



## A SCOPING REVIEW: IMPACT OF MALARIA IN PREGNANCY

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ABSTRACT	Keywords
Based on world malaria reports, the most malaria cases are in the African region, followed by the Eastern Mediterranean region and Southeast Asia region. Twenty-nine countries account for global malaria cases. In the Asia-Pacific region, the rate of malaria transmission is relatively low when compared to sub-Saharan Africa, but it is basically the same as the malaria problem in Africa because the harmful effects of malaria in various regions remain the same. The process of pregnancy can aggravate malaria cases; pregnant women suffering from malaria will affect the process of pregnancy and the fetus and baby born. This Scoping Review aims to synthesize research evidence and categorize research articles on the impact of malaria on pregnant women and their babies in Asia-Pacific countries. Literature search was carried out using the PRISMA flowchart guidelines which were applied to present the article search flow. The synthesis shows 11 articles obtained from the search process. This review raises 6 themes, namely: anemia, low birth weight, premature birth, malaria in infants, placental malaria, and primigravida. The impact of malaria in pregnancy that most often occurs in pregnant women is anemia, low birth weight, premature birth, placental malaria, and malaria in infants.	<b>Pregnant women, Impact, Malaria, Malaria with pregnancy</b>

## INTRODUCTION

Malaria is an infectious disease caused by plasmodium parasites that live and reproduce in human red blood cells. Malaria is transmitted by female Anopheles mosquitoes that contain plasmodium. There are four different species of malaria in humans namely plasmodium falciparum, plasmodium vivax, plasmodium malariae and plasmodium ovale, of which plasmodium falciparum and plasmodium vivax are the most common and plasmodium

falciparum the most dangerous and the greatest threat (WHO, 2015).

The World Malaria Report 2020 states that in 2019 an estimated 229 million cases of malaria occurred worldwide. The most malaria cases were in the African region with 215 million or 94%, followed by the East Mediterranean region with 26%, and the Southeast Asia region with 3% of cases. Twenty-nine countries account for 95% of malaria cases globally. Five countries account for more than half of all malaria cases worldwide: Nigeria (27%),

Democratic Republic of Congo (12%), Uganda (5%), and Mozambique (4%), and Niger (3%) (WHO, 2020). In 2019 there were 409,000 deaths from malaria globally. An estimated 33 million pregnancies of which 35% (12 million) were exposed to malaria infection during pregnancy, and gave birth to about 822,000 low birth weight children (16% of all low birth weight children) while Central Africa has the highest prevalence of low birth weight children due to malaria in pregnancy (WHO, 2020). Transmission rates are relatively low in the Asia-Pacific region compared to sub-Saharan Africa. The perception of malaria in the Asia-Pacific region as a problem is not serious enough, but it is basically the same as the malaria problem in Africa because the risk of danger posed by malaria in various regions remains the same (Baird, 2017).

Malaria in pregnancy endangers the health of the mother and places her at a greater risk of death and impacts on the health of the fetus, causing prematurity and low birth weight as major contributors to neonatal and infant mortality (WHO, 2019). The process of pregnancy will exacerbate malaria cases experienced by pregnant women. A pregnant woman who suffers from malaria will affect the process of pregnancy and affect the condition of her fetus and newborn baby. Malaria infection in pregnant women can cause anemia in the mother and fetus, as well as babies with low birth weight. The risk of low birth weight infants (LBW) in mothers with malaria increased two times compared to pregnant women without malaria. This can increase maternal and infant mortality. Complications of malaria infection in pregnancy can include abortion, low birth weight babies, anemia, pulmonary edema (swelling or accumulation of fluid in the lung tissue), impaired kidney function, and congenital malaria (Budiyanto & Wuriastuti, 2017).

In multigravida, pregnancy-specific immunity to disease is usually developed or through self-protection, but is completely absent in primigravida (Aguzie et al., 2017). Primigravida were more frequently infected with a higher density of parasites in the placenta than multigravida. Primigravida are at dangerous risk, and can be complicated by severe maternal anemia, which can cause postpartum hemorrhage and even lead to low birth weight (LBW) babies (Fried & Duffy, 2017).

