


Original Research Article

Impact of Malarial on Placenta Thickness and Morphology in the Second and Third Trimesters among Pregnant Women in Onitsha Anambra State

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Abstract: Background: Malaria can significantly affect the structure and function of the placenta, leading to changes in its thickness and morphology, which maybe common low resources income countries such as Nigeria. This study was designed to assess the impact of malaria on placental thickness and morphology in the second and third trimesters of pregnancy in Onitsha Anambra state, Nigeria. **Materials and Methods:** The study design was a case control carried among pregnant women with malaria and comparing with apparently health controls. Both groups undergo laboratory test for malaria and ultrasound scan for placental thickness and placental morphology using standard protocols. Descriptive and inferential statistical tools were used for statistical analysis with level of statistical significance set at $p < 0.05$. **Results:** Malaria status did not have a significant effect on placental thickness ($F(1, 394) = 0.041, p = 0.84$). There was a significant main effect of trimester ($F(1, 394) = 9.233, p = 0.001$). There is no significant difference in placental morphology between malaria-affected pregnancies and healthy controls ($F(1, 396) = 1.049, p = 0.31$). **Conclusion:** Placental thickness differs between the second and third trimesters and increases from the second to the third trimester in both malaria-positive and healthy control groups. Malaria status did not meaningfully alter the pattern of placental growth across trimesters. There is no significant difference in placental morphology between malaria-affected pregnancies and healthy controls and placental morphology does not significantly differ between the second and third trimesters. Also, the interaction between malaria status and trimester was not statistically significant.

Keywords: Gestation, Malaria, Pregnancy, Ultrasound.

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INTRODUCTION

Placenta is the organ responsible for controlling nutrition from the mother to the foetus[1], nevertheless placenta is not simply a passive conduit for nutrients but also responsible for both maternal and foetal signals [2], because, maternal physiological adaptations to pregnancy are, in part controlled by the placenta [3]. At any point in gestation, placenta function will reflect a progressive collection of external influences experienced during the path of its development [3]. Additionally, maternal health can have a significant impact on the in-utero environment and thus, on foetal development and the health of the child later in life [4]. Foetuses have to adapt to the supply of nutrients crossing the placenta whether a shortage or an overabundance, and these

adaptations may permanently change their physiology and metabolism [4]. Any impairment in placental development plays an important role in the pathogenesis of a complicated pregnancy [5].

Malaria is a life-threatening disease to gravid women caused by Plasmodium parasites, which are transmitted to people through the bites of infected female Anopheles mosquitoes [6]. Malaria can significantly affect the structure and function of the placenta, leading to changes in its thickness, morphology, and blood flow dynamics [6]. Malaria infection can disrupt placental development, contributing to miscarriage or early foetal loss, through systemic or local deficiencies in the immune response to malaria [7]. Placental malaria in the

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second trimester is associated with an increased risk of intrauterine growth restriction and preterm birth [8], while in the third trimester, sequestration of malaria parasites in the placenta can trigger inflammation and interstitial thickening, causing structural damage that raises placental thickness and compromises placental function [9]. This disrupts maternal-foetal nutrient and oxygen transfer, often resulting in maternal anaemia, intrauterine growth restriction, low birth weight, and heightened risks of infant mortality and morbidity [10].

The severity of the health issues was particularly noted in regions with high malaria transmission rates, suggesting that environmental factors play a significant role in neonatal health outcomes [11]. Findings from comparative studies collectively underscore that malaria during pregnancy poses serious risks to neonatal health. The increased prevalence of conditions like anaemia and the likelihood of low birth weight directly correlate with maternal malaria infection and its severity [12]. These adverse outcomes prompt an urgent need for strategies aimed at preventing malaria in pregnant women, which would ultimately enhance neonatal health and reduce associated risks in third trimester hence the importance of this research.

This study advances understanding of malaria in pregnancy by clarifying its effects on placental thickness and morphology as measured by ultrasound, with the aim of informing and strengthening maternal and foetal health strategies in settings where malaria remains a major public health challenge, particularly across Africa.

