ASSOCIATION BETWEEN DEMOGRAPHICS AND KNOWLEDGE OF GESTATIONAL DIABETES MELLITUS (GDM) WITH FASTING PLASMA GLUCOSE (FPG) AMONG PATIENTS IN HOSPITAL PAKAR UNIVERSITI SAINS MALAYSIA (HPUSM)

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SCHOOL OF HEALTH SCIENCES

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By

NUR NAJWA BINTI MOHD ZAIN

Dissertation submitted in partial fulfillment
of the requirements for the degree
of Bachelor of Health Science (Honours) (Dietetics)

July 2024

CERTIFICATE

This certifies that Ms. Nur Najwa Binti Mohd Zain’s dissertation, "Association Between Demographics And Knowledge Of Gestational Diabetes Mellitus (GDM) With Fasting Plasma Glucose (FPG) Among Patients In Hospital Pakar Universiti Sains Malaysia (HPUSM)" is an authentic consider of research work completed under my supervision between October 2023 until July 2024. After reading this dissertation, I am certain that it satisfies the requirements for scholarly presentation and is suitable in both scope and quality to be submitted as a partial satisfaction of the requirements for the Bachelor of Health Science (Honours) (Dietetics) degree.

DECLARATION

I thus certify that, with the exception of instances clearly marked and properly acknowledged, this dissertation is the product of my own research. I further certify that it has not been submitted in full for any other degree at Universiti Sains Malaysia or any other institution, either previously or concurrently. I give Universiti Sains Malaysia permission to utilise my dissertation for instructional, scientific, and advertising purposes.

Student,

ACKNOWLEDGEMENT

In the name of Allah SWT, The Most Gracious and The Most Merciful. All praise be to Allah SWT for His countless blessings, enabling the completion of this thesis. All praise and gratitude are due to Allah SWT, the Glorious, the Almighty, the Merciful, and the Compassionate, for His blessings and the opportunity to complete this paper titled "Association Between Demographics And Knowledge Of Gestational Diabetes Mellitus (GDM) With Fasting Plasma Glucose (FPG) Among Patients In Hospital Pakar Universiti Sains Malaysia (HPUSM)" by Nur Najwa Binti Mohd Zain. Salutations and blessings are also extended to Prophet Muhammad SAW, who has guided humanity to the righteous path blessed by the Lord.

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ABSTRAK

Pengawalan tahap glisemik darah dengan baik dalam kalangan pesakit Diabetes Mellitus Gestasi (GDM) adalah penting untuk mengelakkan kesan buruk kepada ibu dan anak. Pengetahuan yang mencukupi mengenai GDM dijangkakan dapat menyumbang kepada nilai glukosa plasma puasa yang lebih baik. Kajian ini bertujuan untuk menyiasat hubungan antara tahap pengetahuan mengenai GDM dan nilai glukosa plasma puasa dalam kalangan pesakit GDM. Satu kajian hirisan lintang telah dijalankan dari April hingga Jun 2024 melibatkan 60 pesakit GDM yang dimasukkan ke Wad Obstetrik dan Ginekologi di Hospital Pakar USM. Peserta melengkapkan borang soal selidik pengetahuan tentang GDM (GDMKQ) dengan bimbingan, dan tahap glukosa plasma puasa mereka diperoleh dari rekod perubatan mereka. Seramai 60 data peserta telah dianalisis. Analisis lima domain pengetahuan menunjukkan skor min tertinggi dalam domain nilai diet/makanan (0.93 ± 0.15) dan terendah dalam domain faktor pengetahuan asas tentang GDM (0.57 ± 0.21). Kajian ini mendapati tiada hubungan yang signifikan antara tahap pengetahuan dan glukosa plasma puasa ($r = 0.143$, $p > 0.05$). Korelasi lemah ini menunjukkan bahawa pengetahuan semata-mata mungkin tidak menjadi peramal yang kukuh bagi tahap glisemik. Dapatan ini juga mencadangkan bahawa faktor-faktor lain selain pengetahuan mungkin mempengaruhi kawalan glisemik dalam pesakit GDM. Nilai $p = 0.957$ menunjukkan tiada perbezaan yang signifikan dalam skor pengetahuan terhadap kumpulan umur. Begitu juga, pariti tidak menunjukkan kaitan yang signifikan terhadap skor pengetahuan (nilai $p = 0.564$) atau nilai FPG (nilai $p = 0.912$). Kajian ini juga mendapati bahawa tiada kaitan yang signifikan antara demografi dan pengetahuan mengenai

GDM dengan glukosa plasma puasa dalam kalangan pesakit GDM. Pesakit yang berumur 30-34 tahun, dengan pariti satu, wanita yang bekerja, mempunyai tahap pendidikan ijazah, tiada sejarah keluarga diabetes, dan mengikuti kawalan diet mencatatkan purata skor pengetahuan tertinggi dan purata nilai glukosa plasma puasa terendah. Penyelidikan lanjut disarankan untuk mengkaji faktor tambahan yang mungkin mempengaruhi tahap glisemik yang tidak dipertimbangkan dalam kajian ini.

