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The Impact of Overweight and Obesity in Early Pregnancy on Maternal Complications in Cambodia

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ABSTRACT

Introduction

Overweight and obesity among women of reproductive age are global health issues linked to adverse maternal and neonatal outcomes. In Cambodia, rates of overweight and obesity are rising, yet their impact on maternal health remans under-investigated. This study examines the relationship between early pregnancy body mass index (BMI) and maternal complications.

Methods

This retrospective cohort study was conducted at the National Maternal and Child Health Center in Phnom Penh, Cambodia. Medical records from 400 pregnant women attending their first antenatal visit within 12 weeks of gestation were analyzed. BMI was calculated and categorized according to World Health Organization standards. Maternal complications, including gestational hypertension, preeclampsia, and postpartum hemorrhage, were assessed alongside sociodemographic characteristics and pregnancy outcomes.

Results

The study found that 21% of the women were overweight or obese. These groups had significantly higher numbers of pregnancies and children ($p = 0.002$ and $p = 0.030$, respectively). Overweight and obese women had significantly higher frequencies of cesarean sections (66.7%) compared to underweight and normal weight women ($p < 0.001$) and a higher proportion of preeclampsia. Birth weights were higher in the overweight group ($p = 0.033$).

Conclusion

Overweight and obesity in early pregnancy are associated with increased risks of cesarean sections and maternal complications, including preeclampsia. These findings underscore the importance of implementing effective weight management strategies during antenatal care to mitigate these risks and improve maternal health. Enhanced data collection during antenatal visits is crucial to guide future research.

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Introduction

Overweight and obesity have emerged as significant global health challenges globally, with the rates of these conditions escalating at an alarming rate. The number of individuals classified as overweight or obese increased dramatically from 921 million in 1980 to 2.1 billion in 2013 (1), with an estimated 38.9 million pregnant women globally affected by 2014 (2), underscoring a growing public health concern with significant implications for maternal and neonatal health. Overweight and obesity, defined as a body mass index (BMI) of >25 kg/m2, are associated with numerous health risks, including cardiovascular diseases, diabetes, certain cancers, and musculoskeletal disorders (3). The global burden of these conditions has prompted increased attention from healthcare professionals and policy makers, particularly concerning their impact on vulnerable populations such as pregnant women.

The health risks associated with overweight and obesity are particularly pronounced in women who are overweight or obese before or during pregnancy. These women face heightened risks of adverse maternal and neonatal outcomes, including gestational diabetes, hypertensive disorders, cesarean sections, preterm births, and macrosomia (4, 5). Obesity during pregnancy can lead to excessive inflammatory responses and mechanical complications during childbirth, such as cephalopelvic disproportion and obstructed labor (6). Consequently, managing weight before and during pregnancy is crucial for reducing the risk of these complications and improving maternal and neonatal health outcomes.

Accurate weight assessment during the first 12 weeks of pregnancy is crucial, as this period often reflects pre-pregnancy weight and is less influenced by gestational changes. The Institute of Medicine (7) emphasizes early pregnancy BMI as a key predictor of maternal and neonatal outcomes, including preeclampsia, gestational diabetes, and cesarean delivery. Early assessment provides a foundation for targeted interventions, such as nutritional counseling and weight management strategies, which are most effective when implemented during this critical period (6-8). However, in settings like Cambodia, standardized practices for recording BMI during early pregnancy are limited, highlighting a critical gap in maternal health monitoring.

In Cambodia, the rates of overweight and obesity among women of reproductive age have increased significantly over recent years (9), reflecting broader global trends. According to the National Demographic and Health Survey, the proportion of overweight and obese women rose from 6% in 2000 to 18% in 2014, highlighting a growing public health concern (10). This increase is particularly concerning given the associated risks of non-communicable diseases and adverse maternal outcomes. Overweight and obese women, including those in Cambodia, face higher risks of complications such as obstructed labor, lower infant birth weight, and postpartum hemorrhage, all of which contribute to increased maternal and neonatal morbidity and mortality (11). These risks are particularly pronounced when obesity is present in early pregnancy, as excess weight during this critical period often reflects pre-pregnancy BMI and can exacerbate adverse outcomes throughout gestation.

