DOI: https://doi.org/10.54393/pjhs.v6i7.3124

PAKISTAN JOURNAL OF HEALTH SCIENCES
(LAHORE)
https://thejas.com.pk/index.php/pjhs
ISSN (E): 2790-9352, (P): 2790-9344
Volume 6, Issue 07 (July 2025)

Original Article

OPEN ACCESS

Fetomaternal Outcome of Pregnant Women with Malaria

Mehwish[1], Mehreen Memon[2], Bakhtawar Solangi[1], Erum[1], Ralsehm[1*], Farzana[1], Tosheeba[1] and Neeta Maheshwary[3]

[1]Department of Obstetrics and Gynecology, Peoples University of Medical and Health Sciences, Nawab Shah, Pakistan
[2]Department of Obstetrics and Gynecology, Countenance Difference Fund Hospital, Hyderabad, Pakistan
[3]Ziauddin University, Karachi, Pakistan

ARTICLE INFO

Keywords:
Anemia, Malaria, Low Weight, Preterm Birth, Outcomes

How to Cite:
Mehwish, ., Memon, M., Solangi, B., Erum, ., Raishem, ., Farzana, ., Tosheeba, ., & Maheshwary, N. (2025). Fetomaternal Outcome of Pregnant Women with Malaria : Fetomaternal Outcomes of Pregnant Women. Pakistan Journal of Health Sciences, 6(7), 145-150. https://doi.org/10.54393/pjhs.v6i7.3124

***Corresponding Author:**
Ralsehm
Department of Obstetrics and Gynecology, Peoples University of Medical and Health Sciences, Nawab Shah, Pakistan
dr.rbaloch88@gmail.com

Received Date: 5th May, 2025
Revision Date: 19th July, 2025
Acceptance Date: 23th July, 2025
Published Date: 31st July, 2025

ABSTRACT

Malaria during pregnancy is a major public health concern, with devastating implications for both the mother and the unborn child. **Objectives:** To evaluate the maternal and fetal outcomes in pregnant women infected with Plasmodium falciparum and Plasmodium ovale/vivax. **Methods:** This descriptive cross-sectional study was carried out in Obstetrics and Gynecology Ward II using non-probability convenience sampling. It included 110 pregnant women diagnosed with malaria, excluding those with underlying health conditions. Data were gathered through interviews, medical records, and laboratory tests.Various maternal and neonatal factors, including hemoglobin levels and birth weight, were recorded.The chi-square test was performed to evaluate the relationship between malaria and fetal outcomes, with p-values<0.05 considered statistically significant. **Results:** Among 110 pregnant women, 58 (52.7%) were aged 21–30 years. The majority, 69 (62.7%), had 2–5 pregnancies, while 25 (22.7%) were primigravida. Preterm birth and full-term deliveries were equally distributed, 55 (50.0%), while anemia was prevalent in 82 (74.5%) of cases. Low birth weight was observed in 35 (31.8%) of neonates. Among 71 women with *P. falciparum* infection, 63 (88.7%) developed anemia, which was significantly higher than in the *P. ovale/vivax* group, where only 19 out of 39 (48.7%) were anemic (p<0.001). Preterm birth, 45 (63.4%) and low birth weight, 34 (47.9%), were significantly greater in falciparum cases (p<0.001). **Conclusions:** It was concluded that *Plasmodium falciparum* infection poses a higher frequency of adverse fetomaternal outcomes compared to *Plasmodium ovale/vivax*, characterized by noticeably greater incidences of hypoglycemia, low weight at birth weight, premature birth, and anemia.

