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Research Article

Early Pregnancy Health and Behavioural Patterns among Malaysian Women

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Abstract

Background: Maternal health during pregnancy critically influences birth outcomes and child development. Understanding maternal characteristics is essential for identifying risk factors and guiding interventions. This study describes baseline maternal characteristics from the Pregnancy Exposures and Outcomes Monitoring in Malaysia (PEN-MUM) cohort, which investigates determinants of adverse pregnancy outcomes among women attending public health clinics in Peninsular Malaysia.

Methods: A descriptive analysis was conducted using baseline data from PEN-MUM, which recruited pregnant women aged 18–49 years with gestational ages between 12–18 weeks. Data were collected from March 2022 to March 2023 at 20 government clinics using digital and physical forms. Variables included socio-demographics, health status, behaviours, and health literacy.

Results: Participants were predominantly young Malay women with tertiary education (56.0%). Nearly half were employed in the private sector, while 38.1% were unemployed. Most were married, lived in urban settings, and belonged to the low-income group. Over half resided within 5 km of a clinic. Many had small, nuclear families; nearly half were nulliparous, and over 20% had prior miscarriage or caesarean deliveries. One-third booked antenatal care late. About 45% were overweight or obese; 57% had inadequate and 29% had excessive weight gain. Anaemia and gestational diabetes were prevalent (26.6% and 39.0%, respectively). Smoking exposure, poor sleep, food taboos (76.1%), and non-adherence to supplementation were common. Maternal health literacy was moderate to high (Mean=113.06±22.88).

Conclusion: Findings underscore the need for targeted interventions addressing late antenatal booking, nutrition, smoking exposure, and cultural practices, alongside improving maternal health literacy to enhance pregnancy outcomes.

Keywords: Maternal health, prenatal care, obesity, anaemia, diabetes mellitus, health literacy

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Introduction

Pregnancy is a crucial period that requires close monitoring of maternal health, as it directly impacts both the mother and the developing foetus (1,2). Significant anatomical and physiological adaptations

occur to support foetal growth, with these changes further influenced by various maternal characteristics, including socio-demographic factors, pre-existing medical conditions, behavioural patterns, and nutritional status (2,3).

Research has shown that specific maternal characteristics during pregnancy can have either beneficial or adverse effects on pregnancy outcomes (4). Systematic reviews have highlighted that socio-demographic and obstetric factors can contribute to complications in mothers, as well as adverse neonatal outcomes, including low birth weight, preterm birth, and stillbirth (5,6). A comprehensive understanding of these complex maternal factors enables healthcare providers to deliver personalised care, mitigate health risks, and enhance maternal and foetal health through targeted interventions and support systems (7,8).

As of 2023, Malaysia has 1,077 government health clinics, with the majority (745) located in Peninsular Malaysia (9). These clinics are strategically distributed across urban and rural areas to ensure comprehensive and equitable access to healthcare services for all population groups (10). According to the National Health Morbidity Survey (NHMS) 2022, approximately 91.2% of pregnant women seek antenatal care at public health facilities (11). These findings indicate that conducting research among pregnant women attending government health clinics provides a broad and representative sample, offering valuable insights into the overall maternal health status in Malaysia.

This study aims to describe the characteristics of pregnant mothers attending government health clinics in Peninsular Malaysia who were recruited between 12 and 18 weeks of gestation. It focuses on four key domains: maternal socio-demographic characteristics, maternal health status, maternal behaviours, and health literacy. By examining these factors, the study seeks to identify maternal characteristics that require targeted attention to improve maternal healthcare and pregnancy outcomes.

Methodology

Study Design and Study Settings

This study describes the baseline characteristics of a cohort study namely “Relative Risk of Determinants of Adverse Pregnancy Outcomes Among Pregnant Mothers Attending Government Health Clinics, Peninsular Malaysia” (PEN-MUM) study. The cohort study was conducted across 20 government health clinics in Peninsular Malaysia from March 2022 to March 2023. The findings of the PEN-MUM study have been reported elsewhere (12).

Study Participants

Pregnant mothers aged 18 to 49 years, who were registered and receiving care at government health clinics in Peninsular Malaysia, with a gestational age of 12 to 18 weeks, and who owned a smartphone with internet access for digital survey participation, were enrolled in this study. However, participants were excluded if they had experienced a miscarriage, were diagnosed with intrauterine growth restriction, had multiple pregnancies, had an unconfirmed estimated delivery date before 18 weeks of gestation, had been diagnosed with chronic medical disorders, or had discontinued antenatal visits.

