FACTORS ASSOCIATED WITH GESTATIONAL DIABETES MELLITUS (GDM) AMONG PREGNANT WOMEN IN HULU LANGAT, SELANGOR

By

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Chair : Professor Dr. Zalilah Mohd Shariff, PhD

Gestational Diabetes Mellitus (GDM) has become a global public health concern and it affects around 7 to 10% of pregnancies worldwide. In Asia, the prevalence of GDM was 0.7% to 51%, with the prevalence of GDM in Malaysia ranged between 10.6% to 38.6%. Thus, this study aimed to determine the prevalence and relationship between various risk factors associated with GDM among pregnant women in Hulu Langat, Selangor. This study used secondary data from 2 Klinik Kesihatan Ibu Dan Anak in Hulu Langat district in 2018. Socio-demographic characteristic, obstetrical information, physical activity, iron supplementation and dietary intake were assessed through interviewer-administered questionnaires. Anthropometric, biochemical and blood pressure parameters were measured at different timepoints. GDM was determined using MOH Clinical Practice Guidelines (CPG) 5th edition criteria. Majority of the participants were below 35 years old, Malay, completed tertiary education, were employed, and had a middle range of household income. The prevalence of GDM among pregnant women in Hulu Langat district was 24.4% (n=153). This study demonstrated that the risk factors of GDM was found in women with maternal age more than 35 years old (AOR = 5.803, 95%CI = 1.980 – 17.005) and dietary heme iron intake (AOR = 1.879, 95%CI = 1.098 – 3.214). GDM risk was lower in women with monthly household income of more than RM6000.00 (AOR= 0.287, 95%CI =0.099 – 0.832) compared to lower household income of less than RM3000.00. Understanding these risk factors could assist the development of prevention strategies of GDM in Malaysian pregnant women.

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LIST OF ABBREVIATIONS

2hPG	2-hour Plasma Glucose
BMI	Body Mass Index
CI	Confidence Level
CPG	Clinical Practice Guidelines
DoSM	Department of Statistic Malaysia
FFQ	Food Frequency Questionnaire
FPG	Fasting Plasma Glucose
GDM	Gestational Diabetes Mellitus
GWG	Gestational Weight Gain
HIP	Hyperglycemia of Pregnancy
HTAR	Hospital Tengku Ampuan Rahimah
KKIA	Klinik Kesihatan Ibu Dan Anak
MET	Metabolic equivalent
MOH	Ministry of Health
OGTT	Oral Glucose Tolerance Test
PPAQ	Pregnancy Physical Activity Questionnaire
RNI	Recommended Nutrient Intakes
SPSS	Statistical Package for the Social Sciences
WHO	World Health Organizations

CHAPTER 1

INTRODUCTION

1.1 Background

Gestational Diabetes Mellitus (GDM) is a condition of glucose intolerance that leads hyperglycemia during pregnancy (Farrar, 2016). GDM is of interest because it might occur or be detected after the 24th week of pregnancy as insulin resistance is more likely to be increased during weeks 13 to 28 of pregnancy (Rani, 2016). The prevalence of GDM is increasing globally and is approximately 7-10% by different regions, ethnicity, and screening methods. (Jiwani et al., 2011; Adam & Rheeder, 2017; Nguyen et al., 2018). In the United States, GDM affects 2-10% of pregnancies each year (CDC, 2019). Nguyen et al. (2018) reported the prevalence of GDM across 7 countries in Eastern and Southeastern Asia. Vietnam & Singapore had the highest prevalence, which is approximately 20%, followed by China & Malaysia (11%) and the other remaining countries such as the Republic of Korea, Thailand, Japan, and Taiwan (China) had not more than 8% (Nguyen et al., 2018). The Malaysia National Health and Morbidity Survey reported that the prevalence of hyperglycemia in pregnancy was 13.5% (IPH, 2016). According to the 10th edition of the IDF Diabetes Atlas in 2021, the prevalence of hyperglycemia in pregnancy among Malaysian mothers aged 20 to 49 years old was about 23.2%. These findings indicated that the prevalence of GDM is increasing over time, and it varies across countries.

GDM has become a global public health concern, and it has adverse short- and long-term effects on both mothers and children. Short-term adverse effects include excessive birth weight of fetus and higher chances of C-section birth. Studies have shown that women with GDM have higher difficulty during delivery (Craig et al., 2020; Kalra et al., 2016). Macrosomia might be one of the adverse maternal outcomes for mothers who developed GDM (Kc et al., 2015). Excessive birth weight might require a C-section birth to reduce birth injuries (Gorgal et al., 2012; Boriboonhirunsarn & Waiyanikorn, 2016).

Besides that, GDM might lead to adverse long-term health outcomes, such as both mothers and children will have greater risk of developing Type 2 diabetes in the future (Noctor, 2015; Balaji et al., 2014). In a study conducted by Li et al. (2017) that GDM was associated with obesity in childhood to early adulthood of the offspring. The increased levels of blood sugar, as a result, can put both mothers and infants at risk for complications such as premature birth and developmental problems (Buchanan et al., 2012).