INTRODUCTION

Malaria in pregnancy is a well-documented worldwide health concern [1, 2], posing hazards to maternal, fetal, and newborn health, as well as impacting the wider community [2, 3]. From an epidemiological aspect, Pakistan is categorized as a country with a relatively high prevalence of malaria. Of the 217.1 million people living there, around 98% (212.6 million) are at risk of contracting malaria, with 54% having a high risk of infection [4]. Plasmodium parasite infections cause malaria, with Plasmodium falciparum (P. falciparum) and Plasmodium vivax (P. vivax) posing the greatest threat to humans [5]. When an infected female Anopheles mosquito bites a human, the disease is spread, causing a range of clinical signs from minor discomfort to serious sickness and even death [6]. In Pakistan, *Plasmodium vivax* is the predominant cause of malaria, while *P. falciparum* accounts for approximately 15% of cases [7]. Worldwide, *P. falciparum* is the primary cause of malaria, frequently resulting in severe complications, especially among expectant mothers [8]. For many reasons, pregnant women are more vulnerable to malaria [9, 10], such as impaired immunity, which permits elevated parasitemia levels, and parasite accumulation in the placenta [11]. Furthermore, socioeconomic status and cultural variables may enhance experience or limit access to preventive interventions [12]. Pregnant women from lower SES backgrounds are more susceptible to

DOI: https://doi.org/10.54393/pjhs.v6i7.3124

contracting malaria, insufficient prenatal care, improper health status, and adverse fetomaternal outcomes owing to limited access to healthcare resources and poor living situations [13]. The negative consequences of malaria during pregnancy are numerous and varied, with placental malaria being a frequent pathological consequence. Plasmodium-infected red blood cells becoming trapped inside the placenta's intervillous gaps is a defining feature of this disorder [14]. This can cause placental inflammation and impair the exchange of nutrients and gases, leading to unfavorable consequences such as low birth weight (LBW), premature birth, fetal mortality, and neonatal death [15]. Furthermore, malaria during pregnancy can cause maternal anemia, thus raising the risk of maternal death and further complicating pregnancy and childbirth, especially in malaria-endemic countries [16]. Early diagnosis of malaria is crucial for preventing complications, but it remains challenging. Many women harbor parasites with minimal or no symptoms due to immunity developed from repeated contact. The microscopic analysis of blood smears is the most often utilized approach for detecting placental malaria because of its long-term clinical use. Though this approach repeatedly fails to detect parasites in peripheral blood, even when they are abundantly sequestered in the placenta [17]. Because of this, those who have placental malaria can get false-negative test results, which would keep them untreated and unidentified. For pregnant women, rapid diagnostic tests (RDTs) offer an option, with reported sensitivity surpassing 90%, making them potentially more effective than traditional microscopy or clinical evaluation [18]. Pregnancy-related malaria remains a serious public health concern, particularly in endemic areas, contributing to severe maternal and neonatal complications. *P. falciparum* infection is known to cause more severe adverse outcomes, including anemia, preterm birth, LBW, and hypoglycemia, compared to *P. ovale/vivax*. Socioeconomic factors, residency, and access to healthcare further influence disease burden and outcomes .Understanding the differential impact of malaria parasite species on pregnancy outcomes is essential for emerging targeted prevention and management strategies.

This study aims to analyze and contrast the fetomaternal outcomes of pregnant women infected with *P. falciparum* and *P. ovale/vivax*, focusing on parameters such as maternal anemia, preterm birth, low birth weight, and hypoglycemia.

