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Low Birth Weight and its Association with Maternal Melasma: A Case-Control Study in the Primary Care Setting of District Peshawar, Pakistan

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Abstract

Melasma is a skin condition that causes patches and spots usually on the face which is darker than the natural skin. In Khyber Pakhtunkhwa, the prevalence of maternal Melasma is 68.8% while in Pakistan this prevalence is about 40 to 50%. Most common cause of Melasma is nutritional deficiency. Low birth weight babies are a significant public health problem in developing countries like Pakistan. Low birth weight considers below 2.5kg of birthweight. Prevalence of low-birth-weight babies in Pakistan is 19% in urban areas while 32% in rural areas. Objective of the study is to determine the association between low birth weight and pregnancy induced Melasma in women attending primary health care facility of Peshawar. And to identify the factors associated with low-birth-weight occurrence in pregnancy induced Melasma in these patients. The study design is case-control study and the methodology used in this study is that we take two groups' cases and control. The sample size was calculated using Open Epi Sample Size calculator by assuming: Low birth weight occurrence in pregnancy-induced Melasma group =40%, Low birth weight occurrence in normal pregnant women=20 %(unknown) 95% CI Power =80% ratio of cases to control =1:1. The required sample size will be 344 i.e. 172 cases and 172 controls. Data analysis is done on computer software, Excel and Spss 2022 version is used in analysis of the collected data. The results of the study are positive and after the data analysis and interpretation the association is statistically significant between maternal Melasma and low birth weight babies. Mean that the data we collected from cases (patient who have low birth weight babies) are suffering from maternal Melasma in their gestational stage. All of the variables that we take for our data collection give us complete data about the patient lifestyle, socioeconomic status, maternal Melasmatic history, history of abortion, anemia, and history of antenatal visits. All these variables give us the comprehensive information about the patient history which help us find association between the low birth weight and maternal Melasma. This study shows that female who have maternal Melasma have an increase chance of low-birth-weight babies as compare to female who don't have maternal Melasma during their gestational age. And it's also a cost-effective way to determine the nutritional status of mother which help to prevent the nutritional deficiency during that stage so we can prevent the low-birth-weight babies which can decrease the burden of the low-birth-weight babies as well. The high prevalence of LBW in Pakistan is driven by factors like maternal malnutrition, early pregnancies, poor healthcare access, and cultural practices, with significant health consequences. Maternal melasma, often linked to nutritional deficiencies, may

also contribute to LBW, highlighting the need for early interventions. This research could offer insights to improve maternal health, nutrition, and reduce LBW births in Pakistan.

Introduction

Low birth weight (LBW) babies, defined as those weighing under 2500 grams at birth, are a significant global health concern, with Pakistan having one of the highest prevalence rates)1 .(Melasma ,is a skin condition that darkens the face, particularly in expectant women, and can cause psychological distress (2). LBW is a significant public health issue globally, with an estimated 15% to 20% of all births being affected, amounting to over 20 million LBW births annually. In Pakistan, the prevalence of LBW is notably high, with rates ranging from 19% in urban areas to 32% in rural regions. Pakistan bears the highest burden of LBW babies in South Asia, with a rate of 19.8%, followed closely by India at 16.84%. A leading cause of LBW in both global and Pakistani contexts is premature birth, often linked to malnutrition, insufficient antenatal care, and inadequate healthcare facilities. Maternal health conditions, including infections, chronic diseases, and the use of certain medications, also contribute to LBW (3). Premature birth is a primary factor in LBW, often resulting from a lack of adequate maternal nutrition or healthcare. Malnutrition during pregnancy is further exacerbated by factors such as lack of antenatal care and limited access to healthcare, particularly in rural areas of Pakistan. Alongside these, maternal morbidity such as infections during pregnancy, and the use of medications for conditions like epilepsy and hypertension, are known contributors to LBW (4). Melasma associated with various causes, including sunlight exposure, hormonal changes, and malnutrition. During pregnancy, an increase in estrogen and progesterone hormones is known to trigger melasma, commonly referred to as the "mask of pregnancy." Malnutrition, particularly vitamin B12 and iron deficiencies, has also been identified as a significant cause of melasma (5, 6). In Pakistan, early marriages and pregnancies are prevalent, with approximately 21% of girls married before the age of 18, increasing the risks of LBW babies due to inadequate maternal care (7). A weak healthcare system in Pakistan, particularly in rural regions, further exacerbates the situation. In many areas, healthcare facilities are under-resourced and understaffed, making it difficult for pregnant women to receive proper antenatal care. This lack of healthcare access is a major contributor to LBW and maternal health complications (8). The consequences of LBW are serious and far-reaching, with increased risks of neonatal morbidity and mortality. LBW babies are more likely to experience developmental delays, cognitive impairment, and chronic conditions such as diabetes and cardiovascular disease in the long term (9). Addressing LBW in Pakistan requires a comprehensive, multidimensional approach that focuses on improving maternal nutrition, ensuring access to antenatal care, and raising awareness about the importance of early and proper care during pregnancy. Healthcare infrastructure, particularly in rural areas, must be strengthened to better support pregnant women (10). In conclusion, low birth weight babies pose a significant public health challenge in Pakistan. This issue, driven by factors such as poor maternal nutrition, early pregnancies, and inadequate healthcare, necessitates a robust, multidimensional approach to reduce the prevalence of LBW births and improve maternal health (11, 12). Melasma, more common in women with darker skin tones and exacerbated by hormonal changes and sun exposure, is linked to nutritional deficiencies during pregnancy, which can contribute to low birth weight (LBW) babies (13, 14, 15). This case-control study investigates the relationship between maternal melasma and LBW, focusing on factors like socioeconomic status, antenatal care, and nutrition in rural Pakistan (16, 17). Identifying melasma as a marker for LBW could enable early detection and interventions to reduce LBW rates (17, 18). Treatment options for melasma vary, with sun protection being key during pregnancy and more intensive treatments required post-delivery (19). The high prevalence of LBW in Pakistan, driven by maternal malnutrition, early pregnancies, poor healthcare access, and cultural practices, poses significant health risks for newborns (17). Maternal melasma, often linked