1.2 Problem Statement

Previous research has established that there has been a growing trend in the incidence of GDM among Asian countries (Lee et al., 2018; Behboudi-Gandevani et al., 2019). The National Obstetric Registry Malaysia (2018 – 2020) reported that the numbers of diabetes in pregnancy cases had increased significantly, in which GDM had increased from 14.3% (2018) to 21.4% (2020) in 9 states. The prevalence of GDM in Malaysia ranged from 10.6% to 38.6%. According to the Department of Statistics Malaysia Official Portal, in 2021, the Selangor state had the largest population (20.1%). According to the National Obstetric Registry Malaysia (2018 – 2020), the incidence of GDM in Hospital Tengku Ampuan Rahimah (HTAR) which is in Selangor has increased from 14.4% (2018) to 27.3% (2020). Therefore, it is crucial to conduct a study in Selangor state as GDM could contribute to the prevalence of Type 2 Diabetes Mellitus in the future. The Malaysia National Diabetes Registry report 2013 – 2019 also showed that Selangor had the highest number of diabetes patients (14.4%).

Previous studies have reported that higher maternal age, prediabetes or GDM in previous pregnancy, family history of diabetes mellitus or GDM, obesity, and high parity are well-known risk factors of GDM (Dualis et al., 2020; Erem et al., 2015; Wagan et al., 2021; Ennazhiyil et al., 2019; Ben-Haroush et al., 2004). Although there has been research on the common risk factors of GDM, however, the impact of hypertension history, dietary iron intake and iron supplementation with GDM has not been closely examined in Malaysia, especially in the Selangor state.

In addition, previous study reported that there were differences in fasting blood glucose rates among ethnic groups in Malaysia (Tan et al., 2011). Thus, it is crucial to determine the prevalence of GDM among different ethnic groups in Selangor. Studies showed that socio-economic status has an impact on human health and low socioeconomic population will be more likely to develop chronic diseases (Wan Puteh et al., 2019).

The National Health and Morbidity Survey 2019 reported that about half of the population was overweight and obese (50.1%) due to change of lifestyle from physically active to sedentary behaviour (Chan et al., 2017). Thus, there is increasing concern that physical inactive and high pre-pregnancy BMI are associated with GDM. Studies have reported that the rate of gestational weight gain has a great impact on women's health and children (Kubo et al., 2017). Previous research has reported that excessive gestational weight gain had an increased risk of developing GDM (Brunner et al., 2015; Liang et al., 2021). Although various studies have been conducted on gestational weight gain with GDM, there has been little discussion about the rate of gestational weight gain with GDM among pregnant women in Hulu Langat, Selangor.

Thus, this study aims to address the following questions:

1. What is the prevalence of GDM among pregnant women in Hulu Langat, Selangor?

2. What are the predictors of GDM among pregnant women in Hulu Langat, Selangor?

1.3 Significance of the Study

The increasing prevalence of Diabetes Mellitus has become a public health concern. The National Health and Morbidity Survey reported that 1 in 5 adults in Malaysia was diagnosed with Diabetes Mellitus (IPH, 2020). A family history of diabetes has been shown to increase the risk of GDM in pregnant mothers. Not only that, pregnant women with GDM were associated with an increased risk of Type 2 Diabetes Mellitus in later life. Therefore, the purpose of this study was to investigate the prevalence and factors associated with GDM by ensuring early detection and thus improving the outcomes with special care at the earliest possible stage.

This study provides new insights that can be used by health professionals for planning, implementing, and evaluating intervention programs for Malaysian pregnant women. The determination of risk factors of GDM in Hulu Langat, Selangor might help to contribute in designing the profile for pregnant women's lifestyle. This could aid in developing appropriate implementation and intervention programs for the target group.

GDM has shown significant influences on the future health of both mothers and their children. The findings enhance the awareness of pregnant women to have a better understanding of the factors associated with the risk of GDM. As a result, GDM risk might be reduced in Malaysia. This current study might also provide fundamental data for future researchers in Malaysia and fill the knowledge gap. In addition, it also enhances knowledge pertaining to GDM for the public.

1.4 Research Objectives

1.4.1 General Objective

To determine the factors associated with risk of GDM among pregnant women in Hulu Langat, Selangor

1.4.2 Specific Objective

1. To determine the prevalence of GDM among pregnant women

2. To assess
    a. socio-demographic factors (maternal age, ethnicity, education level, occupation status, monthly household income)
    b. obstetrical factors (gravidity, parity, GDM in previous pregnancy, history of hypertension/ pre-eclampsia, family history of diabetes/ hypertension)
    c. anthropometric measurements (height, pre-pregnancy BMI, gestational weight gain)
    d. lifestyle factors (physical activity, diet, iron supplementation)

    of pregnant women

3. To determine the relationships between

    a. socio-demographic factors (maternal age, ethnicity, education level, occupation status, monthly household income)
    b. obstetrical factors (gravidity, parity, GDM in previous pregnancy, history of hypertension/ pre-eclampsia, family history of diabetes/ hypertension)
    c. anthropometric measurements (height, pre-pregnancy BMI, gestational weight gain)
    d. lifestyle factors (physical activity, diet, iron supplementation)

    and GDM among pregnant women

1.5 Research Hypotheses

There are significant associations between socio-demographic factors, obstetrical factors, pre-pregnancy BMI, gestational weight gain and lifestyle factors with GDM among pregnant women