METHODS

This descriptive cross-sectional study was carried out in Obstetrics and Gynaecology Ward II at Peoples University of Medical and Health Sciences, Nawab Shah, utilizing a non-probability convenience sampling method. The study was performed for almost six months, from 26th June 2024 to 24th December 2024.This study was approved by the Ethical Review Committee with the reference # PUMHSW/SBA/PVC/ERC/44/2024.Using the open size Epi program for sample size calculation, the prevalence of malaria was 9.3%, as previously published study margin of error is 6%, interval 95% and 10% non-response rate.[19].A total of 110 pregnant women in their third trimester who were diagnosed with malaria, based on specific criteria, such as age, gestational age, and severity of the infection, were included in the study.Women with underlying health disorders, such as sickle cell disease or psychological issues, who may have an impact on the study's outcomes, were excluded.All participants provided informed consent before data collection. Structured interviews, inspections of medical records, and laboratory testing were used to gather data.Plasmodium species were found on blood slides, and a Rapid Diagnostic Test (RDT) was used to confirm the diagnosis of malaria.The RDT used in this study was the SD BIOLINE Malaria Ag P.f/Pan (Standard Diagnostics, Republic of Korea; Catalogue No: 05FK60), which is commonly available.A small volume of capillary blood was obtained using a sterile lancet and added to the test cassette, followed by buffer solution as per the manufacturer's instructions.The presence of a colored test line along with a control line indicated a positive result. A pre-designed questionnaire was utilized to collect various data, including sociodemographic information, obstetric history, malaria status, laboratory findings (serum calcium and hemoglobin levels), and fetal outcomes such as preterm delivery (delivery of a baby before 37 weeks of gestation) [20], low birth weight (birth weight of less than 2500 grams (2.5 kg) [21], and neonatal birth weight. Every pregnant woman who was recruited was monitored until her hospital discharge following delivery.Laboratory testing, such as hemoglobin and blood glucose levels, was used to diagnose maternal anemia and neonatal hypoglycemia.Anemia was defined as hemoglobin levels less than 11 g/dL [22], and neonatal birth weight was measured shortly after delivery.Maternal Hypoglycemia was also monitored, which is a condition where blood glucose concentrations are low, defined as less than 2.2 mmol/L (40 mg/dL) [23].Data were analyzed using SPSS version 23.0, with descriptive statistics used to summarize categorical variables as frequencies and percentages. Fetomaternal outcomes and sociodemographic factors were compared between two malarial cases using the Chi-square test;a p-value of ≤0.05 was considered statistically significant.

RESULTS

There are 110 expectant mothers in all, with most of them, 58 (52.7%), aged between 21 and 30 years, followed by 35

DOI: https://doi.org/10.54393/pjhs.v6i7.3124

(31.8%) in the 31 to 40 years' age group, and 17 (15.5%) under 20 years. In terms of parity, 69 (62.7%) of patients had between 2 to 5 pregnancies, while 25 (22.7%) were primigravida, and 16 (14.5%) had more than five pregnancies. Socioeconomic status was predominantly lower class 60 (54.5%), with 34 (30.9%) belonging to the middle class and 16 (14.5%) to the upper class. Regarding education, 45 (40.9%) of patients were uneducated, while 14 (12.7%) had primary education, 28 (25.5%) had secondary education, 16 (14.5%) had matric, and only 7 (6.4%) had studied up to the intermediate level. Most patients, 71 (64.5%), resided in rural areas, while 39 (35.5%) were from urban settings. A significant proportion, 104 (94.5%), were unemployed. The majority, 91 (82.7%), lived in a joint family system, while 19(17.3%) lived in nuclear families. Malarial prophylaxis was taken by only 10 (9.1%) of patients, while 100 (90.9%) did not receive any prophylactic treatment. The incidence of preterm birth was 55 (50.0%), indicating an equal distribution between preterm and full-term births. Anemia was prevalent in 82 (74.5%) of patients, while 28 (25.5%) were non-anemic. Low birth weight was reported in 35 (31.8%) of newborns, whereas 75(68.2%) had normal birth weight.Regarding the type of malaria parasite, *P. falciparum* was the most common, found in 71 (64.5%) of cases, while 39 (35.5%) were infected with *P. oval/vivax*. Hypoglycemia was observed in 18 (16.4%) of patients, whereas 92 (83.6%) had normal blood glucose levels, as depicted in table 1.

