https://doi.org/10.46344/JBINO.2023.v13i01.14

MALARIA IN PREGNANT WOMEN: A REVIEW

Emmanuel Ifeanyi Obeagu[1], Getrude Uzoma Obeagu[2] and Adekemi Linda Adejare[3]

[1]Department of Medical Laboratory Science, Kampala International University, Uganda.
[2]School of Nursing Science, Kampala International University, Uganda.
[3]Intensive Care Unit, Inspira Medical Center, USA.

emmanuelobeagu@yahoo.com

ABSTRACT

Malaria is a serious and sometimes fatal disease caused by a parasite that commonly infects a certain type of mosquito which feeds on humans. People who get malaria are typically very sick with high fevers, shaking chills, and flu-like illness. Malaria infection in pregnancy is a major cause of maternal death, maternal anaemia, and adverse pregnancy outcome (spontaneous abortion, preterm delivery, growth restriction/low birth weight, stillbirth, congenital infection, neonatal mortality) in geographic areas where malaria infection occurs commonly in pregnant women. The prevalence of malaria in Somalia is high with those more affected being pregnant women.

Keywords*: malaria, pregnancy, women, anaemia, stillbirth, pregnancy outcomes*

Introduction

Malaria is a serious and sometimes fatal disease caused by a parasite that commonly infects a certain type of mosquito which feeds on humans [1-4]. People who get malaria are typically very sick with high fevers, shaking chills, and flu-like illness. Four kinds of malaria parasites infect humans: Plasmodium falciparum, P. vivax, P. ovale, and P. malariae. In addition, P. knowlesi, a type of malaria that naturally infects macaques in Southeast Asia, also infects humans, causing malaria that is transmitted from animal to human ("zoonotic" malaria). P. falciparum is the type of malaria that is most likely to result in severe infections and if not promptly treated, may lead to death. Although malaria can be a deadly disease, illness and death from malaria can usually be prevented [5].

Malaria infection in pregnancy is a major cause of maternal death, maternal anaemia, and adverse pregnancy outcome (spontaneous abortion, preterm delivery, growth restriction/low birth weight, stillbirth, congenital infection, neonatal mortality) in geographic areas where malaria infection occurs commonly in pregnant women. Pregnant women are particularly vulnerable to Plasmodium falciparum infection because red cells infected with the parasite can sequester in the placenta, and thereby cause adverse fetal effects. If anti-malarial drugs do not achieve therapeutic levels in the placenta, parasites sequestered there may be released intermittently into the peripheral blood and cause recurrent maternal infection [6-7].

Globally Malaria in tropical regions, which is caused by the protozoan parasites Plasmodium falciparum and Plasmodium vivax, is responsible for 515 million clinical cases and 1 to 3 million deaths annually. Plasmodium vivax, the most widespread parasite causing human malaria, is responsible for estimated 130–435 million infections annually and is the major cause of malaria in most of Asia and Latin America. Although P. vivax infection is commonly considered to be much more benign than Plasmodium falciparum infection, historical evidence suggests significant mortality associated with P. vivax malaria in the preantimalarial era, and death caused by P. vivax malaria has been increasingly recognized over the past few years. Hazaribag, the region under investigation, was primarily dominated by P. vivax whereas some buffering, bordering, and adjoining regions have lower prevalence of P. falciparum and mixed infection [8-11].