ASSOCIATION BETWEEN DEMOGRAPHICS AND KNOWLEDGE OF GESTATIONAL DIABETES MELLITUS (GDM) WITH FASTING PLASMA GLUCOSE (FPG) AMONG PATIENTS IN HOSPITAL PAKAR UNIVERSITI SAINS MALAYSIA (HPUSM)

ABSTRACT

Maintaining well-controlled glycaemic levels in patients with Gestational Diabetes Mellitus (GDM) is crucial to prevent adverse outcomes for both mother and child. Adequate knowledge about GDM is hypothesized to contribute to fasting plasma glucose level. This study investigated the association between the degree of knowledge regarding GDM with fasting plasma glucose among GDM patients. A cross-sectional study was conducted from April to June 2024, involving 60 GDM patients admitted to the Obstetrics and Gynaecology Ward at Hospital Pakar USM. Participants completed the GDM Knowledge Questionnaires (GDMKQ) with assistance, and their fasting plasma glucose levels were obtained from their medical records. A total of 60 patients were included in final analysis. The analysis of the five knowledge domains showed that the diet/food values domain had the highest mean score (0.93 ± 0.15), while basic knowledge of GDM domain had the lowest (0.57 ± 0.21). The study found no significant association between the level of knowledge and fasting plasma glucose ($r = 0.143$, $p > 0.05$). This weak correlation further indicates that knowledge alone may not be a strong predictor of glycaemic control. These findings suggest that other factors may influence glycaemic control in GDM patients. The P-value of 0.957 indicates no significant difference in knowledge scores across age groups. Similarly, parity showed no significant association with knowledge scores (P-value = 0.564) or FPG values (P-value = 0.912). The study concluded no significant association exists between demographics and knowledge about GDM with fasting plasma glucose among GDM patients. Patients aged 30-34 years, with a

parity of one, who are working women, have a degree-level education, no family history of diabetes, and follow a diet control regimen recorded the highest mean knowledge scores and the lowest mean fasting plasma glucose levels. Further research is recommended to explore additional factors that may affect glycaemic levels which were not considered in the current study.

1.0 INTRODUCTION

1.1 BACKGROUND

Generally, gestational diabetes mellitus is an abnormal glucose tolerance that has an onset or is first recognized during pregnancy (Tan et al., 2023). It often begins between the 24th and 28th week of pregnancy, at the middle of the pregnancy (Niyibizi et al., 2016). The National Obstetrics Registry (NOR) of Malaysia reports that 11.1% of Malaysians have gestational diabetes mellitus (GDM) (Hussain et al., 2015). The best glycaemic thresholds fordiagnosis of GDM, as well as testing protocols and screening tactics, are still vigorously debated issues (Wah Cheung & Moses, 2018). Therefore, a precise estimation of the prevalenceis unattainable.

The estimated global diabetes population as of 2017 was 451 million persons between the ages of 18 and 99. About 21.3 million of these were considered to be pregnant women who experienced hyperglycaemia in some capacity, with 18.4 million of those cases being attributable to gestational diabetes mellitus (GDM). This shows that each year, GDM affects about 14% of pregnancies globally (Gyasi-Antwi & Adams, 2020).

Management of GDM is principally dependent on active care measures taken by women to keep their glycaemic levels normal. It depends on sufficient health literacy including the patient’s knowledge about normal and abnormal glycaemic values, dietary values, food restraints, and the importance of physical activity (Heisler et al., 2005). Therefore, in order to prevent adverse effects on both the mother and the fetus, women need to be informed about the disease and apply treatment techniques. Patients with sufficient understanding of GDM are thought to have their blood sugar levels under control, hence reducing the risk of developing the disease's consequences. Knowledge is considered one of the important components of health literacy.

According to Li et al., (2020), since fasting plasma glucose (FPG) is inexpensive, readily available, simple to do, and repeatable, it has become a popular screening test for gestational diabetes mellitus. Its main application in the initial prenatal period has been as a screening tool for overt diabetes. Additionally, it is proposed that FPG be used to screen expectant mothers for oral glucose tolerance test (OGTT) testing, which is necessary for an accurate diagnosis of GDM. Pregnant women may benefit from FPG screening for GDM since it has satisfactory sensitivity and specificity at a cut-off of 92 mg/dl.

1.2 PROBLEM STATEMENT

Limited understanding about disease is linked to inadequate health literacy. It has the effect of reducing adherence to disease management plans, which ultimately results in poor outcomes for both the mother and the baby. For example, poor glycaemic control, maternal infection, stress, and increased risk for offspring. The most prevalent pregnancy-relatedcomplication, gestational diabetes mellitus (GDM), raises the risk of caesarean delivery, persistent hypertension, and fetal death and morbidity (Niyibizi et al., 2016). For this reason, reducing maternal and fetal morbidity requires an early diagnosis of GDM. In addition, it can delay or avoid the beginning of type 2 diabetes.

Over time, type 2 diabetes mellitus (T2DM) develops in around 60% of women with a history of GDM. If a woman has a history of GDM, her chance of developing T2DM increases threefold with each subsequent pregnancy. Women who have experienced GDM in the past were also at a 2–3% annual risk of developing T2DM (Plows et al., 2018). Furthermore, one of the most common fetal problems linked to GDM is fetal macrosomia (Mou et al., 2023). Typically, birthweights greater than 4 kg are classified as macrosomia. Fetal macrosomia newborns have larger birth weights and sizes than average because fetus consumes too much glucose due to diabetes in the birthing parent which might lead to abnormal growth. Thus, it leads to delivery problems that negatively impact the health of the fetus and the birthing parent (Stephens, 2021).

According to Hussain et al. (2015), patients who were under 25 years old, had only completed primary school, were housewives, and had no family history of diabetes were found to have little knowledge and comprehension of GDM. Age may impact an individual's openness to learning and their ability to comprehend and effectively apply management strategies. Ethnicity can shape cultural beliefs regarding diet and healthcare practices, potentially affecting adherence to recommended glycaemic control measures. Educational level and occupation may dictate access to resources and time availability for self-management activities. A family history of diabetes might increase awareness and motivation for glycaemic control, yet it could also introduce familial barriers and misconceptions. Moreover, the specific type of therapy prescribed, whether dietary modifications, insulin therapy, or oral medications, can greatly impact a patient's comprehension and engagement with glycaemic control strategies. Therefore, by being thoroughly aware of these demographic factors, healthcare professionals can more effectively modify support and helpful initiatives. They also can detect disparities between patient groups' knowledge and access to care by examining demographic data. This allows for implementing focused interventions to enhance outcomes and minimize health inequalities.

