term category as many as 10 pregnant women (12.5%). In this study, it is stated that pregnant women in preterm group category were as many as 50 pregnant

women (62.5%). GDM is a common type during pregnancy that is accompanied with an increase in insulin resistance (pregnant women fail to maintain euglycemia) (Domanski et al., 2018). In this group, gestational diabetes mellitus is experienced temporarily during pregnancy, meaning that the condition of diabetes or glucose intolerance is first discovered during pregnancy usually in the second or third trimester. GDM criteria happens if impaired glucose tolerance that occurs during pregnancy returns to normal within 6 weeks after delivery. It is called as diabetes mellitus (not gestation) if impaired glucose tolerance persists after delivery. Gestational diabetes occurs from the 24<sup>th</sup> to the 28<sup>th</sup> week of pregnancy. After pregnancy blood sugar levels return to normal (Domanski et al., 2018).

The education of pregnant women is dominated at the level of basic education (elementary / junior high) as many as 34 pregnant women (42.5%), followed by high schools / vocational high schools category in 31 pregnant women (38.8%), then high education (universities) as many as 15 pregnant women (18.8%). Education becomes an effort to develop personality and abilities inside and outside of school that lasts a lifetime. The study in Italy found that education is associated with socioeconomic status, such as a person's level of employment. Mothers with insufficient education and employment are at an increased risk of developing DMG because the poor health (Pahlawati and Nugroho, 2019).

Educational development in Yogyakarta Special province has increased. This can be seen from several achievements in the education sector such as the availability of educational facilities and infrastructure, school participation rates, average length of pursuing education and increasing

literacy rates time by time. However, the condition happens mostly in urban area, the condition in rural area still biased to analyze the number of those who attend tertiary education. Even based on the data in Sleman regency, it is found that the average length of pursuing education of residents over 25 years grows 1.10% annually during the period 2010 to 2017. This positive growth becomes an important modality in building better quality of human resources in Yogyakarta. In 2017, the average length of pursuing education of residents in Yogyakarta Special Province aged 25 years and over reached 9.19 years, or had completed education until graduating junior high school.

The employment status of the majority of subjects was 47 pregnant women (58.8%) as housewives and 33 working mothers. Lack of activity becomes one of the factors that play a significant role in causing insulin resistance in diabetes mellitus in pregnancy. Active individuals who have a better insulin and glucose profile than passive individuals. The results of this study are strengthened by previous studies in which the pattern of physical activity has correlation to blood sugar levels because subjects with mild activity patterns can result in increased blood sugar levels (Stanford and Goodyear, 2014).

However, based on a research conducted by Rahayu and Rodiani (2016) it is also stated that working mothers influence the risk factors for the occurrence of GDM with a 7.6 times greater risk of developing DM. Pregnant women who work that requires long standing and a lot of physical activity have 20-60% risk in increasing GDM.

Based on the data in table 3, it can be seen that among 80 pregnant women, 54 of them (67.5%) had parity  $\geq 2x$  and as many as 26 pregnant women (32.5%) had a

parity number of 1x. Parity can be described as the condition in which a woman has given birth to a living baby (viable). Parity 2-3 becomes the safest parity from the point of view of maternal mortality. Parity 1 and high parity (more than 3) have a higher maternal mortality rate. The higher the parity of the mother, the worse quality of the endometrium. Nurrahmani (2012) stated that mothers with multiparity  $> 3$  have a risk factor for diabetes mellitus in pregnancy about 78% of women with multiparity  $> 3$ . This can occur due to physiological changes that affect carbohydrate metabolism due to the presence of lactogenous placental hormone that is resistant to insulin so that it can be resistant to insulin. Insulin resistance is not only caused by estimated day of birth alone but also caused by estrogen, progesterone, cortisol and prolactin hormones (Ngala et al., 2017).

In table 4 explained that the majority of overweight nutritional status was in 38 pregnant women (47.5%); the normal status was in 36 pregnant women (45.0%), and Obesity and Underweight status were in 3 pregnant women (3.8%).