Despite the rising prevalence of overweight and obesity, there is limited data available on the relationship between early pregnancy BMI and maternal complications in Cambodia. The maternal health book, a tool used by pregnant women during antenatal care, is widely available across public health facilities in Cambodia and serves as a crucial resource for monitoring maternal health. However, it currently lacks standardized recording of BMI, as healthcare providers typically only document weight and height without calculating BMI. This absence of standardized BMI data hampers the ability to fully assess the impact of overweight and obesity on maternal and neonatal health outcomes. This study aims to address this issue by analyzing BMI data from pregnant women at their first antenatal care visit and examining the association between overweight and obesity in early pregnancy and adverse maternal health outcomes. By elucidating these relationships, the study seeks to inform healthcare practices and policies aimed at improving maternal health in Cambodia.

Methods

Study Design

This retrospective cohort study was conducted to examine the relationship between early pregnancy BMI and maternal health outcomes. The study was carried out at the National Maternal and Child Health Center (NMCHC), a public hospital specializing in obstetrics and gynecology, located in Phnom Penh, Cambodia.

Participants

During the study period, a total of 3,385 women gave birth at the NMCHC. Out of these, the study included 400 women who attended antenatal care visits within the first 12 weeks of gestation. Medical records were excluded if they lacked data on either weight or height at baseline or if the women did not deliver at NMCHC.

Data Collection and Assessment Methods

Data were collected from medical records of women who attended their first antenatal care visit within the first 12 weeks of gestation. BMI was calculated as weight (kg) divided by height squared (m^2) and categorized according to World Health Organization standards as underweight (<18.5 kg/m^2), normal weight (18.5–24.9 kg/m^2) overweight. The following variables were also collected: age, occupational status, place of residence, marital status, antenatal care visits, number of pregnancies, number of children, gestational age, gestational weight at birth, birth weight, and cesarean section. Place of residence was categorized as urban or rural, with urban areas referring to municipalities and rural areas to districts.

Maternal complications were identified from hospital records and categorized as gestational hypertension, preeclampsia, postpartum hemorrhage, premature rupture of membranes, induced labor, and stillbirth. Each complication was defined based on clinical criteria documented in the hospital registry.

Data Analysis

Descriptive data were analyzed as numbers, percentages, means, and are presented as mean ± standard deviation (SD) for each variable. Quantitative variables were analyzed using analysis of variance (ANOVA). Categorical variables were assessed using the chi-square test and are presented as percentages. A p-value of <0.05 was considered statistically significant. Data analysis was performed using the Statistical Package for the Social Sciences (SPSS) software, version 29.0 for Windows (IBM SPSS, Chicago IL, USA).

Ethical Considerations

The study protocol received ethical approval from the Ethics Committee of the Graduate School of Health Care and Nursing at Juntendo University, Japan on December 27, 2023 (approval number 2023-66), and from the Cambodia National Ethics Committee for Health Research on February 21, 2024 (approval number 013). Permission to access and use the medical records was obtained from NMCHC. Data confidentiality was strictly maintained, and all information was anonymized to protect participant privacy. Participants were informed of their rights to withdraw from the study at any time.

Results

Body Mass Index (BMI) Classification

The BMI of 400 pregnant women was calculated at the first antenatal care visit, resulting in an average BMI of 22.22 ± 3.47 kg/m^2. The distribution of participants was as follows: 55 (13.8%) were classified as underweight, 261 (65.2%) as normal weight, 74 (18.5%) as overweight, and 10 women (2.5%) as obese (Fig. 1). Overall, 84 women (21.0%) were classified as overweight or obese.

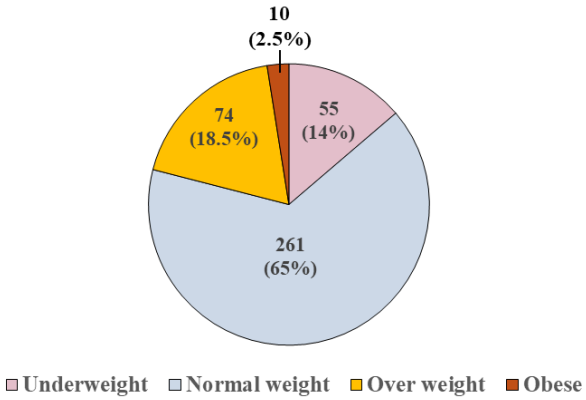

Figure 1: BMI Classification of Pregnant Women

Distribution of BMI among 400 pregnant women at their first antenatal visit. Categories: underweight (13.8%), normal weight (65.2%), overweight (18.5%), and obese (2.5%), based on WHO standards.

Characteristics of Pregnant Women

The sociodemographic and clinical characteristics of the pregnant women were compared across the BMI categories (Table 1). The mean age showed no significant differences among the groups. The majority of participants were unemployed, and this proportion did not significantly differ across BMI categories. Similarly, there were no significant differences in place of residence, with most women residing in rural areas.