Table 1: Demographic Details of Pregnant Women with Malaria (n=110)

Variables		n (%)
Age of Patient (Years)	<20	17 (15.5%)
	21 to 30	58 (52.7%)
	31 to 40	35 (31.8%)
Parity of Patient	Primigravida	25 (22.7%)
	2-5	69 (62.7%)
	>5	16 (14.5%)
Socio Economic Condition	Lower Class	60 (54.5%)
	Middle Class	34 (30.9%)
	Upper Class	16 (14.5%)
Education Status	Uneducated	45 (40.9%)
	Primary	14 (12.7%)
	Secondary	28 (25.5%)
	Matric	16 (14.5%)
	Inter	7 (6.4%)
Residency of Patient	Rural	71 (64.5%)
	Urban	39 (35.5%)
Occupation of Patient	Unemployed	104 (94.5%)
	Employed	6 (5.5%)
Living Status of Patient	Joint Family	91 (82.7%)
	Nuclear Family	19 (17.3%)
Malarial Prophylaxis	Yes	10 (9.1%)
	No	100 (90.9%)
Preterm Birth	Yes	55 (50.0%)
	No	55 (50.0%)
Anemia	Yes	82 (74.5%)
	No	28 (25.5%)
Low Birth Weight	Yes	35 (31.8%)
	No	75 (68.2%)
Plasmodium Type	Falciparum	71 (64.5%)
	Oval/vivax	39 (35.5%)
Hypoglycemia During the Third Trimester of Pregnancy	Yes	18 (16.4%)
	No	92 (83.6%)

Pregnant mothers infected with *P. falciparum* and *P. ovale/vivax* had significantly different fetal outcomes. Women <20 years of age and primigravida cases were significantly greater in the *oval/vivax* group (p<0.001). Socioeconomic and educational status also showed notable variations, with *falciparum* cases being more prevalent among the lower class 42 (59.2%) and uneducated women 30 (42.3%), whereas *oval/vivax* cases were more common in the upper class 15 (38.5%) and among those with higher education levels (p<0.001). Residency and occupation further highlighted disparities, as *falciparum* cases were more frequent in rural areas 53 (74.6%) and among unemployed women 70 (98.6%), while *oval/vivax* cases were relatively more urban-based and included a higher proportion of employed women (p=0.003, p=0.012, respectively).Maternal health outcomes varied significantly between the two groups.Anemia was markedly higher in falciparum cases, 63 (88.7%), compared to oval/vivax 19 (48.7%) (p<0.001).Similarly, preterm birth 45(63.4%), low birth weight 34(47.9%), and hypoglycemia 17 (23.9%) were significantly more frequent in *falciparum* infections (p<0.001 and p=0.004).Interestingly, a higher percentage of women in the *oval/vivax* group had received malarial prophylaxis 9(23.1%)(p<0.001), as depicted in Table 2.

Table 2: Fetomaternal Outcome of Pregnant Women for the Type of Malaria Parasite

Variables		Falciparum n (%)	Oval/Vivax n (%)	p-Value
Age of Patient (Years)	<20	3 (4.2%)	14 (35.9%)	<0.001
	21 to 30	46 (64.8%)	12 (30.8%)	
	31 to 40	22 (31.0%)	13 (33.3%)	
Parity of Patient	Primigravida	5 (7.0%)	20 (51.3%)	<0.001
	2-5	50 (70.4%)	19 (48.7%)	
	>5	16 (22.5%)	0 (0.0%)	
Socio Economic status	Lower Class	42 (59.2%)	18 (46.2%)	<0.001
	Middle Class	28 (39.4%)	6 (15.4%)	
	Upper Class	1 (1.4%)	15 (38.5%)	
Education Status	Uneducated	30 (42.3%)	15 (38.5%)	<0.001
	Primary	11 (15.5%)	3 (7.7%)	
	Secondary	27 (38.0%)	1 (2.6%)	
	Matric	2 (2.8%)	14 (35.9%)	
	Inter	1 (1.4%)	6 (15.4%)	