In the study showed that microscopy infection by *P. falciparum* and *P. vivax* was associated with maternal age, decreased levels of hemoglobin in the blood, low birth weight, high risk for low birth weight, gestational age, and preterm birth. In this study, it was observed that pregnant women infected with malaria had a 2-fold higher risk of anemia than women who were not infected (Vásquez et al., 2020). Malaria in pregnant women living in areas of low transmission also found that a high prevalence of antibodies indicated a significant exposure of pregnant women to *Plasmodium Malaria*. Malaria appears to be benign in the study area because it does not cause symptoms in patients, but pregnant women who are detected to have *Plasmodium* in their blood should be treated immediately, because they can contribute to malaria transmission (Hristov et al., 2014). The results of the study on 1,451 placentas of pregnant women who had a history of malaria, Placental Malaria infection was detected in 269 (18.5%), of which 54 (3.7%) were acute, 55 (3.8%) chronic, and 160 (3.7%) were chronic. 11.0%) is malaria infection during pregnancy. Risk factors for placental malaria included living in a rural area (adjusted odds ratio (AOR) 3.65, 95% CI 1.76–7.51;  $p = 0.001$ ), primigravida (AOR 2.45, 95% CI 1.26–4.77;  $p = 0.008$ ) and had symptoms of malaria during pregnancy (AOR 2.05, 95% CI 1.16–3.62;  $p = 0.013$ ).

compared with uninfected women, acute infection (AOR 1.97, 95% CI 0, 98-3.95;  $p = 0.056$ ) was associated with low birth weight infants, whereas chronic infection was associated with preterm delivery (AOR 3.92, 95% CI). 1.64–9.38;  $p = 0.002$ ) and anemia (AOR 2.22, 95% CI 1.02–4.84;  $p = 0.045$ ) (Lufele et al., 2017).

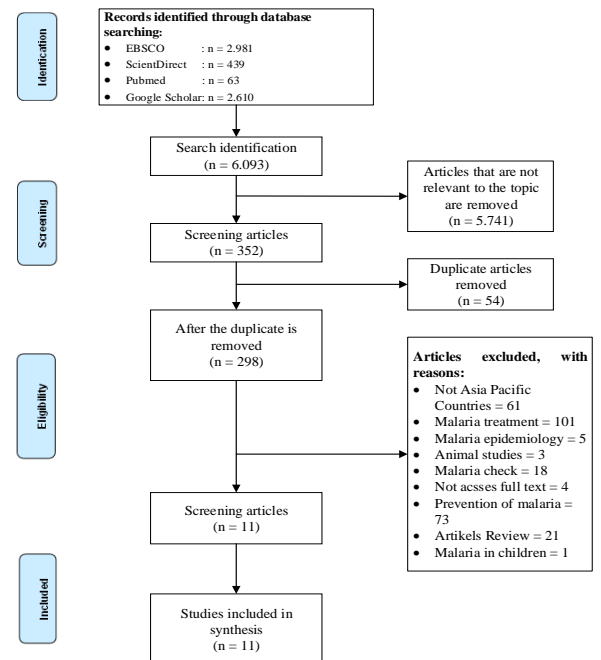
Based on this background, the research question is how the impact of malaria in pregnancy is obtained. The purpose of this scoping review is to synthesize research evidence and categorize or categorize research articles on the impact of malaria on pregnant women and their babies, as well as the impact of malaria on the incidence of anemia, low birth weight, premature birth, placental malaria, and malaria in infants.