While several studies evaluate patients' knowledge in type 1 and type 2 diabetes, there is a lack of research concerning knowledge evaluation in patients with GDM. Therefore, we would like to study the level of knowledge regarding gestational diabetes mellitus and its association with fasting plasma glucose in GDM patients.

1.3 RESEARCH QUESTION

1) What are the demographic characteristics of GDM patients in HPUSM?
2) What is the level of knowledge regarding gestational diabetes mellitus of GDM patients in HPUSM?
3) Is there any association between demographics, levels of knowledge, and fasting plasma glucose (FPG) among GDM patients in HPUSM?
4) Is there any association between the degree of knowledge and fasting plasma glucose (FPG) among GDM patients in HPUSM?

1.4 RESEARCH OBJECTIVE

General Objective:

To assess the demographics and knowledge of GDM patients and its association with fasting plasma glucose (FPG).

Specific Objective:

1) To determine the demographic characteristics among GDM patients in HPUSM.
2) To determine the level of knowledge regarding gestational diabetes mellitus of GDM patients in HPUSM.
3) To determine the association between demographics, levels of knowledge, and fasting plasma glucose (FPG) among GDM patients in HPUSM.
4) To determine the association between the degree of knowledge and fasting plasma glucose (FPG) among GDM patients in HPUSM.

1.5 RESEARCH HYPOTHESIS

Hypothesis 1

H_0: There is no association between demographics, levels of knowledge, and fasting plasma glucose (FPG) among GDM patients in HPUSM.

H_A: There is an association between demographics, levels of knowledge, and fasting plasma glucose (FPG) among GDM patients in HPUSM.

Hypothesis 2

H_0: There is no association between the degree of knowledge and fasting plasma glucose (FPG) among GDM patients in HPUSM.

H_A: There is an association between the degree of knowledge and fasting plasma glucose (FPG) among GDM patients in HPUSM.

1.6 SIGNIFICANT OF STUDY

This study aims to investigate the relationship between demographic factors, knowledge about gestational diabetes mellitus (GDM), and the levels of fasting plasma glucose (FPG) among gestational diabetes mellitus patients in the Obstetrics and Gynaecology (O&G) ward at Hospital Pakar Universiti Sains Malaysia (HPUSM). It is crucial for public health to understand the relationship between fasting plasma glucose levels and demographics and knowledge of GDM. Diabetes during pregnancy can have serious consequences for the mother and the fetus. The mother can get better results by understanding the factors that lead to increased or decreased knowledge levels and how they connect to glucose levels.