MATERIALS AND METHODS

This cross-sectional study was conducted among 400 participants (200 case-groups and 200 control-groups) at the Radiology department Federal Medical Centre, Onitsha Anambra State Nigeria. The study population consist of pregnant women for ultrasound scan diagnosed to be infected with malaria in their second and third trimesters and attends antenatal clinic at Federal Medical Centre, Onitsha Anambra State Nigeria, whose records was assessed at the antenatal unit, within the age range of 18 to 45 years, who attends obstetric clinics and or undergoing obstetric scans in the diagnostic facility (Radiology Department, Federal Medical Centre Onitsha). Similarly, apparently healthy pregnant women in their second and third trimester were also studied as control.

Ethical Approval was obtained from Research Ethics Committee of Faculty of Health Sciences and Technology, College of Health Sciences, Nnamdi Azikiwe University Nnewi campus, Anambra state, Nigeria. With protocol number: FHST/REC/024/1054. A corresponding approval was obtained from Radiology Department, Federal Medical Centre Onitsha, finally each volunteered participant was ensured to sign an informed consent form before enrolment in the study.

A purposive sampling technique was adopted for the adult gravid patients with positive malaria blood test at second and third trimester of pregnancy. Convenience sampling method was employed for patients with negative malaria blood test at second and third trimester of pregnancy control group. A convenient sampling method involves recruiting participants who are readily available, willing and convenient to participate in the study. Purposive sampling, also known as judgmental sampling, is a non-probability sampling technique where participants are selected based on the researcher's judgment and expertise. The goal is to select a sample that is representative of the population of the research interest. Purposive sampling was efficient in this research as it allows the researcher to quickly identify and select participants with specific characteristics.

Inclusion Criteria

1. Gravid women who are willing to participate.
2. Pregnant mothers between ages 18-45 years.
3. Only second and third trimester pregnancies was inclusive
4. Viable singleton gestation confirmed through ultrasound scan.
5. Pregnant women with recent positive malarial laboratory test result seen in the antenatal folder
6. Apparently healthy pregnant women, who are matched in maternal age, foetal gestational age, body mass index (BMI), with the case group was included until the projected sample size was reached.

Exclusion criteria

1. Multiple gestations in the current pregnancy, this is because multiple gestations are reported as being associated with high prevalence of congenital anomalies [13].
2. A foetus with developmental malformation.
3. Maternal medical history of diabetes mellitus, this is because diabetes mellitus in pregnancy crosses the placenta and triggers the foetal pancreas to produce excess insulin; this can cause the foetus to grow too large (macrosomia) [14].
4. Pregnancy-related with IUGR, as it readily affects the foetal biometry [15].

Instrument for Data Collection

The ultrasound machine used is a GE Medical System SCS, Monitor Display, model name: 21.5 Inch Display Module R2, GPN: 5880738 Rev. 7, P/N 301010552, serial number: 2321552267, GE. Equipped with a 3.5MHz curvilinear transducer and electronic callipers. Last calibrated in 17th February, 2025 this is of great importance to ensure reliability of the measured data.

Validation of the Equipment

General Electric Medical System SCS Monitor Display, model name: 21.5 Inch Display Module R2,

GPN: 5880738 Rev. 7, P/N 301010552, serial number: 2321552267, GE, the Placenta Blood Flow (PBF) results that was obtained matched a clinical measurement that stands as the reference value to the study, with a percentage difference in measurement of between 10% and 15%. The measurement of Doppler and Anthropometric parameters was linked to the model following the fact that by definition, Placenta Blood Flow (PBF) = Cross-sectional area of the umbilical vein (CSA_{uv}) × Mean flow velocity integral (FVI_{uv}) / s × 60 (CSA_{uv}) is calculated from the diameter of the umbilical vein and FVI_{uv} is the integrated blood flow velocity measured through the umbilical vein.

Reliability of the Equipment

Doppler ultrasound scanners is generally considered to be highly reliable when used appropriately by a professional, with studies showing good accuracy in measuring blood flow, when considering the right settings and angle of approach; however, its reliability can be affected by factors like operator skill, patient positioning and the complexity of the blood vessel being examined. The reliability of the equipment is dependent on; Operator dependence, Limitations due to anatomy and Different Doppler modes, the researcher will pay detailed attention to these three.