## METHOD

This study uses a scoping review method. Scoping review method is used to synthesize research evidence and classify existing research articles. The PEOs method was used to obtain the focus of the review and research questions. The literature search uses a search system on the EBSCO, ScienceDirect, PubMed and Google Scholar databases. The keywords used in the search for articles in the EBSCO database are “Pregnan\* OR Pregnant WOM\* AND Malaria OR Plasmodium Vivax OR Plasmodium Falciparum OR Plasmodium Ovale OR Plasmodium Malariae OR Plasmodium Knowlesi AND Impact OR Effect AND Asia Pacific OR asia-pacific” in the ScienDirect database and PubMed which limits the use of Boolean researchers use the keywords “Pregnancy Associated Malaria AND Asia Pacific OR asia-pacific”. Inclusion and exclusion criteria were used in the selection of articles. PRISMA Flowchart is applied to present article search flow. Critical appraisal is carried out to assess the quality of the articles to be used by using

assessment tools from Hawker, S. et al. 2002 - Criteria for Quality of the Paper Appraisal.

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## RESULTS

Based on the results of the synthesis, 11 articles were obtained that matched the research criteria, as shown in the following table:

**Table 1. Data Charting**

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1	Risk factors for malaria and adverse birth outcomes in a <i>prospective cohort of pregnant women resident in a high malaria transmission area of Papua New Guinea/Stanisic et al/2015/A1</i>	Population: New Guinea	To determine prevalence, risk factors and congenital malformations during pregnancy in malarious areas	Study: Cohort	Prevalence: 470/328 (69.7%)	23/A	microscopic parasitemia. Most infections occur with Plasmodium falciparum; the remainder was dominated by P. vivax. Anemia and smoking were associated with low birth weight, and low birth weight (16.7%; 51/305) and preterm delivery (21.8%;
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63/290) were common. Histopathological diagnosis of chronic placental malaria was associated with LBW (adjusted odds ratio [aOR] 3.3; p=0.048) and preterm delivery (aOR 4.2; p=0.01). Lack of maternal education tends to cause premature labor

. Sub-microscopic parasitaemia during delivery appears to increase the risk of LBW. Of the genetic polymorphisms, Southeast Asian ovalocytosis, + - thalassemia and complement receptor 1 (CR1) deficiency, heterozygous genotype CR1

						was associated with a reduced risk of anaemia and a substantial but insignificant effect was noted in other comparisons.		mm unit y of Haz arib ag, Jhar kha nd, Indi a/ Soh ail et al/ 201 5/ A2 (Soh ail et al., 201 5)	in the adult population living in areas of P. vivax codominant transmission and prevalence of P. falciparum.	ctive ly. The majority were infected with asymptomatic P. vivax (more than 85%) in the ANC and delivery units. Periparasitaemia was significantly associated with fever in the last week, subjects of rural origin, and first/second pregnancy in
2	Prevalence of Malaria Infection and Risk Factors Associated with Anaemia among Pregnant Women in Semiurban Co	Individual	Evaluated the interaction between anaemia, pregnancy, and asymptomatic malaria, stratified by clinical group	Study Cross-sectional	Prevalence of Malaria was 1.2%, 71 women/444, and maternity/870	The prevalence of MIP was 5.4% and 4.3% in ANC and delivery units, and 13.2% of malaria occurred in women without pregnancy, respectively.	26 / A			

the multi-variate analysis, with the highest risk factor associated with fever followed by the rural population. Strikingly in the cohort, anaemia was common in 86% in the ANC unit compared with 72% in the delivery unit, while severe anaemia

was 3.6% and 7.8% in the ANC unit and delivery unit, respectively. The prevalence of anaemia was higher in the MIP group (88% and 89% in the ANC and delivery units), while severe anaemia was 23% and 21%, respectively.