However, significant differences were observed in the number of pregnancies and the number of children. Women in the overweight and obese groups had a significantly higher mean number of pregnancies (2.96 ± 1.63) compared to those in the underweight (2.13 ± 1.16) and normal weight groups (2.48 ± 1.36) (p = 0.002). The number of children was also significantly higher in the overweight and obese groups (1.20 ± 1.04) compared to the underweight (0.76 ± 0.90) and normal weight groups (0.95 ± 0.99) (p = 0.030).

A significant difference was observed in birth weight, with the highest mean birth weight recorded in the overweight group (3172.05 ± 709.85 g) and the lowest in the underweight group (2927.07 ± 523.27 g) (p = 0.033).

Table 1: Characteristics of pregnant women

	Total N=400 (%)	**Underweight n=55 (13.8)**	**Normal weight n=261 (65.2)**	**Overweight/obese n=84 (21.0)**	**p-value**
BMI (kg/m^2)	22.22±3.47	17.23±0.64	21.67±1.79	27.21±2.19	<0.001
Age (years)	30.72±6.28	30.20±5.85	30.53±6.39	31.63±6.19	0.304
Occupational status, n (%)					
Unemployed	341(85.2)	46 (83.6)	220 (84.3)	75 (89.3)	0.498
Employed	59 (14.8)	9 (16.4)	41 (15.7)	9 (10.7)	
Place of residence, n (%)					
Urban	127 (31.8)	11 (20.0)	91 (34.9)	25 (29.8)	0.090
Rural	273 (68.2)	44 (80.0)	170 (65.1)	59 (70.2)	

	Total N=400 (%)	Underweight n=55 (13.8)	Normal weight n=261 (65.2)	Overweight/obese n=84 (21.0)	p-value
Marital status, n (%)					
Married	395 (98.8)	54 (98.2)	259 (99.2)	82 (97.6)	0.470
Divorced/widowed/separated	5 (1.2)	1 (1.8)	2 (0.8)	2 (2.4)	
Antenatal care visits	5.34±1.57	5.05±1.59	5.29±1.59	5.65±1.47	0.065
Number of pregnancies	2.54±1.42	2.13±1.16	2.48±1.36	2.96±1.63	0.002
Number of children	0.98±1.00	0.76 ±0.90	0.95±0.99	1.20±1.04	0.030
Gestational age at delivery (weeks)	38.50±2.89	38.04±2.52	38.70±3.01	38.19±2.69	0.165
Gestational weight gain (kg)	11.03±4.93	12.29±5.61	10.70±4.82	11.24±4.70	0.085
Birth weight (g)	3063.4±545.1	2927.1±523.3	3057.1±480.1	3172.1±709.9	0.033
Cesarean sections, n (%)	192 (48.0)	24 (43.6)	112 (42.9)	56 (66.7)	<0.001

Abbreviations: BMI, Body Mass Index.
All values are presented as mean (SD). A p-value of <0.05 was considered statistically significant.

Maternal Complications

Maternal complications were analyzed across the BMI categories (Table 2). The frequency of cesarean sections was significantly higher in the overweight and obese groups (66.7%) compared to the underweight (43.6%) and normal weight groups (42.9%). The proportion of preeclampsia was also higher in the overweight and obese groups (8 cases) compared to the underweight group (1 case) and the normal weight group (7 cases). No notable differences were found in the frequency of gestational hypertension, postpartum hemorrhage, premature rupture of membranes, induced labor, or stillbirth across the BMI categories.

Table 2: Maternal complications compared among three groups

	Total N=400	Underweight n=55	Normal weight n=261	Overweight/obese n=84
Gestational hypertension	7	1	6	0
Preeclampsia	16	1	7	8
Postpartum hemorrhage	7	1	5	1
PROM	43	10	23	10
Induced labor	86	12	56	18
Stillbirth	5	2	3	0

Abbreviations: PROM, premature rupture of membrane. All values are presented as frequencies

Discussion

This study examined the relationship between early pregnancy BMI and maternal health outcomes among 400 pregnant women in Cambodia. Notably, 21% of the participants were classified as overweight or obese, highlighting the growing burden of these conditions among women of reproductive age. These findings align with national trends, which have documented a significant increase in overweight and obesity rates over the past two decades (10).