Ultrasound Scan Methodology

The patient details were inputted to the scanner and confirmed with the patient, brief explanation and indication of the scan which is for academic research was done, the patient lies supine on the couch on my right hand and faces the researcher, the subject was properly covered with a protective cloth, application of the ultrasound gel at the lower abdomen and the trans-abdominal probe (3.5MHs) was selected for gestational. The curve liner probe was held at the right hand while the left hand was used to control the knobs and the probe was first placed transverse position at the lower abdomen with the marker as a reference. The placental location was localized, by keeping the image orientation correct as the probe was rotated in clockwise direction when changing from a transverse plan to longitudinal plan and anti-clock wise from longitudinal to transverse. Sliding, rotation, Deeping and angling technique was adopted to determine the location of the umbilical cord insertion, for correct measurement of the placental thickness, maintaining a longitudinal orientation staring at the right funds the probe was slide down towards the symphysis keeping the probe perpendicular to the floor. Sliding was done along the three tracks located to determine the location of the umbilical cord insertion. Fundal, anterior, posterior and anterior and posterior fundal placental positions were determined from the scans.

Placenta Thickness; Transducer Selection: the researcher used a curved array transducer (3.5 MHz) for optimal imaging of the placenta. Placenta Localization: Identification of the placenta and its edges was done using the foetal head or spine as a reference point.

Thickness Measurement of the placental thickness at the thickest point, usually at the level of the umbilical cord insertion. The measurement technique was done by using the calliper function to measure the placental thickness.

Placenta Morphology; using greyscale imaging: by assessing its texture, homogeneity, and presence of any abnormalities. Placenta Maturation: to assess the placental maturation index, which includes evaluation of the placental thickness, texture and presence of calcifications was observed carefully.

The images and videos of the collected data was documented, measurements and any notable findings was saved for time management and later assessed. Report that generates details of the ultrasound findings, including measurements, observations, and recommendations for further evaluation or follow-up were properly guarded.

Laboratory Methodology for the Test Findings

The study population comprised pregnant adult women who attended routine antenatal visits during the study period. Participants who gave their consent where recruited and if they either presented with fever, had a recent history of fever, or showed malaria-related symptoms such as chills, headache, or anaemia. Before each procedure, the purpose of the study was explained to the participants in simple, clear language. Informed consent was obtained from all participants, and great care was taken to maintain confidentiality. Standard infection control practices were strictly followed during every stage of blood collection and laboratory analysis.

Blood Sample Collection

For every participant, venous blood was collected. This method was chosen because it allowed for a larger volume of blood to be obtained, which was useful for preparing both thick and thin smears as well as for any additional confirmatory laboratory tests that were required [16].

During venipuncture, the participant was comfortably seated, and a tourniquet was applied to the upper arm to make the veins more prominent. The chosen puncture site, usually the antecubital fossa, was cleaned with 70% alcohol and allowed to air dry. A sterile syringe and needle were then used to withdraw approximately 2–3 ml of blood. Once the blood was collected, the tourniquet was released and the needle was carefully removed. Pressure was applied with sterile cotton wool until bleeding stopped, and a small plaster was applied. The collected blood was immediately transferred into an EDTA anticoagulant tube, mixed gently by inversion to prevent clotting, and promptly transported to the laboratory.

Preparation of Blood Smears

From each venous blood sample, both thick and thin smears were prepared according to WHO recommendations [17].

For the thick film, a larger drop of blood was placed on a clean slide and spread gently in a circular motion to form a circle of about one centimetre in diameter. The smear was prepared to be thick enough that printed text beneath the slide could only just be seen. The film was then left to air dry naturally without the use of fixatives.

For the thin film, a smaller drop of blood was placed near the frosted edge of a slide. Using another spreader slide held at a 45° angle, the drop was pulled back and then pushed smoothly forward to produce a thin smear with a feathered edge. This thin film was air-dried completely before being fixed with absolute methanol for about thirty seconds and then allowed to dry again.