3	What is the burden of submicroscopic malaria in pregnancy in central India? Singh et al/ 2015/ A3	In diameter	To determine the number of submicroscopic infections during pregnancy in the consecutive years of submicroscopic infection in mother and newborn	Study Cr oss - sec tio nal	Pregnant Women 3425 pregnant women, ie 2477 from the ANC unit and 948 from the delivery unit who had microscopic and PCR samples. The polymerase chain reaction detected significantly more Plasmodium infection than traditional light microscopy of both peripheral blood samples	26 / A	compared with true microscopic infection.	les (3.4 vs 1.2% ; OR 2.9, 95% 95% confidence intervals (CIs) 1.9–4.5) and placenta (4.2 vs 1.7% ; OR 2.5, 95% CIs 1.4–4.8) blood samples. Submicroscopic infection was not associated with anaemia or severe maternal anaemia among ANC or deliv
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ery parti cipa nts and was not asso ciate d with low birth weig ht (LB W) amo ng deliv ery parti cipa nts. In contr ast, micr osco pical ly detec table infec tions were asso ciate d with sever e ane mia and low birth weig ht.	4 . Plas mod ium kno wles i Mal aria Duri ng Preg nanc y/ Bar ber et al/ 201 5/ A4  (Bar ber et al., 201 5)	M al ay sia	To co mp are the risk s and con seq uen ces of kno wle si mal aria duri ng pre gna ncy.	St ud y <i>Co ho rt</i>	Wo me n/ 774	Duri ng 2012 - 2013 , 774 wom en with micr osco pical ly diag nose d mala ria were notif ied, 252 (33 %), 172 (20 %), 333 (43 %), and 17 (2%) with Plas modi um falc iparu m infec tion, Plas modi um viva x infec tion, Plas modi um mala riae / Plas modi um kno	1 7 / B
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<p>wlesi , and mixe d infec tions . Amo ng wom en aged 15- 45 years , preg nanc y was repor ted in 18 of 124 (14.5 %), 9 of 93 (9.7 %), and 4 of 151 (2.6 %) P. faldi paru m, P. viva x, and P. mala riae/ P kno wlesi notic es respe ctive ly (P = 0.00 2). Thre</p>	<p>e wom en with kno wlesi mala ria were confi rmed to be preg nant: 2 had mod erate ane mia, and 1 gave birth to a prem ature baby with low birth weig ht. Ther e were 17, 7, and 0 preg nant wom en with faldi paru m, viva x, and kno wlesi mala ria ident ified from</p>
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women stated that they slept under mosquito nets the night before the survey, and 86% went to the forest in search of food 1 week before the survey in the median. The majority of infections (94%) were asymptomatic and half were associated with anemia.	Overall, 24% of women gave birth to LBW babies. Factors associated with a higher risk of LBW were tobacco use (aRR 2.43; 95% CI 1.64 – 3.60) and preterm birth (aRR 3.17; 95% CI 2.19 – 4.57). Factors associated with a
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						high er mate rnal risk of ane mia were the abse nce of iron supp leme ntati on durin g preg nanc y, Lao Theu ng ethni city and place of resid ence.			in Indi a/ Corr êa et al/ 201 7/ A7	MS F.	in their first and seco nd preg nanc ies, respe ctive ly. Upp er Arm Circ umfe renc e (LIL A) was belo w 230 mm in 74% of them . The prev alenc e of ane mia was 92.4 % (95 % Conf iden ce Inter val (CI): 89.9- 94.3) , wher eas sever e ane mia was ident
7 .	Hig h burd en of mal aria and ane mia amo ng triba l preg nant wo men in a chro nic conf lict corri dor	In di a	To dete rmi ne the pre vale nce of mal aria in wo me n pres enti ng for AN C care at MC	St ud y De skr ipt if (M eto de sur ve y)	Pre gna nt wo ma n/ 575  (mea n age: 26 years , inter quart ile rang e: 25- 30) 29% and 22% were	Amo ng the 575 preg nant wom en (mea n age: 26 years , inter quart ile rang e: 25- 30) 29% and 22% were	1 9 / B				

ified in 6.9% of patients. The prevalence of malaria was 29.3% (95% CI: 25.7-33.2) with 64% caused by isolated P. falciparum, 35% by P. falciparum or mixed malaria and 1% by P. vivax, or P. malariae or P. ovale. The malaria test was positive in

20.8% of asymptomatic cases. Malaria was associated with severe anaemia (prevalence ratio: 2.56, 95% CI: 1.40 – 4.66,  $p < 0.01$ ).