1.7 CONCEPTUAL FRAMEWORK

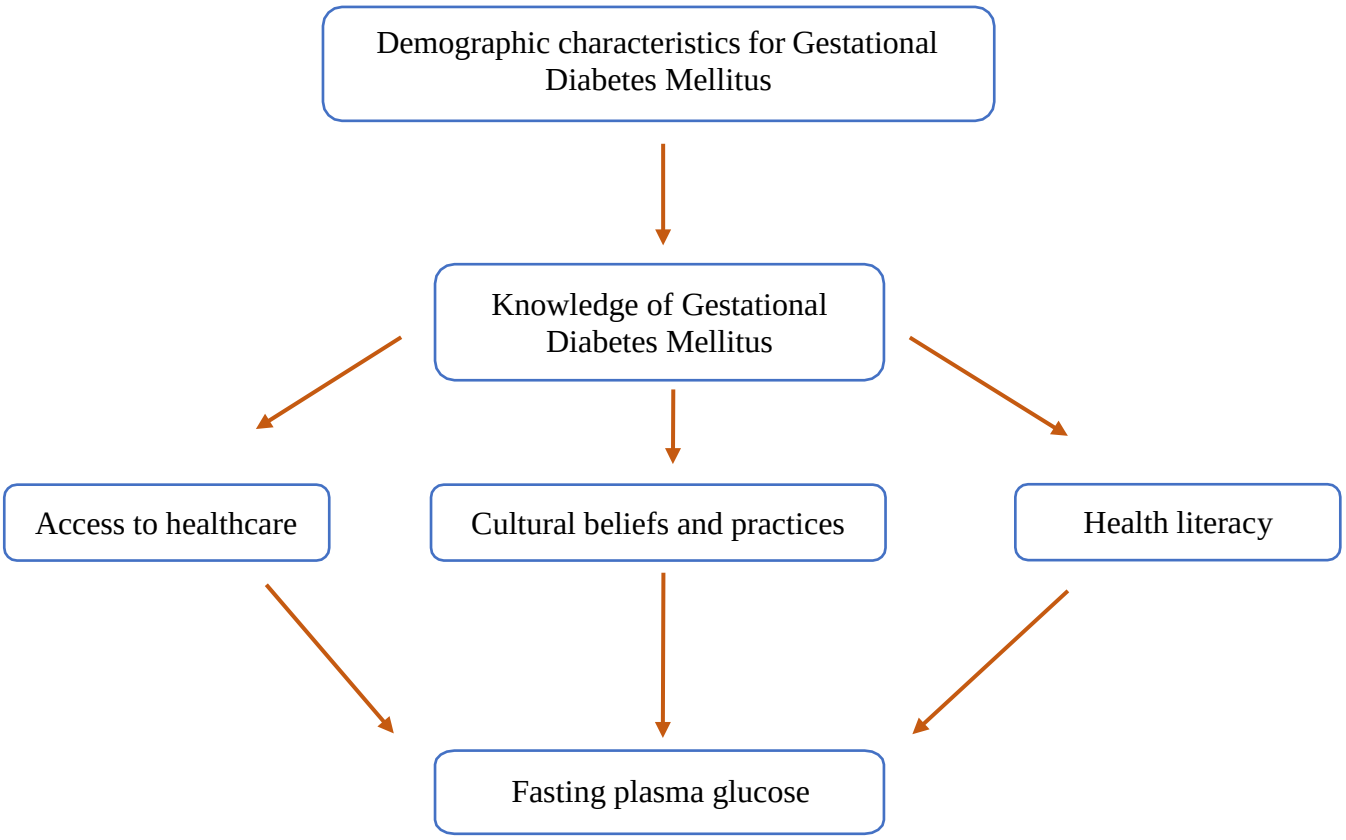


Figure 1: Conceptual Framework

The figure above shows the conceptual framework outlining the association between demographics and knowledge of gestational diabetes mellitus (GDM) with fasting plasma glucose (FPG) among patients at Hospital Pakar Universiti Sains Malaysia (HPUSM). Generally, demographic factors influence the level of awareness and understanding of GDM (Dissassa et al., 2023). Then, for timely therapy, individuals with adequate knowledge will seek for healthcare services. Hence, having improved access to healthcare facilitates proper management of GDM. Besides, knowledge also may influence cultural practices, particularly dietary habits which impact glycaemic control and health outcomes (Shriraam et al., 2013). Last but not least, with higher health literacy, it enables better management of FPG.

2.0 LITERATURE REVIEW

2.1 Pathophysiology Of Gestational Diabetes Mellitus

The pathophysiology of GDM involves a combination of hormonal changes and the body's response to these changes, leading to impaired insulin function. The pathogenesis of GDM includes β-cell dysfunction and tissue insulin resistance, which ultimately lead to insufficient regulation of glucose homeostasis during pregnancy (Stern et al., 2021). Generally,the storage and production of insulin to control blood glucose levels is carried out by pancreaticß cells (Plows et al., 2018). By detecting the levels of hormones, neurotransmitters, and other substances high in energy and secreting insulin in response, beta cells serve a crucial role in maintaining homeostasis. When important target tissues are suitably responsive to insulin, insulin stimulates the uptake and storage of nutrients in those tissues. Insulin levels decrease, and stored energy is used during starvation (Skelin Klemen et al., 2023). Beta cell dysfunction becomes severe by glucotoxicity when beta cell mass declines. This can result in elevated plasma glucose levels (Skelin Klemen et al., 2023).

In addition, when cells no longer react to insulin as well as they should, insulin resistance develops. Insulin resistance is typically caused by a malfunction in insulin signaling at the molecular level, which leads to insufficient translocation of glucose transporter 4 (GLUT4) into the plasma membrane. GLUT4 is the main transporter that carries glucose into cells for energy production (Plows et al., 2018). Insulin resistance is more likely in GDM patients than in healthy pregnant women (Catalano, 2014). This is because women with GDM experience increased resistance to glucose uptake (mostly in the skeletal muscle), glucose synthesis (mainly in the liver), and fatty acid levels (adipose tissue).

2.2 Risk Factors and Etiology of Gestational Diabetes Mellitus

i) Family history of diabetes

Gestational diabetes mellitus is a complex illness influenced by both environmental and hereditary factors. Diabetes in the family is a major independent risk factor for the onset of GDM (Lowe et al., 2016). Individuals may inherit genetic variations that raise their chance of developing insulin resistance or poor glucose metabolism if there is a family history of diabetes, especially type 2 diabetes. For instance, there are genes that had been found such as transcription factor 7-like 2 [TCFL7L2], melatonin receptor 1B [MTNR1B], CDK5 regulatory subunit-associated protein 1-like 1 [CDKAL1] potassium voltage-gated channel, KQT-like subfamily, member 1 [KCNQ1] and insulin receptor substrate-1 [IRS1] (Alejandro et al., 2020). Genetic variations that raise the risk of insulin resistance or poor glucose metabolism may be inherited by individuals with particular genes. Moreover, a family history of diabetes may have a higher prevalence of unhealthy lifestyle choices, such as poor eating habits and inactivity, which raises the risk of gestational diabetes mellitus (GDM).

ii) Overweight or obesity

In general, being overweight or obese is linked to early pregnancy metabolic risk factor clustering, which is linked to an increased risk of gestational diabetes mellitus (Yen et al., 2019). A higher pre-pregnancy BMI is associated with an increased risk of gestational diabetes mellitus. Asian women with BMIs of at least 30 kg/m2 had the highest prevalence of GDM (13.78%), followed by those with BMIs of at least 25 kg/m2 (10.22%) and at least 20 kg/m2 (6.09%) (Lee et al., 2018). Furthermore, overweight or obesity condition are strongly related with insulin resistance which is a disorder in which the body's cells lose their sensitivity to the effects of insulin. For example, adipokines, which are chemicals released by fat cells in adipose tissue, can disrupt insulin signalling and exacerbate insulin resistance. This occurs when there

is a significant rise in the amount of adipose tissue resulting from an inadequate energy expenditure and an increase in nutritional intake (Wondmkun, 2020).