Staining of Smears

Both the thick and thin blood films were stained using the Giemsa staining technique, which is considered the gold standard for malaria microscopy [17, 18]. A 10% Giemsa solution was prepared using buffered water at pH 7.2, and slides were immersed in the solution for ten minutes. For quality control, some slides were stained using 3% Giemsa for thirty to forty-five minutes. After staining, the slides were rinsed gently with buffered water and placed vertically on a drying rack to air dry completely before examination.

Microscopy

Examination of the stained slides was carried out using a light microscope fitted with a 100x oil immersion objective lens.

The thick films were used for parasite detection and density estimation. Each slide was first scanned under the 10x objective to identify suitable fields, and then carefully examined using the oil immersion lens. At least 100 high-power fields were studied before a slide was declared negative.

The thin films, on the other hand, were used primarily for parasite species identification. Morphological characteristics such as the size and shape of the parasites, chromatin patterns, and stippling were observed to differentiate between species. Mixed infections were also recorded whenever present.

Parasite Density Estimation

Parasite density was estimated using the WHO semi-quantitative method [17]. The grading was done as follows:

1. (+): 1–10 parasites per 100 high-power fields
2. (++) : 11–100 parasites per 100 fields
3. (+++) : 1–10 parasites per field
4. (++++): More than 10 parasites per field

This method was adopted because it is widely used in clinical and epidemiological studies, and it provided a reliable way of categorizing the parasite burden among participants [16].

Interpretation of Results

Slides were declared positive when malaria parasites were detected and the species identified. A slide was declared negative only after at least 100 high-power fields had been thoroughly examined with no parasites seen. For pregnant women, even very low levels of parasitemia were considered important, since malaria infection during pregnancy is associated with adverse outcomes such as maternal anaemia, placental malaria, and poor pregnancy outcomes [19].

Method of Data Analysis

Data was analysed using the statistical package for social science-SPSS software version 20.0, in line with the research objectives:

1. To determine the difference in placental thickness in the second and third trimester between the pregnancy affected by malaria and healthy controls. An analysis of covariance (ANCOVA) was conducted to examine the difference in placental thickness in the second and third trimester between the pregnancy affected by malaria and healthy controls.
2. To determine the difference in placental morphology in the second and third trimester between the pregnancy affected by malaria and healthy controls. A two-way ANOVA was conducted to assess the effect of malaria status and trimester on placental morphology.

A descriptive and inferential statistical tool was adopted for statistical analysis with level of statistical significance set at $p < 0.005$.

RESULTS

A total of 400 participants were included in the study. Table 1, showed the distribution of socio-demographic and selected obstetric variables. For age distribution, majority of the participants were within the 21–30 years' age group 191(47.8%), making this the most represented category. This was followed by those aged 31–40 years 137 (34.3%). Participants aged 41–50 years accounted for 44(11.0%), while the least represented group was those below 20 years 28(7.0%). This indicates that most of the study population were in their prime reproductive age. In parity most of the women were multiparous 267(66.8%), indicating they had given birth more than once. Grand multiparous women constituted 68(16.9%), while primiparous women (first-time mothers) accounted for 65(16.3%). This suggests that the study population was largely composed of women with previous childbirth experience. In terms of gravidity, the highest proportion of participants was G5 90(22.5%), followed 81(20.3%) and G4 70(17.3%). Lower gravidity levels such as G1 54(13.5%) and G2 57(14.3%) were moderately represented. Higher-order pregnancies (G6–G9) were relatively less common, collectively accounting for a small percentage of the population. Overall, the gravidity distribution indicates that a significant proportion of

participants had experienced multiple pregnancies (Table 1).

In table 2, clinically, most participants were in the third trimester 252(63%), with 148 (37%) in the second trimester, showing that the majority were in late pregnancy at the time of assessment. Placental location was most commonly anterior 183(45.8%) and posterior 149(37.3%), with less frequent anterior-fundal, posterior-fundal, and fundal positions. Malaria status was nearly evenly split between positive 200(50.0%) and negative 200(50.0%) participants. Among those infected, moderate parasitemia (2++) was slightly more common 101(25.5%) than mild parasitemia 99(1+, 24.8%). Most participants had normal amniotic fluid index 333(83.2%), with only a small proportion showing borderline 62 (15.5%) or low 5(1.3%) AFI. Similarly, placental morphology was predominantly normal 326(81.5%), while myoma 46(11.5%), cysts 22(5.3%), and placenta accreta 7 (1.7%) were observed less frequent (Table 2).