Sample Size

The sample size was calculated using the formula for longitudinal studies with two proportions (13). Considering a 95% confidence level, 80% power, and a 30% non-response rate, a total of 630 participants was required, based on the proportion of low birth weight (LBW) among mothers with and without hypertension during pregnancy (14).

Sampling Method

A multistage random sampling approach was used to select 20 government health clinics in Peninsular Malaysia. Following this, the probability proportional to size (PPS) sampling method was applied for each clinic based on the calculated sample size. In the end, systematic random sampling was employed to identify eligible pregnant mothers from each of the chosen government health clinics.

Data Collection

Data collection began in March 2022 with the recruitment of eligible pregnant mothers between 12 and 18 weeks of gestation. Those who provided consent completed an online questionnaire to capture data on maternal socio-demographic characteristics, behaviours, and health literacy. Meanwhile, maternal health status information was obtained using a standardized physical data collection form after reviewing their maternal health records. The cohort was followed at three time points: Point 1 (24–28 weeks of gestation), Point 2 (36–40 weeks of gestation), and Point 3 (post-delivery). However, only data from the first time point (baseline data) are presented in this study.

Study Instruments

Two study instruments were utilized: an online self-administered questionnaire and a physical standard data collection form. Both instruments underwent a quality control process that included assessments of content validity and face validity. A one-week test-retest reliability showed good agreement (Cohen’s Kappa: 0.53–0.86) and reliability (intra-class correlation: 0.75–0.84). This study included four variables: maternal socio-demographic characteristics, maternal health status, maternal behaviour and health literacy. Maternal health status was extracted from the maternal record book and recorded using a standardized physical data collection form. The remaining variables were collected through an online, self-administered questionnaire available in both English and Malay. This questionnaire was developed for the PEN-MUM cohort study and adapted from previous research. The questionnaire is provided in Supplementary File 1.

Maternal Socio-demographic Characteristics

Maternal socio-demographic characteristics include age (numbers in years), ethnicity (Malay, Chinese, Indian, or others), education level (primary, secondary, or tertiary), employment status (unemployed, self-employed, private sector employee or public sector employee), marital status (married or unmarried/widowed/separated), monthly household

income, residency area (urban or rural), home distance to the government health clinic (within access or far from access), family size (small, moderate or large) and living status (nuclear family, extended family or single parent family). The monthly household income was then categorised as below 40% of the population income (B40), middle 40% of the population income (M40) and top 20% of the population income (T20) (15).

Maternal Health Status

Maternal health status describes obstetric-related problems and specific medical issues recognised during pregnancy. It Obstetric-related problems include parity (nulliparity, low multiparity or grand multiparity) (16), pregnancy interval (primigravida, ≤ 2 years or > 2 years) (17), history of miscarriage ("Yes" or "No"), history of caesarean ("Yes" or "No"), contraception use ("Yes" or "No"), gestational age at booking (early booking or late booking) (18), maternal height (< 145 cm or ≥ 145 cm) (19), maternal body mass index (BMI) (underweight, normal weight, overweight or obese) (20), and gestational weight gain (inadequate, adequate or excessive) (21).

Specific medical issues involve a family history of medical problems ("Yes" or "No") and the presence of particular medical conditions ("Yes" or "No") at recruitment, including dengue infection, urinary tract infection, COVID-19 infection, gestational hypertension (22), preeclampsia (22), maternal anaemia (23), and gestational diabetes mellitus (GDM) (24).