8	Risk factors and pregnancy outcomes associated with placental malaria, for placental malaria, maternal	Paupa pregnant women who attended antenatal visits	To determine prevalence of placental malaria, risk factors for placental malaria, maternal	Study Cross-sectional	Prevalence of malarial parasitaemia (P. falciparum, P. vivax, P. malariae, P. ovale) was determined by Giemsa stained blood smears	Of the 1451 patients examined, PM infection was detected in 269 (18.5%), of which 54 (3.7%) were acute, 55	21 / A
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Papua New Guinea women / Lufele et al/ 2017/ A8	ern al ane mia and birt h out co mes ass ocia ted wit h plac enta l mal aria wh o rece ive d at leas t one dos e of trea tme nt. Inte rmit tent pre ven tion duri ng pre gna ncy (IP Tp) and slee p und er Inse ctic ide mos quit o nets	(3.8 %) chro nic, and 160 (11.0 %) were child hood infec tions . then. PM risk facto rs inclu ded livin g in a rural area (adju sted odds ratio (AO R) 3.65, 95% CI 1.76 – 7.51; p = 0.00 1), prim igrav ida (AO R 2.45, 95% CI 1.26 – 4.77; p = 0.00 8) and had sym ptom	(IT N).	s of mala ria durin g preg nanc y (AO R 2.05, 95% CI 1.16 – 3.62; p = 0.01 3). After adjus tmen t for cova riate s, com pare d with uninf ected wom en, acute infec tion (AO R 1.97, 95% CI 0.98- 3.95; p = 0.05 6) was asso ciate d with low birth weig ht infan ts,
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whereas chronic infection was associated with preterm delivery (AOR 3.92, 95% CI 1.64 – 9.38; p = 0.002) and anaemia (AOR 2.22, 95% CI 1.02 – 4.84; p = 0.045).	9 Iron deficiency during pregnancy is associated with a reduced risk of adverse birth outcomes in a malarial endemic area in a longitudinal national cohort study/Fowkes et al/2018/9	Paupers' Nigwe Guitene Aweiron deficiency and delivery outcomes, and to measure how malaria mediates the relationship, in a study of pregnant women in a malarial endemic	To investigate the association between iron deficiency and delivery outcomes, and to measure how malaria mediates the relationship, in a study of pregnant women in a malarial endemic	Study conducted in the main/05	Pregnancy was common (71% at enrollment) and was associated with a higher mean birth weight (230g; 95% confidence interval, CI 118, 514; p < 0.001), and a decrease in likelihood of LBW (adjusted odds ratio, aOR	Iron deficiency in pregnant women was common (71% at enrollment) and was associated with a higher mean birth weight (230g; 95% confidence interval, CI 118, 514; p < 0.001), and a decrease in likelihood of LBW (adjusted odds ratio, aOR	21/2
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emic area of Papua New Guinea (PNG), which has the largest population. risk of anemia, malnutrition and poor birth outcomes in the Southwestern Pacific region.	= 0.32; 95% CI 0.16, 0.64; p = 0.001) and preterm delivery (aOR R = 0.57; 95% CI 0.30, 1.09; p = 0.089 ). The magnitude of the greatest influence on primigravida (birth weight 351 g; 95% CI 188.514; p < 0.001; LBW aOR 0.26; 95% CI 0.10, 0.66;	p = 0.005; PTB aOR = 0.39, 95% CI 0.16, 0.97; p = 0.042. Sequential analysis of medication showed that the protective association of iron deficiency in LBW was mainly mediated through mechanisms independent of malaria or anemia.
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10.	The impact of malaria in pregnancy on infant susceptibility to malaria infection/Indrawanti et al/2018/A10	Population	To determine the impact of malaria during pregnancy.	Prospective Cohort	Infant/178	One hundred and seventy-eight infants consisted of 95 (53.37%) babies born to mothers with malaria and 83 (46.63%) without malaria 91 (51.12%) boys and 87 (48.88%) children. Women were included in this study. The mean maternal age was	25.35 years $\pm$ 6.30 vs. 26.0 $\pm$ 5.69 years. At the ages of 6 and 12 months, infants born to malaria-positive mothers were more susceptible to malaria infection than infants born to malaria-negative mothers with RR = 3.49; 95% CI: 1.02-11.96; p = 0.03
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## DISCUSSION