The descriptive analysis shown in table 3, the participants' gestational age ranged from 20.45 to 40.00 weeks, with a mean of 31.19 ± 5.55 weeks, indicating that the majority were in the second and third trimesters. Placenta Thickness: Placental thickness varied between 2.43 mm/s and 4.78 mm/s, with a mean of 3.65 ± 0.53 mm/s, reflecting the normal variability in placental growth across gestation. Amniotic Fluid Index (AFI): AFI ranged from 4.00 to 73.00 cm, with a mean of 10.98 ± 3.98 cm, showing that most participants had normal fluid levels, although there were a few extreme values. Maternal Age: Ages ranged from 18 to 45 years, with a mean of 29.53 ± 6.89 years, confirming that most participants were within the prime reproductive age (Table 3).

An analysis of covariance (ANCOVA) was conducted in table 4, to examine the difference in placental thickness in the second and third trimester

between the pregnancy affected by malaria and healthy controls. After adjustment, malaria status did not have a significant effect on placental thickness ($F(1, 394) = 0.041, p = 0.84$). There was a significant main effect of trimester ($F(1, 394) = 9.233, p < 0.001$), indicating that placental thickness differs between the second and third trimesters. The interaction between malaria status and trimester was not significant ($F(1, 394) = 3.249, p = 0.07$), suggesting that the effect of malaria does not differ across trimesters. Both maternal age and gestational age significantly influenced placental thickness ($p = 0.01$ for both covariates) (Table 4). The estimated marginal means plot in figure 1, shows that placental thickness increases from the second to the third trimester in both malaria-positive and healthy control groups. The slight crossing of lines suggests a minor difference in the trajectory between malaria and control groups, but this interaction was not statistically significant, indicating that malaria status did not meaningfully alter the pattern of placental growth across trimesters. Overall, the chart illustrates that trimester has a clear effect on placental thickness, while malaria status has little effect, consistent with the ANCOVA results (Figure 1).

A two-way ANOVA was conducted in table 5, to assess the effect of malaria status and trimester on placental morphology. The results showed that malaria status did not have a statistically significant effect on placental morphology ($F(1, 394) = 1.049, p = 0.31$). This indicates that there is no significant difference in placental morphology between malaria-affected pregnancies and healthy controls. Similarly, trimester did not show a significant effect ($F(1, 394) = 0.538, p = 0.46$), suggesting that placental morphology does not significantly differ between the second and third trimesters. Furthermore, the interaction between malaria status and trimester was not statistically significant ($F(1, 394) = 0.099, p = 0.75$), indicating that the effect of malaria on placental morphology does not vary across trimesters (Table 5).

Table 1: Frequency distribution of socio-demographic and Obstetric characteristics of the study participants (N=400)

Variable	Category	Frequency (n)	Percentage (%)
Age group(years)	< 20	28	7.0
	21 – 30	191	47.8
	31 – 40	137	34.3
	41 - 50	44	10.9
	Total	400	100.0
Parity	Primipara	65	16.3
	Multipara	267	66.8
	Grand Multipara	68	16.9
	Total	400	100.0
Gravidity	G1	54	13.5
	G2	57	14.3
	G3	81	20.3
	G4	70	17.3
	G5	90	22.5
	G6	32	8.0

Variable	Category	Frequency (n)	Percentage (%)
	G7	7	1.8
	G8	8	2.0
	G9	1	0.3
Total		400	100.0

Table 2: Frequency distribution of clinical variables (N=400)

Variable	Category	Frequency(n)	Percentage (%)
Trimester	2 nd Trimester	148	37
	3 rd Trimester	252	63
	Total	400	100.0
Placenta Location	Anterior	183	45.8
	Anterior-Fundal	28	7.0
	Fundal	16	3.9
	Posterior	149	37.3
	Posterior-Fundal	24	6.0
	Total	400	100.0
Malaria Status	Negative	200	50.0
	Positive	200	50.0
	Total	400	100.0
Malaria Intensity	1+	99	24.8
	2++	101	25.5
	Neg	200	50.0
	Total	400	100.0
Amniotic Fluid Index (AFI)	Low	5	1.3
	Borderline	62	15.5
	Normal	333	83.2
Morphology	Accreta	7	1.7
	Cysts	21	5.3
	Myoma	46	11.5
	Normal	326	81.7
	Total	400	100.0