Maternal Behaviours

Maternal behaviours consist of multiple variables such as dietary diversity, smoking status, sleep habits, compliance to iron-folic acid (IFA) supplementation, food taboos practice, and traditional medicine used practice. This study adapted the Minimum Dietary Diversity for Women of Reproductive Age (MDD-W), a list-based approach used to assess the dietary diversity of pregnant mothers (25). Fourteen mutually exclusive questionnaires were used to capture specific food group categories, which were later aggregated into the MDD-W's 10 food groups; (i) Staples food (grains, white roots, tubers, and plantains); (ii) plant foods (pulses like beans, peas and lentils); (iii) plant foods (nuts and seeds); (iv) animal food (meat, poultry, and fish); (v) animal foods (eggs); (vi) animal foods (milk and dairy products); (vii) vegetables and fruits (dark-green leafy vegetables); (viii) vegetables and fruits (vitamin A-rich); (ix) vegetables and fruits (other vegetables); and (x) vegetables and fruits (other fruits). Participants were asked to recall the foods they consumed in the 24 hours prior to questionnaire administration. They marked 'Yes' if they had consumed any item from a given food group and 'No' if they had not. Finally, dietary diversity scores were categorized as adequate (≥ 5 food groups) or inadequate (< 5 food groups)

Maternal smoking status was assessed based on previous studies (26, 27, 28). Exposure to cigarette smoking during pregnancy was defined as the consumption of cigarettes, e-cigarettes, or a combination of both at least once during the current

pregnancy. Participants were assessed using the question: "Did you smoke any tobacco products during this pregnancy?" If they answered "Yes," a follow-up question was asked to specify the type of tobacco used; cigarettes, e-cigarettes/vapes, or a combination of both. To assess passive smoking status, participants were asked three questions; (i) "Does your husband or partner smoke any tobacco products inside your home during this pregnancy?", (ii) "Not including yourself or your husband/partner, does anyone else smoke any tobacco products inside your home during this pregnancy?" and (iii) "Do you spend time at home, in your workplace, or any other location where you are exposed to tobacco smoke during this pregnancy?" Participants were classified as passive smokers if they answered "Yes" to any of these questions.

Maternal sleep habits were assessed using the original English and translated Malay versions of the Pittsburgh Sleep Quality Index (PSQI/PSQI-M) to evaluate sleep quality and patterns. The original PSQI has an internal consistency of 0.83, while the validated Malay version has an acceptable internal consistency with a Cronbach's alpha of 0.74 (29, 30). Permission to use the PSQI/PSQI-M was obtained. The adapted questionnaire consists of 19 items measuring subjective sleep quality over the past month. These items are grouped into seven components that assess different aspects of sleep; sleep quality (1 item), sleep latency (2 items), sleep duration (1 item), sleep efficiency (3 items), sleep disturbance (9 items), sleep medication (1 item) and daily dysfunction (2 items). Each component is scored from 0 to 3, and the total score is obtained by summing the seven component scores, yielding a global PSQI score ranging from 0 to 21. Respondents with a global score > 5 were classified as "poor" sleepers, while those with a score ≤ 5 were classified as "good" sleepers.

Maternal compliance with Iron-Folic Acid (IFA) supplements was assessed based on a previous study (31). Compliance behaviour was defined as the daily intake of IFA supplements and adherence to dietary advice on IFA intake starting from one month before recruitment. First, pregnant mothers were asked to specify the type of IFA supplement they had taken during the recommended period. The available options were based on supplements provided in health clinics, including; Ferrous Fumarate tablet, Zincofer tablet, Maltofer chewable tablet, Iberet Folic tablet, Obimin tablet and Folic Acid tablet. Next, participants were asked whether they had taken IFA supplements daily throughout the recommended period. Those who answered "Yes" were classified as compliant, while those who answered "No" were classified as non-compliant. Practices related to food taboos and the use of traditional herbal medicines were assessed based on previous studies (32,33). Participants were categorized as practicing these behaviours if they answered "Yes", and as not practicing them if they answered "No".

Maternal Health Literacy

This study used validated maternal health literacy scale (34). This section consists of four domains: obtaining maternal health information, knowledge of maternal

health, assessment of maternal health information, and maternal health decision-making behaviour, adapted from a previous study (34). Of the original forty questions, thirty-three were modified to suit the local population and study objectives. Items related to maternal health knowledge were rated on a 5-point scale ranging from 'I don't know at all' to 'I know fully', while items in the other three domains were rated on a 5-point scale ranging from 'not at all' to 'always'. All responses were summed, with higher scores indicating greater maternal health literacy. The total score range was from 33 to 165.

Statistical Analysis

Data entry and analysis were conducted using IBM SPSS version 26.0. Prior to analysis, data cleaning was done. The data set was checked for errors, including missing data and outliers. Normality testing was performed on continuous data using skewness, kurtosis and histograms. Continuous variables were expressed in mean and standard deviations or median and interquartile range (IQR), while the categorical variables were represented as absolute frequencies and percentages.