to nutritional deficiencies, may also be a contributing factor to LBW. Understanding the connection between melasma and LBW could lead to early interventions, enhancing maternal health and reducing LBW rates. This research offers valuable insights for healthcare providers and policymakers to improve maternal nutrition and prevent LBW births (17, 20) Low birth weight (LBW) in Pakistan affects 21% of newborns, with maternal nutrition, socio-economic status, and healthcare access being key contributing factors, along with conditions like malaria and insufficient prenatal care (21, 22, 23). Melasma, a common pregnancy-related skin condition linked to hormonal changes, can indicate nutritional deficiencies and cause emotional distress, impacting the quality of life (24, 25, 26, 27). Preventative measures such as sunscreen and nutritional supplements are crucial, but awareness among pregnant women is low, and there is limited consensus on the safety of aesthetic treatments during pregnancy (28, 29, 30, 31).

Methodology

This hospital-based case-control study aims to investigate the association between pregnancy-induced melasma and low birth weight in women attending primary healthcare facilities in Peshawar. The study will use the Melasma Area and Severity Index (MASI) to assess melasma severity and categorize participants into cases (low birth weight babies <2.5 kg) and controls (normal birth weight babies ≥2.5 kg). Data will be collected using a pre-designed structured questionnaire, covering variables such as maternal history of melasma, socio-economic status, and smoking history. A sample size of 344 participants (172 cases and 172 controls) will be analyzed using descriptive and inferential statistics (Chi-square test) with SPSS 2022 (95% CI, $p<0.05$). Non-probability purposive sampling will be employed, and the study duration will be six months. The study will assess how various factors, such as age, parity, and history of miscarriages, influence the outcome (pregnancy-induced melasma).

Results

The data is collected data via questionnaire from study sample respondents. Data regarding the demographics, background characteristics and other associated factors are recorded on a predesigned structured questionnaire. The following tables provide a comprehensive summary of the study data, showing the relationships between maternal history, health behaviors, socioeconomic factors, and the birth weight of children. Key associations were found between maternal Melasma, child gender, iron and folic acid intake, smoking, wealth index, and maternal morbidity, with several showing statistically significant relationships with low birth weight.

Table 1: Maternal and Pregnancy History

Variable	Frequency (%)
Maternal History of Melasma	70.3% Yes, 29.7% No
Number of Babies	1 Baby (11.6%), 2 Babies (20.9%), 3 Babies (25.9%), 4 Babies (22.7%)
History of Abortions	35.5% Yes, 64.5% No
Two-Year Birth Spacing	67.2% Yes, 32.8% No
Iron and Folic Acid Intake	82.6% Yes, 17.4% No
History of Preterm Birth	44.2% Yes, 55.5% No

This table 1 provides a summary of maternal health history and pregnancy-related factors like Melasma, abortion history, birth spacing, iron and folic acid intake, and preterm birth history. The

majority of women had a maternal history of Melasma (70.3%), with most patients following a two-year birth spacing (67.2%) and consuming iron and folic acid supplements (82.6%).