Table 3: Descriptive Statistics of Selected Maternal and Obstetric Parameters

Variables	N	Minimum	Maximum	Mean	SD
Gestational Age (Weeks)		20.45	40.00	31.19	5.55
Placenta Thickness (mm/s)	400	2.43	4.78	3.65	0.53
Amniotic Fluid Index (cm)		4.00	73.00	10.98	3.98
Maternal Age		18	45	29.53	6.89

Table 4: Differences in the placental thickness in the second and third trimester between the pregnancies affected by malaria and healthy controls

Source of Variation	Type III Sum of Squares	Df	Mean Square	F-value	p-value	Partial Eta Squared
Malaria status	0.011	1	0.011	0.041	0.84	0.000
Trimester	2.411	1	2.411	9.233	0.00	0.023
Malaria × Trimester	0.848	1	0.848	3.249	0.07	0.008
Maternal age (covariate)	1.878	1	1.878	7.192	0.01	0.018
Gestational age (covariate)	1.760	1	1.760	6.741	0.01	0.017
Error	102.619	394	0.261			
Total	5358.532	400				

Statistically significant at $p < 0.05$

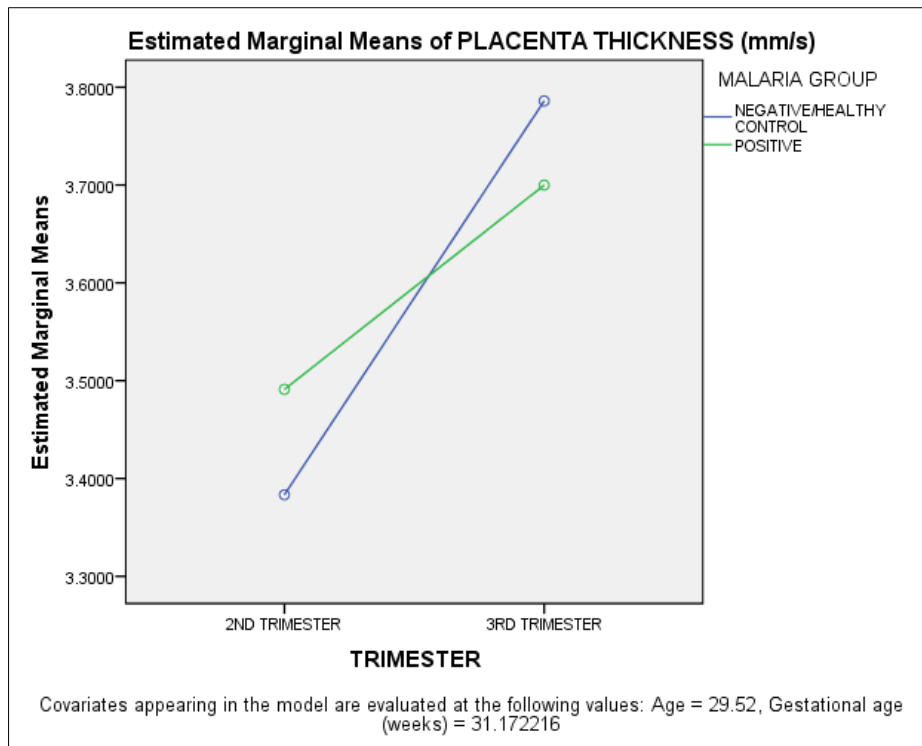


Figure 1: Estimated marginal means of placental thickness by malaria status and trimester

Table 5: Differences in placental morphology in the second and third trimester between the pregnancies affected by malaria and healthy controls

Source of Variation	Type III Sum of Squares	Df	Mean Square	F-value	p-value	Partial Eta Squared
Malaria status	0.412	1	0.412	1.049	0.31	0.003
Trimester	0.212	1	0.212	0.538	0.46	0.001
Malaria × Trimester	0.039	1	0.039	0.099	0.75	0.000
Error	155.250	394	.393			
Total	5720.000	400				