iii) Maternal age >35 years

Maternal age raises the incidence of GDM linearly, according to a meta-analysis involving 120 million participants. The causes in pregnant women of advanced maternal age may include increased nutritional intake, weight gain, elevated circulating adipokine, and oxidative stress (Sun et al., 2023). The age-related decline in anti-inflammatory cytokines mayincrease the vulnerability of older women to inflammation (Sun et al., 2023). Besides, insulin sensitivity naturally declines with age in women, which increases the risk of insulin resistance.Thus, the decline in beta cell function with age can contribute to impaired glucose regulation.

iv) Polycystic Ovarian Syndrome (PCOS)

A hormonal condition called polycystic ovarian syndrome **(**PCOS) may have an impact on insulin sensitivity. For women of reproductive age, it is the most prevalent endocrine condition. Insulin resistance, hyperandrogenism, and persistent oligomenorrhea are the primarysymptoms of polycystic ovarian syndrome (PCOS), an endocrine and metabolic condition (Alejandro et al., 2020). Hyperinsulinemia interacts with insulin-like growth factors in the ovary after PCOS occurs, impairing the ability of the follicular membrane cells to convert androstenedione into oestrogen. This results in an increase in androgens and the formation of hyperandrogenemia (Aktun et al., 2016). It has been discovered that androgens can stimulate pancreatic b cells to undergo apoptosis. Insulin resistance causes a reduction in insulin sensitivity and a corresponding increase in insulin secretion. Sex hormone binding globulin (SHBG) synthesis and production in the liver can both be inhibited by elevated insulin levels.As a result of this, the circulatory system becomes disrupted in relation to sex hormones, whichin turn causes abnormalities related to the metabolism of fat and glucose. This exacerbates

insulin resistance and eventually results in the development of GDM (Calzada et al., 2019). Hence, gestational diabetes is more likely to occur in women with PCOS.

2.3 Clinical Management of Gestational Diabetes

Self-glucose monitoring is one clinical care strategy for gestational diabetes mellitus. The goal of medical care for expectant mothers is to maintain blood glucose concentrations within the reference interval. It is advised that women with GDM self-monitor their blood glucose levels before and two hours after major meals, including pre- and after (Bereda, 2022).The American Diabetes Association (ADA) recommended aiming for blood glucose levels of less than 95 mg/dL during fasting and less than 140 mg/dL or less than 120 mg/dL after two hours of postprandial blood glucose (Lende & Rijhsinghani, 2020). Women may decide to reduce the frequency of pre- and postprandial glucose measures to twice weekly if the glycaemic goals are readily reached within two weeks of starting lifestyle changes, provided that the readings remain within target.

In addition, dietary modification is also important to maintain blood glucose level for gestational diabetes mellitus patient. The diet plan is customised based on the patient's height and weight, taking into account the nutritional requirements of pregnancy and the fundamentals of diabetic diet therapy. The dietary modification included higher-quality complex carbohydrates with lower glycaemic indicators such as whole-grain cereals like oats, vegetables and fruits with skins are recommended because they could reduce postprandial hyperglycaemia and the requirement for insulin (Bereda, 2022). The American Diabetes Association suggests that a person should consume 1–1.5 g/kg of protein day, or 15-20% of their caloric intake (Lende & Rijhsinghani, 2020). It takes at least three servings of protein-rich foods every day to meet the increased requirement. Reducing the amount of fatty foods consumed is advised to lower blood glucose levels (Popova et al., 2021). For instance, GDM patient have to stay away from foods like butter, cheese, bacon, and hamburgers that are heavy

in saturated fat. Hence, it is recommended to control the portion of food, consume complex carbohydrate and adequate protein intake, and limit the fatty food intake.

Apart from that, exercise has been demonstrated to improve glucose control in GDM. If there are no contraindications related to health or pregnancy, a woman with GDM should participate in moderate activity for at least half an hour per day. For instance, GDM patients can reduce the rise in blood sugar after meals by walking quickly or performing arm exercises while seated in a chair for at least 10 minutes (Bereda, 2022).

3.0 RESEARCH METHODOLOGY

3.1 Research design

In this research, the study design used was a cross-sectional study. This design provided a snapshot of the population at a specific point in time, making it suitable when resources and time were limited. This design was conducted among gestational diabetes mellitus patients to assess their demographic data, knowledge of gestational diabetes mellitus (GDM), and the value of fasting plasma glucose (FPG).

3.2 Study area

The research was conducted among GDM patients in HPUSM to ensure a diverse sample of participants and generalizable results. It was generally carried out in the obstetrics and gynecology ward at HPUSM.

3.3 Study population

The study population for this research included 60 individuals diagnosed with gestational diabetes mellitus. The study focused on patients at least 18 years old who were receiving treatment and care at Hospital Pakar Universiti Sains Malaysia (HPUSM).

3.4 Subject criteria

Inclusion criteria

- Gestational diabetes mellitus patient
- Aged over 18 years old and above
- Patients who were receiving treatment and care at Hospital Pakar Universiti Sains Malaysia (HPUSM)
- Patients who can read, speak, and understand the Malay language

Exclusion criteria

- Patients with severe comorbidities like HIV
- Patients who refused to participate in the study

3.5 Sample size estimation

In this study, Raosoft Software was used to calculate the sample size. Based on data provided by the Obstetrics and Gynaecology ward in HPUSM, the average cumulative number of patients over two months was 153. A confidence level of 95% was considered to account for individual compliance during the test, with a 5% confidence interval and a 10% margin of error. Therefore, the sample size used was 60 participants.