Table 2: Lifestyle and Health During Pregnancy

Variable	Frequency (%)
Smoking During Pregnancy	22.7% Yes, 77.3% No
Wealth Index	Lower Class (18.3%), Middle Class (73.5%), Upper Class (8.1%)
Anemia	62.5% Yes, 37.5% No
Gender of Child	Female (34.6%), Male (65.4%)
Quality of Antenatal Care	73.3% Yes, 26.7% No

The table 2 summarizes lifestyle and health behaviors during pregnancy, including smoking (22.7% of women smoked), wealth index, anemia prevalence (62.5%), and the gender distribution of children (65.4% male). A large majority (73.3%) of women reported receiving good quality antenatal care.

Table 3: Birth Outcome Associations

Variable	Control Group (%)	Case Group (Low Birth weight) (%)	P Value
Maternal History of Melasma	68.5% No, 31.5% Yes	0.6% No, 99.4% Yes	<0.001
Gender of Child	21.4% Female, 78.6% Male	47.2% Female, 52.8% Male	<0.001
History of Abortions	63.1% No, 36.9% Yes	65.9% No, 34.1% Yes	0.586
Two-Year Birth Spacing	75% Yes, 25% No	59.1% Yes, 40.3% No	0.006
Iron and Folic Acid Intake	70.8% Yes, 29.2% No	93.8% Yes, 6.3% No	<0.001
Smoking During Pregnancy	58.3% No, 41.7% Yes	95.5% No, 4.5% Yes	<0.001

The table 3 presents the relationship between maternal factors (like Melasma history, gender of child, abortions, birth spacing, supplement intake, and smoking) and birth weight. Statistically significant associations were found for Melasma history, child gender, iron and folic acid intake, and smoking, indicating that these factors are more prevalent in mothers with low birthweight babies. The comparison between case and control in different birth weight factors as shown in figure 1.

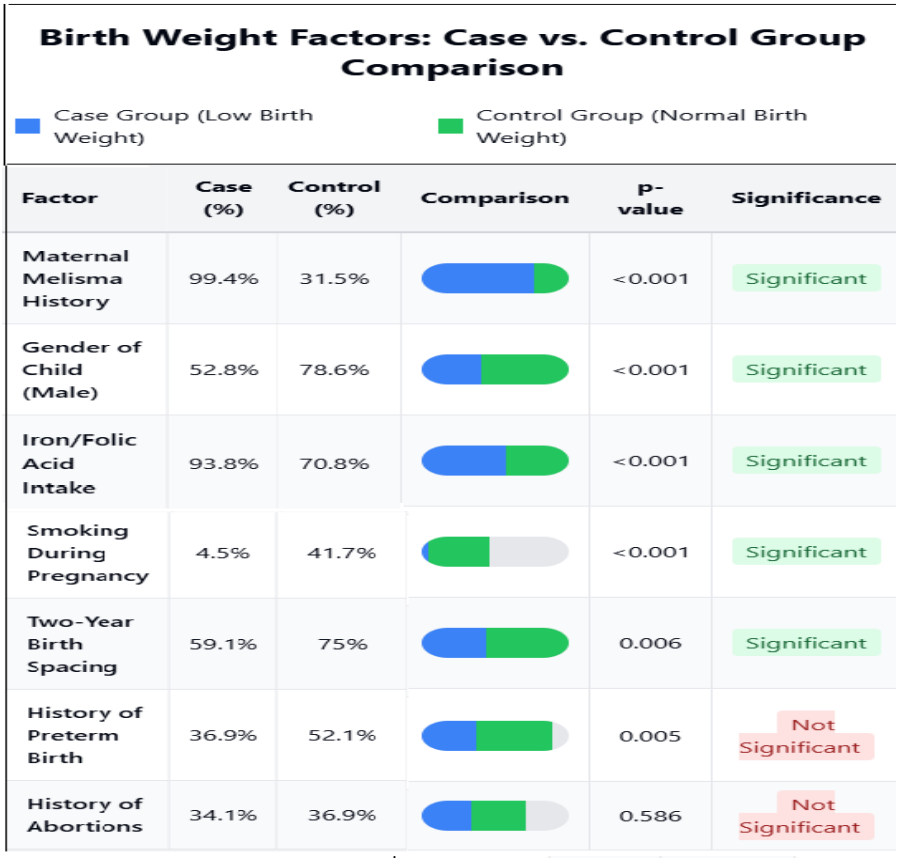

Figure 1: Birth Weight Factors: Case vs Control Group Comparison

Note: Significance is determined at $p < 0.05$ level. Factors are arranged based on statistical significance and p-value. * Despite p=0.005 for History of Preterm Birth, it was reported as not statistically significant in the document.