Ethics approval and consent to participate

The National Medical Research and Ethics Committee (NMREC) of the National Institute of Health, Ministry of Health Malaysia, has granted ethical permission (NMRR-21-1789-61052) for this study. Permission was also acquired from the respective state health departments involved (Selangor, Negeri Sembilan,

Pahang, and Penang). Online informed consent was obtained from participants upon recruitment, and they were assured that all data would be maintained with utmost confidentiality and that they might withdraw from the study at any given time.

Results

A total of 630 pregnant mothers were approached during the recruitment period. However, only 507 consented to participate in this study, giving a response rate of 80.5%.

Maternal Socio-demographic Characteristics

Figure 1 shows the socio-demographic characteristics of the sampled mothers. It shows that most participants were in the younger reproductive age group, which aligns with typical maternal age distributions. The sample predominantly represents the Malay population, which may reflect the demographic composition of the mothers attending the 20 government clinics. More than half of the participants had tertiary education (56.0%), followed by secondary education (42.0%). Nearly half of the mothers were private sector employees, while 38.1% were unemployed. A smaller proportion were public sector employees (11.6%) and self-employed (6.3%). The vast majority were married and resides in urban areas. However, majority of them belong to low socio-economic group represent by below 40% income group (B40). Majority lived within 5 km of a government health clinic with more than half had a small family (1-3 members) and more than two third were nuclear family.

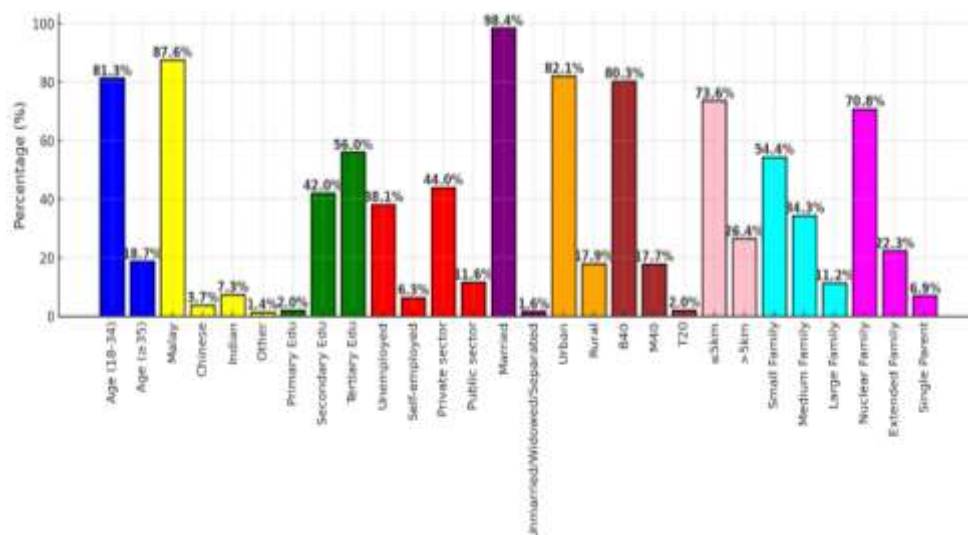


Figure 1: Distribution of maternal socio-demographic characteristics.

Maternal Health Status

Figure 2 shows maternal health status of the participants. More than half of the mothers had low parity, defined as having 1 to 4 births, with nearly half classified as nulliparous. One-fifth of the mothers reported a history of miscarriage, and almost the same proportion had undergone a caesarean section. Additionally, over one-fifth indicated that they used contraception. Approximately one-third of participants booked their antenatal care late. Almost all mothers had

a maternal height exceeding 145 cm. A significant proportion (45%) were classified as overweight or obese. More than half (57%) experienced inadequate weight gain during pregnancy, while 29% gained excessive weight. Furthermore, nearly 40% reported a family history of medical issues. Only a small percentage of mothers were diagnosed with urinary tract infections (5.1%) and COVID-19 during pregnancy (8.5%).