DOI: https://doi.org/10.54393/pjhs.v6i7.3124

Residency of Patient	Rural	53 (74.6%)	18 (46.2%)	0.003
	Urban	18 (25.4%)	21 (53.8%)	
Occupation of Patient	Unemployed	70 (98.6%)	34 (87.2%)	0.012
	Employed	1 (1.4%)	5 (12.8%)	
Living Status of Patient	Joint Family	64 (90.1%)	27 (69.2%)	0.006
	Nuclear Family	7 (9.9%)	12 (30.8%)	
Malarial Prophylaxis	Yes	1 (1.4%)	9 (23.1%)	<0.001
	No	70 (98.6%)	30 (76.9%)	
Preterm Birth	Yes	45 (63.4%)	10 (25.6%)	<0.001
	No	26 (36.6%)	29 (74.4%)	
Anemia	Yes	63 (88.7%)	19 (48.7%)	<0.001
	No	8 (11.3%)	20 (51.3%)	
Low Birth Weight	Yes	34 (47.9%)	1 (2.6%)	<0.001
	No	37 (52.1%)	38 (97.4%)	
Hypoglycemia	Yes	17 (23.9%)	1 (2.6%)	0.004
	No	54 (76.1%)	38 (97.4%)	

DISCUSSION

Several negative outcomes, including LBW, preterm birth, and small-for-gestational-age (SGA) newborns, have been linked to malaria during pregnancy.The fetomaternal outcomes of pregnant women infected with *P. falciparum* and *P. ovale/vivax* were illustrated in this study. In the present study, pregnant women infected with *P. falciparum* experienced a significantly higher incidence of anemia 63 (88.7%), preterm birth 45 (63.4%), low birth weight 34 (47.9%), and hypoglycemia 17(23.9%) compared to those with P. ovale/vivax infections (p<0.001, p=0.004).These findings align with a meta-analysis that reported elevated risks of low birth weight (LBW), preterm birth (PTB), and small-for-gestational-age (SGA) infants among malaria-infected mothers, estimating a 75.5% increase in LBW, a 48.4% increase in PTB, and 55.4% increase in SGA births [24]. Similarly, other systematic reviews have observed a 63% higher risk of LBW and a 23% increase in PTB among infected women [25], as well as a notable association between malaria and stillbirths [26]. Another meta-analysis highlighted the predominance of *P. falciparum* in pregnant women (22.1%), followed by *P. vivax* (3%), *P. malariae* (0.8%), and *P. ovale* (0.2%) [27]. Interestingly, the present study showed a higher percentage of malaria prophylaxis usage among women infected with *P. ovale/vivax* 9 (23.1%) (p<0.001).Previous studies have also shown that malaria prophylaxis can reduce the risk of anemia, LBW, and preterm labor [28], indicating that prophylactic treatment may contribute to the relatively better outcomes seen in the *P. ovale/vivax* group. Another research showed that post-delivery anemia 47.2%) and LBW 36.7% were among the most common maternal and fetal complications in malaria-infected pregnancies.That study also reported that age, parity, socioeconomic status, and lack of malaria prophylaxis were significantly associated with adverse outcomes (p≤0.05) [28]. Likewise, anemia was found to be nearly twice as common among malaria-infected pregnant women in multiple studies [29-31], which is in agreement with the present study, showing that post-delivery anemia 63(88.7%) and LBW 34 (47.9%) were among the most common maternal and fetal complications in *P. falciparum* malaria-infected pregnancies. Socioeconomic status, education, and place of residence were significantly associated with malaria type and fetomaternal outcomes. *P. falciparum* was more frequent among women from lower socioeconomic backgrounds, 42 (59.2%), rural areas, 53 (74.6%), and those who were uneducated, 30 (42.3%) or unemployed, 70 (98.6%).These results support previous research indicating that low socioeconomic and educational status, as well as rural residence, are strong predictors of adverse pregnancy outcomes among malaria-infected women [28, 32]. Lufele *et al.*, also found that rural women had a higher likelihood of delivering LBW infants and experiencing preterm birth [32]. The present study demonstrated that the adverse effects of malaria are also influenced by the timing and frequency of infection during pregnancy. Malaria during the first trimester has been associated with increased risk of LBW and PTB, as observed in studies from Congo, Kenya, and Zambia [33]. Some studies report conflicting findings, while Moeller *et al.* demonstrated that infection before 15 weeks significantly reduced birth weight in Tanzanian women [34]. Likewise, a study by Accrombessi *et al.*, found no such effect in Beninese women [35]. These inconsistencies may relate to differences in transmission intensity, host immunity, and access to prenatal care.