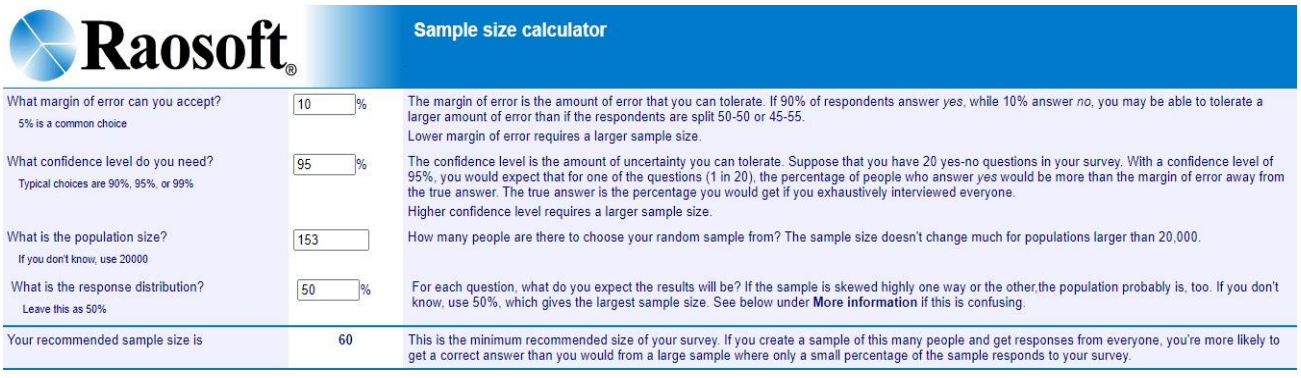


Figure 2: Raosoft Software

3.6 Sampling method and subject recruitment

The study used a purposive sampling design. Eligible patients who met the study criteria were invited to participate in the study. 60 participants were chosen. Informed consent and nondiscrimination were two key components of the project's careful participant recruitment method, which was based on ethical standards. As an initial step towards attracting potential participants from the Obstetrics and Gynaecology ward in Hospital Pakar Universiti Sains Malaysia, posters explaining the requirements, methods, possible advantages, and risks of the study were displayed in an understandable and straightforward manner. After that, study participants interacted with researchers to make sure they understood the material and to provide them a chance to ask questions. Before everyone was enrolled, their consent form was requested, and they were only asked to sign a consent form saying they were willing to join voluntarily. Special consideration was given to guarantee that the recruitment procedures were free from discrimination and upheld the autonomy and dignity of every person, irrespective of their medical history or other health-related characteristics, such as their diagnosis of GDM. The participants were required to read the research information, complete the consent forms if applicable, and answer all the questionnaires provided.

3.7 Research tool

In this study, data was collected by using an interviewer administered questionnaire. The questionnaire included demographic information such as age, ethnicity, educational level, occupational status, family history of diabetes and type of therapy.The Gestational Diabetes Mellitus Knowledge Questionnaire (GDMKQ) was used to assess the knowledge regarding gestational diabetes mellitus among GDM patients (Hussain et al., 2015). The 15 questions of the GDMKQ were divided into five main categories which were management (3 questions), food and diet values (3 questions), risk factors (3 questions), fundamental knowledge about

GDM (3 questions), and complications or outcomes (3 questions). To prevent participants from making needless guesses, all questions were multiple choice, with the option "I don't know." Any correct response received a score of 1, and any incorrect response received a score of 0. Higher scores indicated more advanced GDM understanding. The maximum score was, therefore, 15, while the lowest is 0 (Hussain et al., 2015).

The fasting plasma glucose (FPG) was used to record the glycaemic readings. The mean was determined by taking the three most recent FPG values from the patient's medical profile. A poorly controlled GDM was indicated by FPG readings above ≥5.6 mmol/l, as indicated by the Ministry of Health, Malaysia's Division of Family Health Development, and antenatal care.

3.8 Operational definition

Gestational diabetes mellitus: Level of glucose intolerance that began or was initially identified during pregnancy.

Fasting plasma glucose: A test used to measure the blood sugar level after a person has fasted for at least 8 hours (typically overnight).