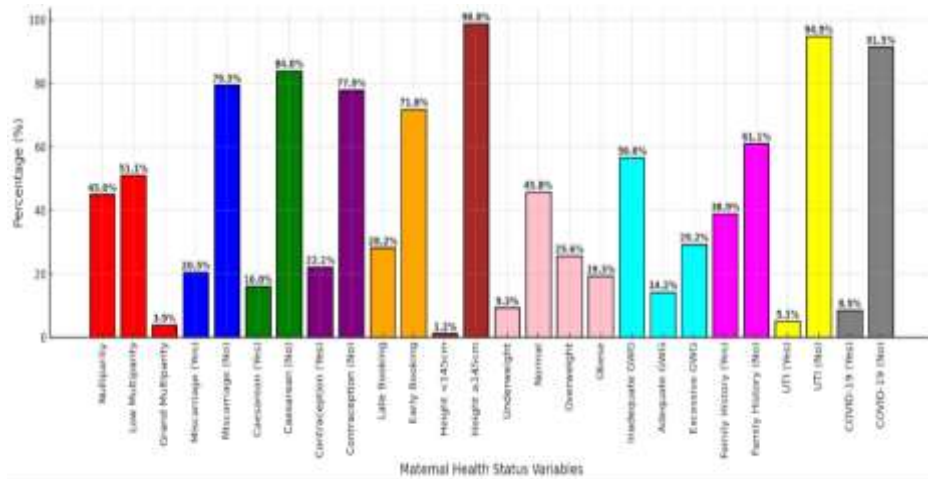


Figure 2: Distribution of maternal health status.

Figure 3 illustrates the distribution of anaemia and gestational diabetes mellitus (GDM) diagnosed during the study recruitment. Notably, no cases of gestational hypertension or preeclampsia were identified during

this period. More than a quarter of pregnant mothers experienced anaemia during pregnancy, while 39% were diagnosed with GDM, and nearly one-tenth faced both conditions at the time of recruitment.

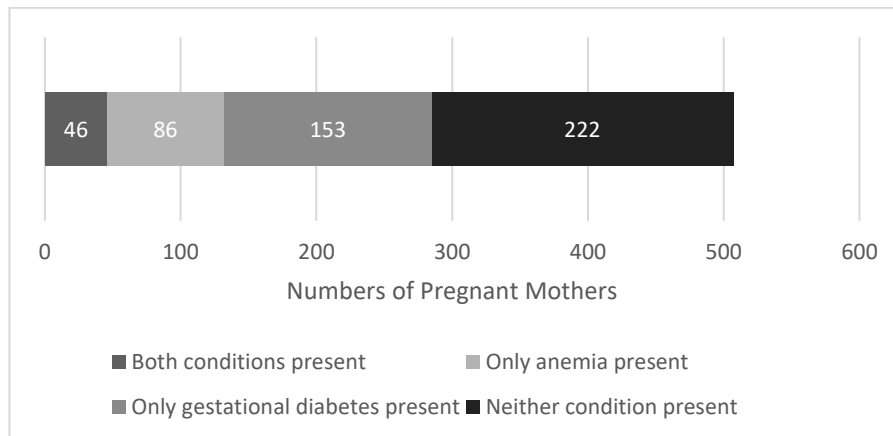


Figure 3: Numbers of pregnant mothers with anaemia in pregnancy and gestational diabetes mellitus (GDM).

Maternal Behaviours

Figure 4 illustrates the maternal behaviours among the sampled participants. More than three-quarters of pregnant mothers had an adequate dietary diversity, indicating good nutritional intake. Nearly half of the pregnant women were exposed to smoking, either as

active or passive smokers while one-third were poor sleepers. About one-third of the mothers did not adhere to supplementation. A substantial proportion (76.1%) of pregnant women adhered to food taboos, categorising this behaviour as unfavourable, whereas the majority refrained from using traditional medicine.