CONCLUSIONS

It was concluded that Plasmodium falciparum infection increases the risk of unfavourable fetomaternal outcomes as compared to Plasmodium ovale/vivax infection, with significantly higher rates of anemia, preterm birth, reduced birth weight, and hypoglycemia. Rural, lower-class, and uneducated women are more likely to be affected by socioeconomic and demographic differences, which also affect the severity of the condition. The results emphasize the value of early detection, malaria prevention, and focused prenatal care in lowering the risks of malaria-related pregnancy problems for both mothers and newborns.

Authors Contribution

Conceptualization: M
Methodology: M, MM, BS, E, R, F, T, NM
Formal analysis: M, MM, BS, E, R, F, T, NM
Writing review and editing: M, R, NM

All authors have read and agreed to the published version of the manuscript

Conflicts of Interest

All the authors declare no conflict of interest.

DOI: https://doi.org/10.54393/pjhs.v6i7.3124

Source of Funding

The author received no financial support for the research, authorship and/or publication of this article.

REFERENCES

[1] Whittaker C, Slater H, Nash R, Bousema T, Drakeley C, Ghani AC et al. Global patterns of submicroscopic Plasmodium falciparum malaria infection: insights from a systematic review and meta-analysis of population surveys.The Lancet Microbe.2021Aug; 2(8): e366-74. doi: 10.1016/S2666-5247(21)00055-0.

[2] Reddy V, Weiss DJ, Rozier J, Ter Kuile FO, Dellicour S. Global estimates of the number of pregnancies at risk of malaria from 2007 to 2020: a demographic study. The Lancet Global Health.2023Jan;11(1):e40-7.doi: 10.1016/S2214-109X(22)00431-4.

[3] Bakken L and Iversen PO. The impact of malaria during pregnancy on low birth weight in East-Africa: a topical review. Malaria Journal.2021Aug;20(1):348. doi: 10.1186/s12936-021-03883-z.

[4] Khan MI, Qureshi H, Bae SJ, Khattak AA, Anwar MS, Ahmad S *et al.* Malaria prevalence in Pakistan: A systematic review and meta-analysis (2006–2021). Heliyon.2023Apr;9(4).doi:10.1016/j.heliyon.2023.e15373.

[5] Sato S. Plasmodium—a brief introduction to the parasites causing human malaria and their basic biology. Journal of Physiological Anthropology.2021 Jan; 40(1): 1. doi: 10.1186/s40101-020-00251-9.

[6] White NJ. Severe malaria. Malaria Journal.2022 Oct; 21(1): 284. doi: 10.1186/s12936-022-04301-8.

[7] Bhatti MA, Azharuddin M, Bhatti S, Islam M, Khan MA. Malaria and pregnancy: the perspective in Pakistan. Journal of Pakistan Medical Association.2007;57(1): 15.

[8] Cowman AF, Healer J, Marapana D, Marsh K. Malaria: Biology and Disease.Cell.2016 Oct; 167(3): 610-24. doi: 10.1016/j.cell.2016.07.055.

[9] Gontie GB, Wolde HF, Baraki AG. Prevalence and associated factors of malaria among pregnant women in Sherkole district, Benishangul Gumuz regional state, West Ethiopia.BMC Infectious Diseases.2020Dec;20:1-8.doi:10.1186/s12879-020-05289-9.