1.6 Research Framework

The conceptual framework for this study is presented in Figure 1.1. This conceptual framework was based on cross-sectional, cohort and case-control studies that examined the risk factors associated with GDM. This study examined 4 independent variables, such as socio-demographic, obstetrical, lifestyle factors and anthropometric measurements. Asian pregnant women are at higher risk of developing GDM (Chong et al., 2014). Studies have shown that parity of more than 3 is one of the risk factors of GDM (Tian et al., 2014; Woticha et al., 2018; Lee et al., 2018).

Li et al. (2018) showed that pregnant women of Chinese population with low stature (<158 cm) with obesity or overweight found out they had a greater risk of GDM. Arafa

& Dong (2019) reported that GDM risk is reduced by 20% with every 5cm increase in height. Li et al. (2020) have found overweight and obesity had a higher tendency to develop GDM in China. High pre-pregnancy BMI and gestational weight gain are associated with the risk of having GDM as well (Sun et al., 2020).

Diabetes Mellitus has been shown to be related to Western dietary patterns that normally consist of processed foods, red meat, foods that are high in fats and sugar (Shu et al., 2017). Modification in diet can aid in reducing diseases such as diabetes mellitus, high blood pressure and cardiovascular diseases. Several studies have shown that there is a relationship between iron and the risk of getting GDM (Zhao et al., 2017; Kataria et al., 2018; Zhang & Rawal, 2017). However, micronutrient needs such as iron are relatively higher during pregnancy than in non-pregnant states because iron contributes to red blood cell mass and placental formation as well as fetus development (Bothwell, 2000). In addition, diets with high calorie intake are interrelated with obesity and weight gain, thus increasing the risk of developing noncommunicable diseases such as cardiovascular diseases, diabetes, and hypertension.

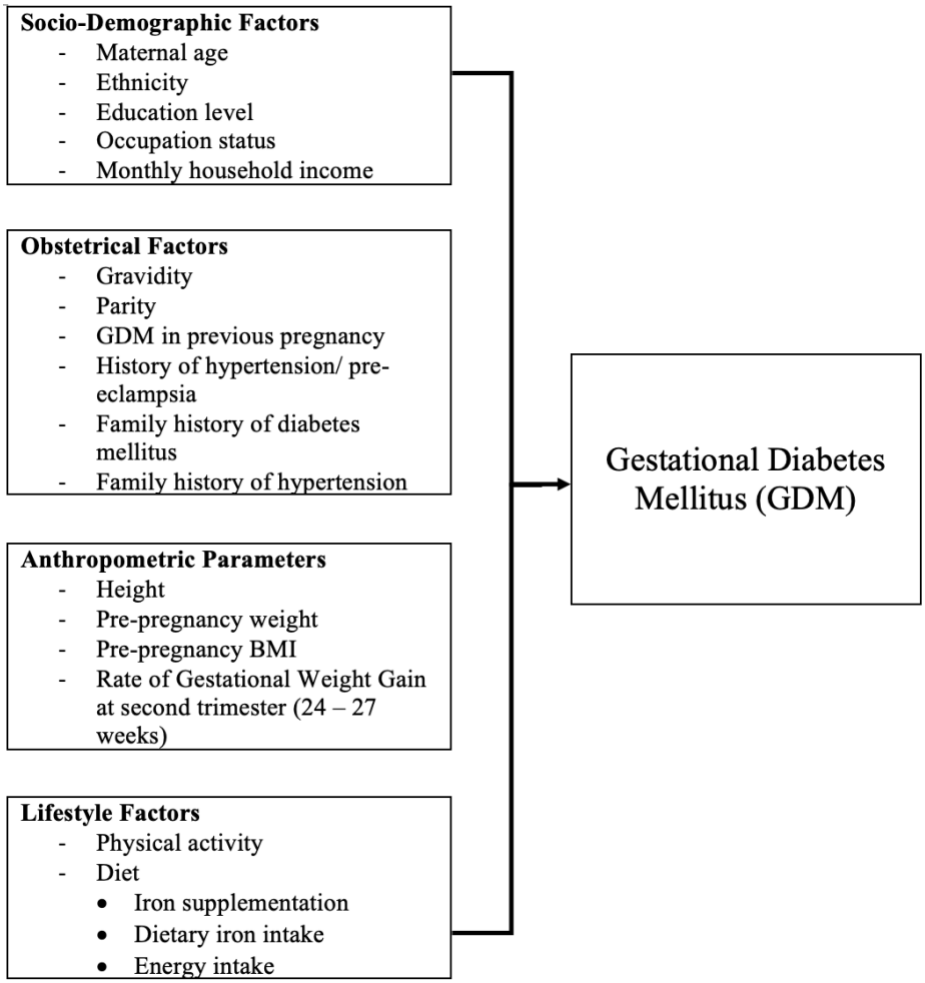

Figure 1.1: Research framework

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