The study found that women in the overweight and obese categories had significantly higher numbers of pregnancies and children compared to those in the underweight and normal weight groups. This suggests that higher BMI may be linked to increased parity, which could contribute to weight gain among women of reproductive age. Previous studies in Cambodia have similarly identified associations between higher BMI and increased parity, as well as other sociodemographic factors such as age, employment status, and place of residence (12). Additionally, our study observed a significant difference in birth weight across the BMI groups, aligning with prior research that demonstrated a relationship between maternal BMI and infant birth weight. These finding underscore the need for tailored prenatal care strategies to address the specific risks associated with maternal overweight and obesity (13).

One of the most critical findings of this study was the significantly higher frequency of cesarean sections among overweight and obese women. This aligns with existing literature demonstrating a consistent association between higher BMI and an increased risk of cesarean delivery (14, 15). In Cambodia, cesarean section rates appear to be higher than those in other developing countries, particularly in South and Southeast Asia. For instance, studies from Vietnam and the Philippines have reported lower cesarean section rates despite comparable socioeconomic contexts (16, 17). However, as our study presents descriptive proportions rather than adjusted analysis, comparisons should be interpreted cautiously, as adjusted studies account for potential confounding factors. These findings offer an initial understanding of the relationship between BMI and cesarean delivery in Cambodia based on descriptive trends.

The higher cesarean section rates in Cambodia may be influenced by multiple factors. Cultural preferences, such as selecting auspicious delivery dates or the belief that cesarean sections are safer for both mother and child, likely contribute to this trend (18). Logistical factors, including the availability of surgical facilities in urban centers and private healthcare providers, may also play a role. Patient demand of healthcare providers opting for surgical delivery to manage labor complications more predictably could further explain the preference for cesarean sections. The elevated cesarean section rates among overweight and obese women underscore the need for targeted weight management interventions before and during pregnancy. Reducing the rates of overweight and obesity could decrease the need for surgical interventions, improve maternal and neonatal outcomes, and alleviate the burden on the healthcare system.

Another significant finding was the higher proportion of preeclampsia among women in the overweight and obese groups. This result aligns with other studies demonstrating an increased risk of hypertensive disorders in pregnant women with higher BMI (3). Preeclampsia is a serious condition that can lead to severe maternal and neonatal complications, emphasizing the need for monitoring and managing BMI in early pregnancy.
The reliance on BMI as a measure during pregnancy provides a standardized approach for assessing maternal health risks, but it may not fully capture variations in fat distribution or body composition across populations. Although BMI is a practical tool for assessing pre-pregnancy weight and early pregnancy health risks, it has limitations, particularly as gestational weight gain progresses (6-8). However, its use in early pregnancy remains justified due to its ability to predict adverse outcomes and its alignment with global maternal health monitoring standards (7, 8). The challenges of calculating BMI in this population highlight systemic issues in data collection that require attention in low-resource settings like Cambodia (18).

The study did not find notable differences in other maternal complications such as gestational hypertension, postpartum hemorrhage, premature rupture of membranes, induced labor, or stillbirth across the BMI categories. While some previous studies have reported associations between higher BMI and these complications, the lack of significant findings in this study may be reflect the sample size or other contextual factors unique to the Cambodian population.

Limitations

Several limitations of this study should be acknowledged. First, the retrospective design relied on medical records, which may have introduced information bias due to missing or incomplete data, particularly regarding BMI and other variables. To mitigate this, the dataset was curated to include only records with complete baseline and delivery data, ensuring consistency in the analysis. Second, women excluded due to missing data may differ in

their risk profiles or maternal complications, potentially introducing selection bias. Third, confounding factors, such as maternal age, parity, and socioeconomic status, were not controlled for, which may influence the observed associations between BMI and maternal outcomes. Despite these limitations, the use of BMI in early pregnancy remains justified for predicting adverse outcomes and aligns with global research standards. Finally, as this study was conducted at a single tertiary hospital, the findings may not be generalizable to other settings or populations in Cambodia. Future studies should include a more comprehensive dataset and additional measures to improve the accuracy of maternal health outcomes.

Conclusion

This study highlights the relationship between early pregnancy BMI and maternal health outcomes, particularly the higher frequencies of cesarean sections and preeclampsia among overweight and obese women. These findings suggest the need for healthcare providers in Cambodia to prioritize weight management strategies during antenatal care to address the risks associated with maternal overweight and obesity. Additionally, this study identified gaps in data collection, including missing weight and height measurements during the first 12 weeks of pregnancy. Improved routine data collection during antenatal care is essential for effective maternal health monitoring. Future research should focus on addressing these gaps and examining the relationships between BMI and maternal complications using robust analytical methods and diverse populations.

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Declaration of Conflicting Interests

The Authors declare that there is no conflict of interest.

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