[10] Ahadzie-Soglie A, Addai-Mensah O, Abaka-Yawson A, Setroame AM, Kwadzokpui PK. Prevalence and risk factors of malaria and anaemia and the impact of preventive methods among pregnant women: A case study at the Akatsi South District in Ghana. PLOS One. 2022Jul;17(7):e0271211.doi:10.1371/journal.pone.0271211.

[11] Chua CL, Khoo SK, Ong JL, Ramireddi GK, Yeo TW, Teo A. Malaria in pregnancy: from placental infection to its abnormal development and damage. Frontiers in Microbiology.2021Nov;12:777343.doi:10.3389/fmicb.2021.777343.

[12] Naserrudin NA, Lin PY, Monroe A, Culleton R, Baumann SE, Sato S *et al.* Exploring barriers to and facilitators of malaria prevention practices: a photovoice study with rural communities at risk to Plasmodium knowlesi malaria in Sabah, Malaysia. BioMed Central Public Health.2023Jul;23(1):1316.doi: 10.1186/s12889-023-16173-x.

[13] Majumder S. Socioeconomic status scales: Revised Kuppuswamy, BG Prasad, and Udai Pareekh's scale updated for 2021.Journal of Family Medicine and Primary Care.2021Nov;10(11):3964-7.doi:10.4103/jfmpc.jfmpc_600_21.

[14] Zakama AK, Ozarslan N, Gaw SL. Placental malaria. Current Tropical Medicine Reports.2020Dec;7(4): 162-71.doi: 10.1007/s40475-020-00213-2.

[15] Goldstein JA, Gallagher K, Beck C, Kumar R, Gernand AD. Maternal-fetal inflammation in the placenta and the developmental origins of health and disease. Frontiers in Immunology.2020Nov;11:531543.doi:10.3389/fimmu.2020.531543.

[16] Fondjo LA, Addai-Mensah O, Annani-Akollor ME, Quarshie JT, Boateng AA, Assafuah SE *et al.* A multicenter study of the prevalence and risk factors of malaria and anemia among pregnant women at first antenatal care visit in Ghana. PIOS one.2020 Aug ;15(8):e0238077.doi:10.1371/journal.pone.0238077.

[17] Schantz-Dunn J and Nour NM.Malaria and pregnancy :a global health perspective.Reviews in Obstetrics and Gynaecology.2009;2(3):186.

[18] Minja DT, Schmiegelow C, Oesterholt M, Magistrado PA, Boström S, John D *et al.* Reliability of rapid diagnostic tests in diagnosing pregnancy-associated malaria in north-eastern Tanzania. Malaria Journal. 2012 Dec; 11: 1-0. doi: 10.1186/1475-2875-11-211.

[19] Ullah H, Khan MI, Suleman SK, Javed S, Qadeer A, Nawaz M, Mehmood SA. Prevalence of malaria infection in district Dir lower, Pakistan.Punjab University Journal of Zoology.2019; 34(2): 137-41.doi: 10.17582/journal.pujz/2019.34.2.137.141.

[20] Quinn JA, Munoz FM, Gonik B, Frau L, Cutland C, Mallett-Moore T et al. Preterm birth: Case definition & guidelines for data collection, analysis, and presentation of immunisation safety data. Vaccine. 2016 Dec; 34(49): 6047-56. doi: 10.1016/j.vaccine.2016.03.045.

[21] KC A, Basel PL, Singh S. Low birth weight and its associated risk factors: Health facility-based case-control study.PLOS ONE.2020Jun;15(6):e0234907. doi: 10.1371/journal.pone.0234907.

[22] Cappellini MD and Motta I. Anemia in clinical practice—definition and classification: does hemoglobin change with aging? In Seminars in

DOI: https://doi.org/10.54393/pjhs.v6i7.3124

Hematology.2015Oct;52(4):261-269.doi:10.1053/j.seminhematol.2015.07.006.