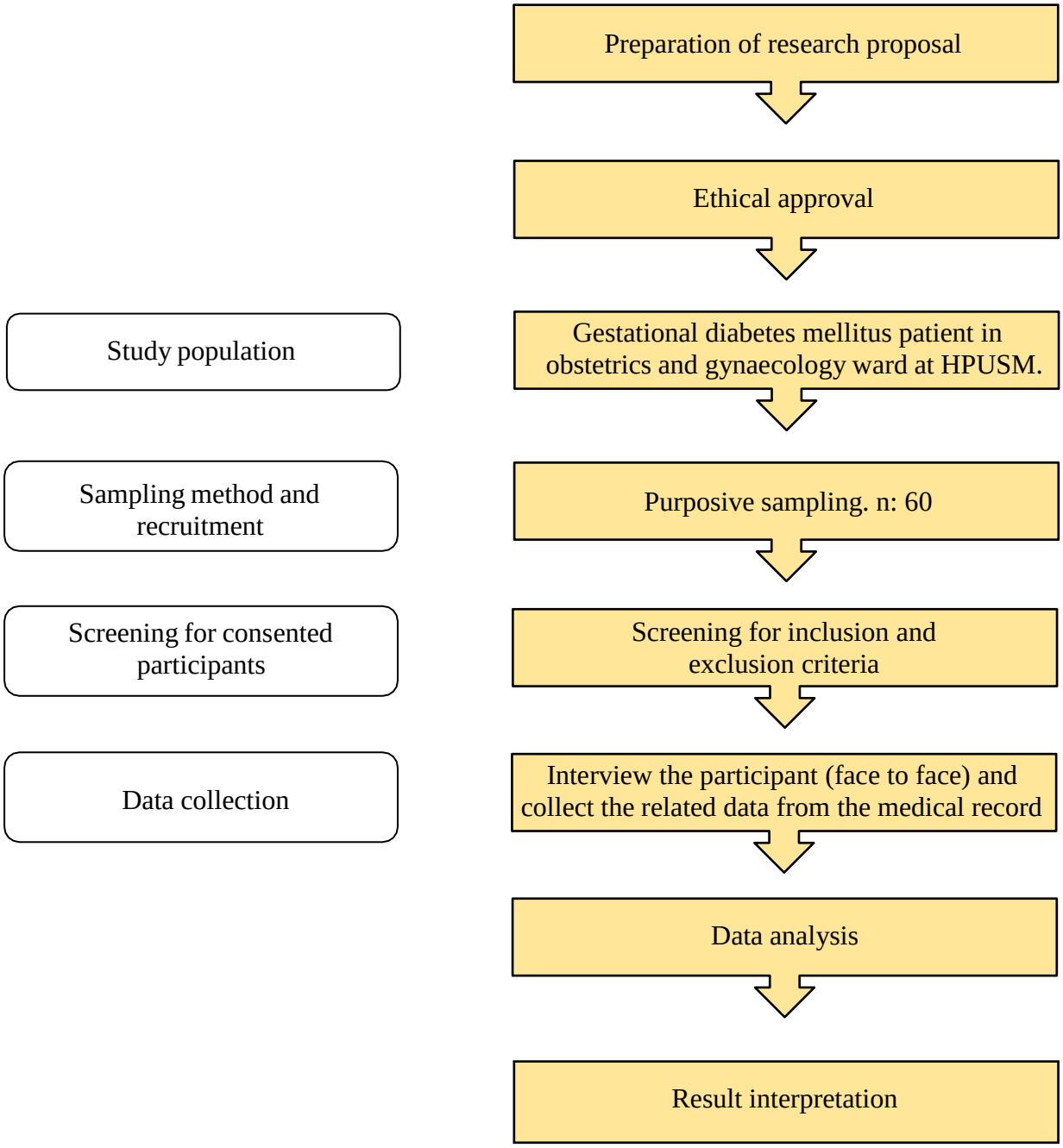
Glycaemic level: It refers to the amount of glucose (sugar) in the blood.

Oral glucose tolerance test (OGTT): A precise and accurate enzymatic diagnostic test for gestational diabetes mellitus based on the amount of glucose in venous plasma.

3.9 Data collection

This study was conducted at Hospital Pakar Universiti Sains Malaysia on gestational diabetes mellitus patients. Data collection was started after getting ethical permission from the USM Human Research Ethics Committee (JEPeM) and the Director of Hospital Pakar Universiti Sains Malaysia. Using purposive sampling, the participant information sheet, consent form, and questionnaires were given to the participants. The participants were assisted throughout the data collection process. The data collection was carried out starting from May 2024 to June 2024. Before the data collection, participants were completely informed about the procedures, benefits, and risks of the study and asked to sign an agreement to participate in this study. After that, the principal investigator reviewed the GDM patients' medical records to get the fasting plasma glucose values.

3.10 Study flowchart



3.11 Data analysis

All the statistical analysis was done by using Statistical Package for Social Sciences (SPSS Inc., Chicago, IL) version 27. Number and percentage were used for grouped variables, whereas mean and standard deviation were used for continuous variables. Responses to all questions of GDMKQ were recorded in numbers and percentages. The association between demographics and knowledge of gestational diabetes mellitus (GDM) with fasting plasma glucose among GDM patients was represented using the Mann-Whitney U test (for 2 group variables) and the Kruskal Wallis test (for more than 2 group variables). The association between the degree of knowledge and the fasting plasma glucose level was identified using Spearman rank correlation. A p-value of <0.05 will be considered significant for all the statistical analyses.

3.12 Ethical Consideration

Subject Vulnerability

This quantitative study aimed to evaluate the fasting plasma glucose (FPG), patient demographics, and knowledge of GDM. There was no bias when the researcher asked about gestational diabetes mellitus.

If a person had cognitive, speech, or hearing issues that could interfere with understanding and communicating, they were not required to participate. Before commencing the study, participants received a permission form explaining the procedures to be followed, the aim of the study, and their rights to withdraw at any time and access their information. Informed consent was a procedure of agreement between the researcher and the participant, which the participants questioned. As a result, everyone taking part understood their ability to discontinue participation at any time without facing consequences.

Declaration of absence of conflict of interest

There was no conflict of interest in this study. The researcher was responsible for any component of the research process, including data collection and the informed consent procedure.

Privacy and confidentiality

The information gathered only be accessible to the supervisor and researcher. The responses given by study participants were not identified in the thesis and findings presentation. No parties unrelated to this study received access to the subjects' personal data.

Community sensitivities and benefits

The researcher for the study inquired about the patient's knowledge regarding gestational diabetes mellitus. To reduce any potential pain, participants were given a brief description of the study prior to giving their consent. They were offered the option to decline participation. The information gathered was only utilized for research and not distributed to outside parties not involved in the project. This study may benefit the community (pregnant mothers) by guiding patients on how to maximize the consumption of low glycaemic index foods.

Honorarium and Incentives

Participants were not given any honorarium. A brief pamphlet with suggestions for improving food intake and nutritional treatment of gestational diabetes mellitus (GDM) was distributed to participants.