Based on the 11 articles obtained, as many as 7 articles came from the Southeast Asian region which includes Indonesia, Malaysia, Laos, and Papua New Guinea. In the South Asian region there are 4 articles, all of which are from India. The article uses a quantitative research study, with a cohort study design of 5 articles, a cross-sectional study of 5 articles, and a descriptive study of 1 article. In 2015 there were 4 articles published, in 2016 there were 2 articles, in 2017 there were 2 articles, in 2018 there were 2 articles, and in 2019 there were 1 article.

Malaria in pregnancy is a clinical condition in which a pregnant woman is infected with the Plasmodium parasite that causes malaria. Malaria in pregnancy can harm pregnant women and their fetuses (Djabanor et al., 2017). Based on the results of the review of research articles, several themes were found that could answer the objectives and questions of this scoping review, namely: anemia, low birth weight, premature birth, malaria in infants, placental malaria, and primigravida.

### Anemia

Pregnant women generally will experience mild anemia, especially in primigravida women (Fowkes et al., 2018). Women who did not take iron supplements during pregnancy had a 58% higher risk of anemia than women who took iron supplements (Briand et al., 2016). Women who have had malaria are more likely to experience anemia than women without malaria (Sohail et al., 2015). Women who

detected malaria microscopically had significantly lower mean hemoglobins. The likelihood of severe anemia is much higher in women with microscopically detectable malaria infection (Singh et al., 2015). Active cases of malaria in endemic areas are not the cause of most cases of anemia, but contribute to the incidence of severe anemia (Corrêa et al., 2017). In Plasmodium falciparum infection, pregnant women living in areas with unstable malaria transmission are at risk for severe disease complications, including severe anemia (Barber et al., 2015). Low Hb levels and malaria infection during pregnancy and delivery result in reduced birth weight and an increased risk of low birth weight and premature delivery (Stanisic et al., 2015). Anemia can also cause placental malaria infection, a significant decrease in maternal hemoglobin levels results in moderate to severe anemia compared to those without placental malaria infection (Lufele et al., 2017). Malaria anemia during pregnancy can cause life-threatening conditions for both mother and fetus (Chandrashekar et al., 2019).

### Low Birth Weight Baby

Women infected with malaria during pregnancy are at risk of giving birth to babies with low birth weight (Chandrashekar et al., 2019). Malaria infection results in adverse pregnancy outcomes including low birth weight and prenatal death (Barber et al., 2015). Decreased birth weight and increased risk of low birth weight are caused by low maternal Hb levels and malaria infection during pregnancy and childbirth (Stanisic et al., 2015). Malaria infection of the placenta can also cause low birth weight (Lufele et al., 2017). Placental infections that are detected microscopically are more likely to give birth to babies with low birth weight. Sub-microscopic placental infection was not associated with an increased risk of LBW

(Singh et al., 2015). LBW is a major risk factor in infant morbidity and mortality. Iron deficiency in the mother can cause the baby to be born with low birth weight. In malaria endemic areas iron deficiency and anemia often occur, resulting in poor birth outcomes (Fowkes et al., 2018), but low birth weight can also be associated with malnutrition in pregnant women (Briand et al., 2016).