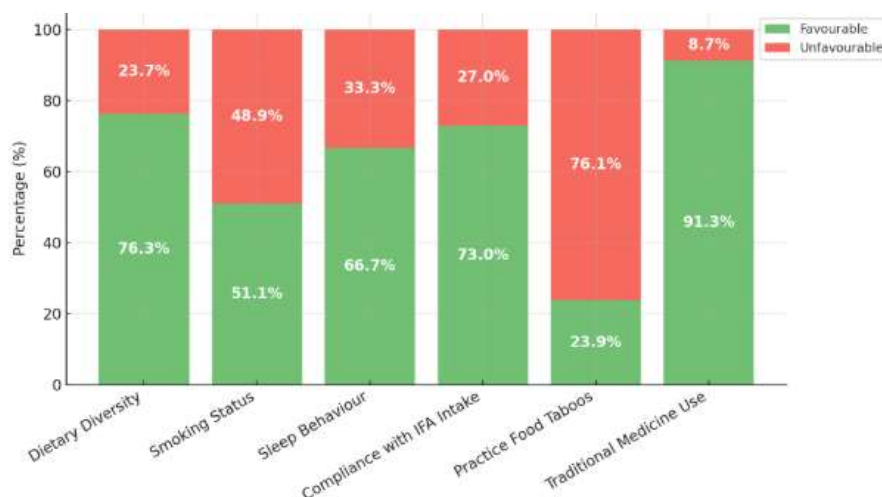


Figure 4: Maternal behaviours of the study sample.

Maternal health literacy

The mean maternal health literacy score among the study participants was 113.06 ± 22.88 . This suggests that, on average, pregnant women in the study demonstrated a moderate to high level of health literacy.

Discussion

The findings of this study provide valuable insights into the maternal socio-demographic characteristics, maternal health status, behaviours, and health literacy of pregnant women. Understanding these factors is crucial for developing targeted public health interventions to improve maternal and neonatal outcomes.

The socio-demographic characteristics of mothers in this study are generally consistent with those reported in the NHMS 2022 (11). However, a higher proportion of participants in our study had attained at least secondary education, resided in urban areas, and were employed, particularly in the private sector. This difference may be attributed to the higher representation of urban mothers in our cohort, who are more likely to have greater access to educational opportunities, subsequently increasing their employment prospects (35).

Despite higher employment rates, the majority of participants in our study were classified as having low-income status. This may be due to factors such as underemployment, where individuals work in jobs that do not fully utilise their qualifications, or the higher cost of living in urban areas, which affects overall financial stability (36). Additionally, our findings indicate that most mothers received antenatal care within 5 km of their homes, suggesting that healthcare services in Peninsular Malaysia are generally accessible (37).

Our findings on maternal health status present a mixed comparison with previous local studies. The proportion of mothers with a history of caesarean section in our study was slightly lower than the 23.2% reported in a study based on data from the Malaysian National Obstetrics Registry (38). This discrepancy may be attributed to methodological differences, as our study represents only the population of Peninsular Malaysia. Additionally, our study observed a higher proportion of early antenatal booking (39).

Most participants were multiparous, which may have contributed to greater awareness of early pregnancy symptoms and the importance of timely antenatal care, potentially influencing their decision to book early (40). However, late antenatal booking remains a significant concern, as it can lead to missed opportunities for early risk detection and preventive care. This highlights the need for targeted strategies to encourage timely healthcare-seeking behaviours among pregnant women. On the other hand, the relatively high proportion of women who did not use contraception suggests potential gaps in family planning education, necessitating improved access to postpartum contraceptive counselling and reducing unintended pregnancies (41).

Most mothers in our study had a height over 145 cm, which is supported by the fact that the average adult height in Malaysia was between 160.9 and 161.3 cm, with the mean for female adults being 157.3 ± 7.1 cm (42). The percentage of women with a family history of medical disorders was higher in our study compared to others, which suggests an increasing trend of chronic diseases within the local population (43). In contrast, the prevalence of COVID-19 during pregnancy was lower compared to other local research, which could be attributed to the characteristics of their study participants, as they included those at all gestational ages up to six weeks post-delivery (44).

Anaemia in pregnancy remains a significant public health concern, with findings aligning with global trends where anaemia is commonly attributed to iron deficiency, increased maternal blood volume, and inadequate nutritional intake (45). Most participants in our study are low-income or urban poor, living in a nuclear family without extended family support could influence their access to a healthy diet, which could lead to anaemia in pregnancy (46). As for GDM, the findings were consistent with some studies in Asia, which showed that a higher proportion of them with the condition resided in urban areas and had low-income status (47,48). The reason could be that urban living often encourages a sedentary lifestyle with limited physical activity and greater access to processed foods (49,50). Additionally, low-income individuals may limit access to fresh, nutritious foods due to financial constraints (51). These lifestyle factors have been proven to increase the risk of developing GDM among pregnant mothers (52).