4.0 DATA ANALYSIS & RESULT

4.1 Demographic Characteristics

Generally, the demographic characteristics of patients in the study reveal diverse age distribution and parity levels. The majority of patients aged 30-34 years (31.7%), followed closely by those aged ≥ 35 years (35.0%), indicating that most participants were in their early to mid-thirties. Additionally, the parity of the patients varied, with 43.3% having more than three children, 31.7% having 2 to 3 children, and 25.0% being first-time mothers. This indicates a broad range of maternal experiences among the study participants.

Ethnic distribution predominantly featured Malay patients, who constituted 98.3% of the sample, with only one Chinese participant (1.7%) and no Indian participants, reflecting the ethnic composition of the region. In terms of educational background, nearly half of the participants held a degree (48.3%), while 36.7% had secondary education, 13.3% had a diploma, and a small fraction (1.7%) had only primary education. This variation in educational levels could potentially influence the patients' knowledge and management of GDM. The occupational status showed that a majority were housewives (58.3%), with the remaining 41.7% being working women, suggesting that lifestyle factors associated with employment might play a role in GDM management.

Regarding the family history of diabetes, 65.0% of the patients reported having a family history of diabetes, which is significant given the genetic predisposition to the condition. Treatment methods for GDM among the patients were primarily diet control (78.3%), with a smaller proportion requiring insulin (16.7%) and a few using oral hypoglycaemic agents (OHA) (5.0%). This distribution highlighted the varying degrees of GDM severity and management approaches within the patient cohort. Understanding these demographic characteristics is crucial for tailoring educational and therapeutic interventions to improve glycaemic control

among pregnant women at HPUSM.

Table 4.1: Demographic characteristics (n=60)

Variable	Category	(Mean ± SD)	n (%)
Age of patients	< 25 years	2.97 ± 0.92	3 (5.0)
	25-29 years		17 (28.3)
	30-34 years		19 (31.7)
	≥ 35 years		21 (35.0)
Parity	1		15 (25.0)
	2-3		19 (31.7)
	> 3		26 (43.3)
Ethnicity	Malay		59 (98.3)
	Chinese		1 (1.7)
Educational level	Primary		1 (1.7)
	Secondary		22 (36.7)
	Diploma		8 (13.3)
	Degree		29 (48.3)
Occupational status	Working woman		25 (41.7)
	Housewife		35 (58.3)
Family history of diabetes	Family history of DM		39 (65.0)
	No family history of DM		35 (58.3)
Type of therapy	Diet control		47 (78.3)
	Insulin		10 (16.7)
	OHA, s		3 (5.0)

4.2 Gestational Diabetes Mellitus Knowledge Questionnaire Responses

The results from Table 4.2 on the response of study participants to all Gestational Diabetes Mellitus Knowledge Questionnaire (GDMKQ) items reveal varying levels of knowledge across different domains. Participants demonstrated the highest level of knowledge for questions related to dietary practices and food values associated with GDM. Specifically, almost all participants correctly identified which foods can be eaten without restriction during GDM (Q. 8, 98.3%) and the nutritional source provided by rice (Q. 9, 96.7%). Additionally, a high percentage correctly answered that foods high in certain contents should be avoided (Q. 7, 83.3%). These results indicated a strong patient awareness about dietary management of GDM, which is crucial for controlling the condition.

On the other hand, the lowest level of knowledge was observed in questions related to the risk factors for developing GDM and basic management practices. Only 15% of participants correctly identified one of the increased chances of developing GDM (Q. 5), and just 36.7% knew the best way to test blood glucose levels in GDM patients (Q. 3). Moreover, understanding of the most common sign of hyperglycemia was also limited, with only 41.7% answering correctly (Q. 10).

Table 4.2: Response of study participants to all GDMKQ items (n=60)

Question		Right No. (%)	Wrong No. (%)
Basic knowledge about GDM	Q. 1 Gestational Diabetes Mellitus is the type of diabetes that occurs:	40 (66.7)	20 (33.3)
	Q. 2 In uncontrolled Gestational Diabetes Mellitus, the blood sugar level is:	41 (68.3)	19 (31.7)
	Q. 3 What is the best way to test blood glucose levels for Gestational Diabetes Mellitus patients?	22 (36.7)	38 (63.3)
Knowledge about risk factor	Q. 4 You are at increased risk of developing Gestational Diabetes Mellitus if you are:	50 (83.3)	10 (16.7)
	Q. 5 You have increased chances of developing Gestational Diabetes mellitus if:	9 (15.0)	51 (85.0)
	Q. 6 You are more likely to develop Gestational Diabetes Mellitus if you have:	46 (76.7)	14 (23.3)
Knowledge about diet/food values	Q. 7 If you have Gestational Diabetes Mellitus, you should avoid food containing high content of:	50 (83.3)	10 (16.7)
	Q. 8 Which of the following food can be eaten without restriction during Gestational Diabetes Mellitus:	59 (98.3)	1 (1.7)
	Q. 9 What does rice mainly provide as a nutritional source?	58 (96.7)	2 (3.3)
Knowledge about the management of GDM	Q. 10 The most common sign of hyperglycemia (high blood sugar) is:	25 (41.7)	35 (58.3)
	Q. 11 The normal value of fasting plasma glucose (FPG) is:	51 (85.0)	9 (15.0)
	Q. 12 If you feel the onset of hypoglycemia (low blood sugar) symptoms, you should:	43 (71.7)	17 (28.3)
Knowledge about GDM complications/ outcomes	Q. 13 In uncontrolled Gestational Diabetes Mellitus, your baby may be:	55 (91.7)	5 (8.3)
	Q. 14 If you have Gestational Diabetes Mellitus, you have:	25 (41.7)	35 (58.3)
	Q. 15 Gestational Diabetes Mellitus is a condition that:	59 (98.3)	1 (1.7)