DISCUSSIONS

The difference in placental thickness in the second and third trimester between the pregnancy affected by malaria and healthy controls revealed that malaria status did not have a significant effect on placental thickness but there was a significant main effect of malaria on trimester. This indicates that placental thickness differs between the second and third trimesters. Also, placental thickness increases from the second to the third trimester in both malaria-positive and healthy control groups. The slight crossing of lines suggests a minor difference in the trajectory between malaria and control groups. This interaction was not statistically significant, indicating that malaria status did not meaningfully alter the pattern of placental growth across trimesters. Overall, the trimester has a clear effect on placental thickness, while malaria status has little effect, consistent with the ANCOVA results.

This finding is in keeping with the findings of the studies conducted by Elmahdy *et al.*, [20], Prerna, Shivani and Vaishali [21]. In a study conducted by Elmahdy *et al.*, [20], to determine to Correlation between late second and third trimester placental thickness

detected by ultrasound and gestational age in normal and IUGR pregnancies which involved a prospective study that was conducted on 100 pregnant women who attended the outpatient clinics or admitted at inpatients wards of Obstetrics and Gynaecology department, Tanta University during the period from December 2019 to December 2020. Majority of gestational age groups, the mean placental thickness was lower in group I than that detected in group II ($P < 0.01$) except that detected between 28 and 29 weeks and 29 and 30 weeks, where there was no significant difference between two studied groups regarding placental thickness ($P > 0.05$). Prospective study was conducted on 200 women with normal pregnancy between 13–40 weeks’ gestation in an outpatient clinic, Obstetrics and Gynaecology Hospital, Karbala, Iraq from February 2023 and March 2024. Placental thickness and other parameters were measured using transabdominal two-dimensional ultrasounds, and foetal outcomes were examined. Data were analyzed using SPSS software (Version 24). Positive correlation was found between thickness of placenta in the 2nd and 3rd trimester with weight of both foetus and placenta after delivery and with Apgar score ($P\text{-value} \leq 0.05$). The cases admitted to NICU were higher in thick and thin

placenta compared to normal placenta thickness. Also the foetal outcome was better with normal placental thickness compared to that with thin and thick placenta. The study revealed that placental thickness can be utilized in forecasting gestational age and foetal outcomes. In a study by Prerna, Shivani and Vaishali [21], to evaluate placental thickness measurement at second and third trimester and its association with foeto maternal outcome. A prospective observational study was conducted at Kasturba Hospital, Delhi, from August 2023 to October 2024. The minimum required sample size was estimated to be 36 considering a 95% confidence level, 90% power and an absolute error of 5% and a correlation coefficient of 0.51 between placental thickness and neonatal birth weight. A total of 42 pregnant women were enrolled in the study in their first or second trimesters. Ultrasonography for placental thickness (PT) was performed at 25- and 35-weeks period of gestation (POG). Patients were followed up till delivery and various foetal and maternal outcomes such as birth weight, Pregnancy Induced hypertension (PIH), intrauterine growth restriction (IUGR), Gestational Diabetes Mellitus (GDM), Intrahepatic Cholestasis of pregnancy (IHCP) among many more were recorded. Statistical analysis was performed using SPSS-25 and a p-value <0.05 was considered significant. Mean PT at 25 weeks POG was found to be 26.29±4.47 mm and at 35 weeks POG was found to be 33.23 ±5.74 mm. Posterior wall placentae were found to be thicker as compared to anterior wall implanted placentae (at 25 weeks POG mean PT for anterior vs posterior placentae were 24.72 vs 27.57; at 35 weeks POG mean PT for anterior vs posterior placentae were 30.22 vs 35.44). Birth weight was found to increase with increase in PT (at 25 weeks POG Pearl's correlation coefficient R= 0.36, p=0.02; at 35 weeks POG Pearl's correlation coefficient R= 0.479, p=0.002). Pregnant Women (PW) with normal PT (>-2SD;<2SD) and thick PT (>2SD) at 25 weeks POG had mean birth weights 2.85kg and 3.13kg respectively. PW with thin (<-2SD), normal thickness (>-2SD; <2SD) and thick placentae (>2SD) at 35 weeks POG had mean birth weights 2.51kg, 2.85kg and 3.18kg respectively. The study revealed that measurement of PT antenatally on sonography can indicate about health of foetus in utero and its outcomes in the postnatal life.