The co-occurrence of anaemia and GDM further highlights the interplay of multiple maternal health risks. Anaemia has been linked to glucose metabolism dysfunction, potentially exacerbating insulin resistance and worsening pregnancy outcomes (53). These findings reinforce the need for integrated antenatal care strategies that address both nutritional deficiencies and metabolic conditions through comprehensive maternal health interventions.

The findings on maternal behaviours suggest both positive and concerning trends. While the majority of pregnant women reported adequate dietary diversity, a significant proportion had inadequate diversity, potentially leading to micronutrient deficiencies. Similarly, while adherence to iron-folic acid supplementation was generally high, non-compliance among some participants could increase the risk of maternal anaemia and related complications (54). A striking finding was the high prevalence of smoking exposure, either actively or passively, which poses significant risks such as foetal growth restriction and preterm birth (55). Such findings could be potentially linked to socioeconomic and environmental factors, as many in this study are from low socioeconomic status and reside in urban areas, which are usually densely populated (56). This underscores the urgent need for

comprehensive tobacco control policies targeting pregnant women and their households.

Furthermore, a high number of mothers who adhere to food taboo practices may be attributable to their strong beliefs and following their ancestors' traditional practices, even though some are considered myths and false beliefs (57). Cultural influences on dietary practices were evident, with a substantial proportion of women adhering to food taboos. While these practices are deeply rooted in tradition, they may restrict essential nutrient intake and adversely affect maternal and foetal health. In contrast, the low prevalence of traditional medicine use is reassuring, given the potential risks associated with unregulated herbal remedies during pregnancy (58). Healthcare providers should engage in culturally sensitive discussions to address misconceptions while respecting traditional beliefs. On the other hand, poor sleep quality was also prevalent among a third of the participants, with potential implications for gestational hypertension and metabolic dysregulation (59). Sleep education and interventions should be incorporated into routine prenatal care to improve maternal well-being.

Maternal health literacy scores suggest that most women possess a moderate to high level of understanding regarding health information, which is crucial for informed decision-making during pregnancy. Our findings could suggest the success of health educational activities during antenatal visits in government health clinics and the improvement in access to healthcare resources (60,11). However, the wide variation in literacy levels indicates disparities in knowledge access and comprehension, highlighting the need for simplified health messaging and tailored educational interventions to support all pregnant women effectively. Strengthening health education initiatives may help address these gaps and enhance maternal practices.

Limitations

This study has several limitations. As a descriptive study, it does not establish causal relationships between the examined factors and pregnancy outcomes. Self-reported data on behaviours such as smoking exposure, dietary practices, and health literacy may be influenced by recall bias and social desirability bias. Moreover, the study was limited to pregnant women attending government health clinics, which may reduce its applicability to those receiving private healthcare or not seeking antenatal care. Requiring participants to have a smartphone may have also excluded lower-income mothers, potentially affected the representativeness of the sample and introduced selection bias.

Conclusion

These findings highlight the need for comprehensive maternal health interventions that address socio-demographic disparities and health-related behaviours. Efforts should focus on improving dietary diversity, increasing adherence to prenatal supplementation, reducing smoking exposure, and enhancing maternal

health literacy. Encouraging early antenatal care attendance, providing personalised nutritional counselling, and integrating culturally sensitive approaches to address food taboos and traditional medicine use are essential steps towards optimising pregnancy outcomes. Future research should explore the long-term impact of these factors on maternal and neonatal health to further inform public health strategies.

List of abbreviations

BMI – Body Mass Index
B40 – Bottom 40% Household Income Group ($\leq$ RM 4850) approximately less than USD1,088.
M40 – Middle 40% Household Income Group (RM 4851–RM 10,970) approximately between USD1,088 and USD2,462
T20 – Top 20% Household Income Group ($\geq$ RM 10,971) approximately more than USD2,462.
GDM – Gestational Diabetes Mellitus
MHL – Maternal Health Literacy
RM – Ringgit Malaysia (Malaysian Currency)
PEN-MUM – Relative Risk of Determinants of Adverse Pregnancy Outcomes Among Pregnant Mothers Attending Government Health Clinics, Peninsular Malaysia

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