Being overweight is one factor of the incidence of gestational diabetes mellitus because when obesity occurs, fat cells that fatten will produce several substances classified as adipocytokines which are more numerous than non-obese circumstances. These substances cause insulin resistance. As a result of insulin resistance it is difficult for glucose to enter the cell, this condition makes blood glucose remain high (hyperglycemia) and diabetes mellitus occurs, especially in pregnancy. Normal weight in pregnant women is around the average total weight gain of pregnant women ranging from 10-15 kg (Yeto et al., 2014). Another related study, Pauley et al. (2018) found that mothers who have a

history of obesity have risks 3.56 times to suffer from gestational diabetes mellitus compared to mothers who have no history of obesity.

Family history of disease was divided into two, those were mothers with a history as many as 47 pregnant women (58.8%), and those without history as many as 33 pregnant women (41.3%). History of the disease that had been suffered by subjects was majority diseases of genetic factors from mother, father and grandparents. Based on the data, 20 pregnant women whose parity was more than 2 times also experiences GDM in their previous pregnancies.

Based on the results of research conducted by Lagadec et al. (2018), it showed that a supporting factor from other medical history is a history of suffering from previous GDM because poor glucose control during the first 7 weeks of fetal formation results in an increased risk of congenital malformations and fetal death. Maternal complications are also more serious such as retinopathy or nephronopathy. Pregnant conditions with diabetes must be under strict supervision so that babies born later will not have blood sugar levels below 60 mg / dL.

Table 5, above states that majority of the subjects had Hypertention Disorders in Pragnancy (HDP), i.e. 47 pregnant women (58.8%), and those without HDP were 33 pregnant women (41.3%). Hypertension is the most frequent problem in pregnancy. Hypertension is a 5-10% complication in pregnancy and is one of the most common causes of mortality besides bleeding and infection, and also contributes a lot to the morbidity and mortality of pregnant women.

Though insulin plays a role in increasing glucose uptake in many cells and in this way also regulates carbohydrate meta-

bolism. If there is insulin resistance by cells, the level of sugar in the blood can also be disrupted. In women with GDM, hypergilikemia is often associated with hyperinsulinemia, dyslipidemia, and hypertension which together lead to cardiovascular disease and stroke. Hypertension is a major risk factor for DM. The relationship between hypertension and GDM is very complex; hypertension can make cells insensitive to insulin (insulin resistant). Risks to the mother include damage to the retina, kidneys and heart, urinary tract infections, diabetes ketoacidosis, and cesarean section (Morampudi et al., 2017).

Based on table 6, most pregnant women did not comply with ANC visit standards ( $<4x$ ) as many as 41 pregnant women (51.3%) and only 39 pregnant women who had a complete pregnancy check (ANC) ( $\geq 4$ ) during pregnancy. Pregnancy examination is very important to be done by all pregnant women to determine fetal growth and maternal health and to find out as early as possible any abnormalities that occur during pregnancy (Riskesdas, 2013).

However, there were still many pregnant women who did not do ANC examination 4 times. Non-compliance of mothers doing ANC hapened because pregnant women only checked their pregnancy in the third trimester if they have found complaints or at the time of the birth signs (uns). The government of Yogyakarta Special Province has tried to improve the ANC standard, but the implementation is not optimum due to a number of factors such as low education levels, full time jobs (pregnant mothers do not have an opportunity to have a pregnancy check-up), support from the family, as well as access to remote health services.



### AUTHORS CONTRIBUTIONS

Siti Hardyanti and Indriani collected the data from medical records blood sugar classification  $\geq 105$  gr/dL and fasting blood sugar  $\geq 126$  gr/dL, from January-December 2018 at Minggir Primary Health Center, Tempel I Primary Health Center and Mlati 1 Primary Health Center, Sleman, Yogyakarta.

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### CONFLICT OF INTEREST

The authors declare there is no conflict of interest.

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