In a study carried out by Singoei *et al.*, [22], to determine placenta terminal villi morphology in patients with and without malaria in pregnancy. The study followed a retrospective cohort design in which 116 placentae, 58 from mothers who have had malaria in pregnancy and 58 from mothers without a history of malaria in pregnancy were assessed by histological examination. Statistical analyses were performed using SPSS to compare features of the placenta in the two groups. From the findings, the odds of having low placental weight was significantly higher for those with malaria compared to those without malaria (mean placental weights 478.27g ± 40.95 and 511.55g ± 35.58 respectively; P=0.001, OR=4.424). Morphometric

analyses showed significantly higher counts of syncytial knot (p-value <0.001, CI: 1.549 - 4.596) and delimitation (p-value 0.01, CI: 0.715 - 4.667), fibrin deposition (p-value 0.009, CI: 0.029 - 0.188), smaller intervillous space area (p-value 0.036, CI: -0.013- -0.362) and (p-value 0.004, CI: 0.846 - 3.98) in placenta from mothers with malaria in pregnancy compared to the non-exposed group. The findings provide a morphological basis for understanding adverse pregnancy outcomes in women who have had malaria in pregnancy. Measures should be put in place aggressively to treat and hence reduce the severity of adverse foeto-maternal outcomes of malaria infection in pregnant mothers. In a study by Ahenkorah *et al.*, [23], to assess by stereology the histomorphology of selected placental structures in placenta malaria compared with normal placentae at term. A total of 10 placentae comprising 5 controls and 5 cases were selected from 50 placentae that were collected at term (38 weeks ± 2 weeks) from the maternal delivery suit of Korle-Bu Teaching Hospital in Accra, Ghana. Blood from the placentae was collected for both rapid diagnostic test and microscopic examinations. Samples collected were examined for Plasmodium parasites, after which they were classified as study group (Plasmodium positive) or control (Plasmodium negative). Stereological quantification using systematic uniform random sampling technique with test point and intersection counting of photomicrographs were employed to estimate the mean volume densities of syncytial knots, syncytial necrosis, foetal capillaries, and intervillous spaces of the placentae on a total of 1,600 photomicrographs. Out of the fifty placental samples from the maternal side tested for Plasmodium, six representing 12% were found to be infected with the parasite by both rapid diagnostic test and microscopy. On stereological assessment, the mean volume density of syncytial knots was significantly higher in the placental malaria group compared with the control placentae at term ($p = 0.0080$), but foetal capillaries ($p = 0.7813$), intervillous spaces ($p = 0.8078$), and syncytial necrosis ($p = 0.8249$) were not significantly different. This preliminary result indicates that placental malaria may cause significant increase in the syncytial knots but not foetal capillaries, intervillous spaces, or syncytial necrosis. This finding signifies early maturation of the placenta and may be crucial in understanding perinatal outcomes.

With regards to the determination of the difference in placental morphology in the second and third trimester between the pregnancy affected by malaria and healthy controls, it was found that malaria status did not have a statistically significant effect on placental morphology. This indicates that there is no significant difference in placental morphology between malaria-affected pregnancies and healthy controls. Similarly, trimester did not show a significant effect, suggesting that placental morphology does not significantly differ between the second and third trimesters. Furthermore, the interaction between malaria

status and trimester was not statistically significant, indicating that the effect of malaria on placental morphology does not vary across trimesters.

CONCLUSION

Placental thickness differs between the second and third trimesters and increases from the second to the third trimester in both malaria-positive and healthy control groups. Malaria status did not meaningfully alter the pattern of placental growth across trimesters. There is no significant difference in placental morphology between malaria-affected pregnancies and healthy controls and placental morphology does not significantly differ between the second and third trimesters. Also, the interaction between malaria status and trimester was not statistically significant.

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