[23] Silva CM, Arnegard ME, Maric-Bilkan C. Dysglycemia in pregnancy and maternal/fetal outcomes.Journal of Women's Health.2021Feb;30(2):187-93.doi:10.1089/jwh.2020.8853.

[24] Satapathy P, Khatib MN, Gaidhane S, Zahiruddin QS, Sharma RK, Rustagi S *et al.* Adverse pregnancy outcomes in maternal malarial infection: A systematic review and meta-analysis. New Microbes and New Infections.2024Aug:101474.doi:10.1016/j.nmni.2024.101474.

[25] Thompson JM, Eick SM, Dailey C, Dale AP, Mehta M, Nair A *et al.* Relationship between pregnancy-associated malaria and adverse pregnancy outcomes: a systematic review and meta-analysis. Journal of tropical pediatrics.2020Jun;66(3):327-38. doi: 10.1093/tropej/fmz068.

[26] Das JK, Lakhani S, Rahman AR, Siddiqui F, Padhani ZA, Rashid Z *et al.* Malaria in pregnancy: Meta-analyses of prevalence and associated complications .Epidemiology and Infection.2024 Jan;152:e39.doi: 10.1017/S0950268824000177.

[27] Danwang C, Bigna JJ, Nzalie RN, Robert A. Epidemiology of clinical congenital and neonatal malaria in endemic settings: a systematic review and meta-analysis. Malaria Journal.2020 Dec; 19: 1-8. doi: 10.1186/s12936-020-03373-8.

[28] Soomro P, Bhatti N, Abid K. Fetomaternal outcomes among pregnant females suffering from malaria, a study from Interior Sindh, Pakistan. Pakistan Journal of Medical Research. 2021 Oct; 60(3): 111-6.

[29] Sohail M, Shakeel S, Kumari S, Bharti A, Zahid F, Anwar S *et al.* Prevalence of malaria infection and risk factors associated with anaemia among pregnant women in semiurban community of Hazaribag, Jharkhand, India. BioMed Research International. 2015; 2015(1): 740512. doi: 10.1155/2015/740512.

[30] Kassa GM, Muche AA, Berhe AK, Fekadu GA. Prevalence and determinants of anemia among pregnant women in Ethiopia; a systematic review and meta-analysis. BioMed Central Hematology.2017 Dec; 17: 1-9. doi: 10.1186/s12878-017-0090-z.

[31] Adam I, Ibrahim Y, Elhardello O. Prevalence, types and determinants of anemia among pregnant women in Sudan: a systematic review and meta-analysis. BioMed Central Hematology.2018Dec;18:1-8.doi: 10.1186/s12878-018-0124-1.

[32] Lufele E, Umbers A, Ordi J, Ome-Kaius M, Wangnapi R, Unger H *et al.* Risk factors and pregnancy outcomes associated with placental malaria in a prospective cohort of Papua New Guinean women.Malaria Journal.2017Dec;16:1-0.doi:10.1186/s12936-017-2077-4.

[33] Leuba SI, Westreich D, Bose CL, Olshan AF, Taylor SM, Tshefu A *et al.* Effects on maternal and pregnancy outcomes of first-trimester malaria infection among nulliparous women from Kenya, Zambia, and the Democratic Republic of the Congo.PLOS ONE.2024 Dec;19(12):e0310339.doi:10.1371/journal.pone.0310339.

[34] Moeller SL, Nyengaard JR, Larsen LG, Nielsen K, Bygbjerg IC, Msemo OA *et al.* Malaria in early pregnancy and the development of the placental vasculature. The Journal of Infectious Diseases. 2019 Sep; 220(9): 1425-34. doi: 10.1093/infdis/jiy735.

[35] Accrombessi M, Yovo E, Fievet N, Cottrell G, Agbota G, Gartner A *et al.* Effects of malaria in the first trimester of pregnancy on poor maternal and birth outcomes in Benin. Clinical Infectious Diseases.2019Sep;69(8):1385-93. doi: 10.1093/cid/ciy1073.