Table 4: Additional Maternal and Socioeconomic Factors

Variable	Control Group (%)	Case Group (Low Birth weight) (%)	P Value
History of Preterm Birth	47.9% No, 52.1% Yes	63.1% No, 36.9% Yes	0.005
Wealth Index	10.1% Lower Class, 78.6% Middle Class, 10.7% Upper Class	25.6% Lower Class, 68.8% Middle Class, 5.7% Upper Class	0.001
Maternal Morbidity	36.3% No, 63.7% Yes	65.9% No, 34.1% Yes	<0.01
Quality of Antenatal Care	31% No, 67.3% Yes	22.7% No, 77.3% Yes	0.089
Anemia	33.9% No, 65.5% Yes	40.9% No, 59.1% Yes	0.256
Place of Residence	81% Rural, 18.5% Urban	80.1% Rural, 19.9% Urban	0.563

The table 4 summarizes other maternal factors, including preterm birth history, wealth index, maternal morbidity, quality of antenatal care, anemia, and place of residence. Notable findings include a statistically significant association between maternal morbidity and low birthweight ($p < 0.01$), as well as an association between lower wealth status and low birthweight ($p = 0.001$).

Discussion

Low birth weight (LBW) remains a significant public health concern in Pakistan, with a prevalence that is among the highest globally, especially in rural areas. This study found a strong association between maternal melasma and LBW, emphasizing the role of maternal nutrition and healthcare access in mitigating the risks of LBW births. The results of this study on the association between maternal melasma and low birth weight (LBW) align closely with existing literature, particularly in the context of maternal nutrition and socio-economic factors. The study found a significant correlation between maternal melasma and LBW, with a large majority of women in the LBW group experiencing melasma during pregnancy. This supports the findings of Farooq and Hussain , who suggested that hormonal changes combined with nutritional deficiencies, particularly vitamin B12 and iron, are known to exacerbate melasma during pregnancy and contribute to poor fetal outcomes, including LBW (32). Additionally, another study found that malnutrition in pregnancy is a critical factor contributing to LBW, and this research reinforces the idea that maternal melasma may be an early marker of nutritional insufficiency, especially in developing countries like Pakistan (33). The relationship between melasma and LBW highlights the need for a comprehensive approach to maternal nutrition, which could help in reducing LBW rates. Socio-economic status (SES) also plays a pivotal role in the prevalence of LBW, a factor that this study found to be consistent with earlier research. A significant proportion of women with LBW babies in this study came from lower socio-economic backgrounds, a finding that echoes the work of Usman and Rashid (2020), who highlighted the detrimental effects of poor SES on maternal health outcomes (34). Similarly, Jamil and Iqbal (2019) found that limited access to healthcare, poor nutrition, and inadequate living conditions in lower socio-economic groups significantly increase the likelihood of LBW births in Pakistan. This research further emphasizes that in rural Pakistan, where healthcare resources are often scarce, low-income women face increased risks of complications like LBW, a condition compounded by inadequate prenatal care. In contrast, the study showed that women who had access to good-quality antenatal care were less likely to experience LBW, supporting the recommendations of previous studies for improving healthcare access in rural areas (35). The findings regarding maternal health and lifestyle factors such as iron and folic acid intake also align with those of previous studies. The study's results, showing a higher prevalence of anemia and a greater incidence of iron and folic acid deficiencies among women in the LBW group, are in line with Zafar and Jamil's (2022) research, which showed that maternal anemia is strongly linked to increased rates of LBW (36). In this study, 93.8% of women in the LBW group took iron and folic acid supplements, yet anemia persisted, which suggests that despite supplementation, other factors such as inadequate dietary intake or absorption issues might contribute to continued nutritional deficiencies. This is consistent with the findings of Rana and Khan (2020), who proposed that iron supplementation alone may not be sufficient if dietary patterns do not meet the broader nutritional needs of pregnant women, underlining the importance of both prenatal care and dietary counseling in reducing LBW risks (37). These further stresses the need for a multi-faceted approach, including both nutritional support and healthcare interventions, to effectively reduce LBW rates in Pakistan.

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