### **Premature Birth**

Women infected with malaria during pregnancy are at risk of Intrauterine Growth Restriction (IUGR) and the risk of preterm delivery which is also associated with umbilical cord parasitemia (Chandrashekar et al., 2019) resulting in adverse pregnancy outcomes including low birth weight and prenatal death (Barber et al., 2019). al., 2015). Low Hb levels and malaria infection during pregnancy and delivery result in reduced birth weight and an increased risk of low birth weight and premature delivery (Stanisic et al., 2015). Factors associated with LBW are premature births (Briand et al., 2016). Chronic placental malaria is associated with an increased risk of preterm delivery (Lufele et al., 2017)

### **Malaria In Babies**

Malaria in pregnancy can cause malaria infection in infants at the age of 6 and 12 months. Babies born to malaria-positive mothers during pregnancy are more susceptible to malaria, presumably because placental malaria causes a decrease in maternal antibody transfer, and increases the baby's susceptibility to malaria infection. Malaria in pregnancy in the second trimester and the infant's susceptibility to malaria infection are thought to be related to the length of exposure to malaria in the mother (Indrawanti et al., 2018).

### **Placental malaria**

The risk factor for placental malaria is in pregnant women who live in rural areas and experience symptomatic malaria infection during pregnancy (Lufele et al.,

2017). *Plasmodium falciparum* is the main cause of malaria infection in the placenta which is a side effect on mothers and babies worldwide in malaria endemic areas. Placental malaria is detected in more than 40% of pregnancies (Lufele et al., 2017). Acute placental malaria infection is associated with a doubled likelihood of developing low birth weight (Lufele et al., 2017). *P. falciparum* infection affects the placental weight ratio, especially in the absence of fever or chills during pregnancy (Sukma Oktavianthi et al., 2016).. In African women, chronic placental infection (especially massive chronic intervillitis, accumulation of large numbers of white blood cells in the maternal blood space from the placenta) is specifically associated with growth restriction, whereas acute infection with high parasitaemia is associated with preterm delivery (Stanisic et al., 2015).

### **Primigravida**

Primigravida women are more susceptible to malaria infection, this susceptibility will decrease in subsequent pregnancies. Primigravida are susceptible to malaria infection because malaria immunity in pregnancy has not yet formed a protective antibody response (Lufele et al., 2017) this is due to a decrease in the immune response in pregnant women. In subsequent pregnancies, women will experience repeated infections. The lack of anti-parasitic antibodies during the first pregnancy increases the parasite burden in primigravida compared to multigravida (Chandrashekar et al., 2019). The effects of iron deficiency are greatest for primigravida women, this group is at high risk of being more susceptible to various infectious diseases (Fowkes et al., 2018).

## **CONCLUSIONS**

The impact of malaria in pregnancy that most often occurs in pregnant women is anemia, low birth weight, premature birth, placental malaria, and malaria in infants.

Pregnant women will generally experience mild anemia. In malaria endemic areas, iron deficiency and anemia are common and are exacerbated by the risk of malaria infection. Women infected with malaria during pregnancy are at risk of giving birth to babies with low birth weight. Decreased birth weight and increased risk of LBW are caused by low maternal Hb levels and malaria infection during pregnancy and childbirth. Low Hb levels and malaria infection during pregnancy and delivery result in decreased birth weight, increased risk of low birth weight and premature delivery. Symptomatic malaria infection suffered by the mother in the second trimester of pregnancy can cause placental malaria, malaria in the placenta results in a decrease in the size of the placenta. Malaria infection during pregnancy, especially in the second trimester, makes babies born more susceptible to being infected with malaria at the age of 6 to 12 months. Malaria infection is more common in primigravida because the decreased immune response in pregnant women has not yet formed a protective antibody response.

Researchers recommend that health service agencies should provide health education about the importance of iron supplements or blood boosters in pregnancy. Conduct malaria screening at every Antenatal visit (ANC), especially in each trimester for pregnant women in malaria endemic areas, or pregnant women who come from malaria endemic areas, as well as carry out preventive efforts and provide safe malaria prevention treatment for pregnant women to anticipate asymptomatic infections in those infected with the malaria parasite without symptoms. With this action, it is hoped that it can prevent the transmission of malaria, as well as relieve the burden of anemia caused by the malaria parasite in pregnant women by regularly consuming blood-enhancing tablets.

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