Every year, in India, 28 million pregnancies take place with 67,000 maternal deaths (Registrar General of India, Sample Registration System, Special Bulletin on Maternal Mortality in India, 2004-06), with 1 million women left with chronic ill health and 1 millionneonatal deaths. Pregnancy is an event of immunologic tolerance, whereby a woman accepts the implantation of the fatal allograft in her uterus; initiating a gestation phase becomes physiologically susceptible and

vulnerable to malaria infection. Pregnant women with relatively lower levels of previously acquired immunity are particularly at high risk of the most severe complications of malaria during pregnancy, such as cerebral malaria, severe malaria anaemia, abortions, intrauterine fatal death, premature delivery, stillbirths, and maternal and infant mortality. In malaria endemic areas, pregnant women are more susceptible to Plasmodium infections than their non pregnant peers. The adverse outcomes of these infections are primarily felt by primigravidae, although, in areas of low or unstable transmission, women of all gravidities may be equally at risk. Pregnant women are 3 times more likely to suffer from severe disease as a reset of malarial infection compared with their non pregnant counterparts and have a mortality rate from severe disease that approaches 50%Jharkhand, India [12].

Factors influencing malaria prevalence in pregnant women include maternal age, parity, use of prophylaxis, nutrition, host and parasite genetics and level of anti-parasitic immunity with conflicting data concerning maternal age and parity depending on urban or rural setting. So far, only one study had investigated the risk factors of malaria during pregnancy in Burkina Faso. This study had been carried out in a rural area and one year [13-16].

Age

In our study, it was observed that maternal age was associated with malaria prevalence, showing that a pregnant woman of younger maternal age is at a greatest risk of malaria infection, as well as having the highest parasite densities. Similar findings have been reported in Lagos where prevalence and parasite density were observed to decrease as age increased It has been consistently demonstrated that infection rates are higher in women in their first and second pregnancies, with lower rates in later pregnancies. This is understandable as pregnancy is naturally accompanied by general immune suppression that may cause loss of acquired immunity to malaria especially among primigravidae. This is because they lack the specific immunity to placental malaria that is acquired from exposure to malaria parasites during pregnancy. This immunity accumulates with successive pregnancies, provided there is exposure to malaria infection [12].

Despite efforts aimed at controlling and eliminating malaria, the disease still remains a major public health problem. It was estimated that 228 million cases of malaria occurred worldwide in 2018 (decreased from 231 million cases in 2017), and that there were 405,000 deaths in 2018 compared to 416,000 in 2017. Most malaria cases (93%) and deaths (94%) occurred in the World Health Organization (WHO) Africa Region, with Plasmodium falciparum accounting for 99.7% of the cases. Children under 5 years of age and pregnant women are the most at risk of malaria infection. In sub-Saharan Africa where moderate to high transmission of malaria occurs, an estimated 11 million out of 38 million (29%) pregnancies were exposed to malaria in 2018. Although often

asymptomatic, P. falciparum infection in pregnancy is associated with unfavorable pregnancy outcomes such as stillbirth, low birth weight (LBW), pre-term delivery, abortion and maternal anemia. Prevalence of malaria in pregnant women peaks in the second trimester. Malaria in pregnancy is also a useful marker for malaria surveillance at community level with common risk factors being a primigravida and being young [17].

Knowledge

Different articles revealed that knowledge of pregnant women on malaria is influenced by socio-demographic characteristics like education status, occupation, residence, ownership of television or radio, religion, ethnicity, age, and family monthly income. Cross-sectional studies were done in Ethiopia especially in Shahsango, Bonke, and Tepito assess knowledge on

malaria among pregnant women showed that 74.1%, 16.5%and 17.7% of the respondents had good knowledge respectively. However; different studies reveal that practice of malaria preventive measure and health-seeking behaviour of the community are related to the level of knowledge. Having a good knowledge regarding malaria cause, mode of transmission, sign and symptom, the effect of malaria on pregnancy and prevention of malaria leads to use malaria prevention mechanism and increase health- seeking behaviour. In Ethiopia, women's level of practice on malaria preventive measure is too poor. Therefore, determining women's knowledge on malaria is an important solution [18].

Evidence from malaria knowledge, attitudes, and practices (KAP) studies reported that misconceptions on malaria transmission and risk factors still exist with adverse impact on malaria control programmes. Findings from a study conducted by Singh et al. in rural areas of Northern Nigeria revealed that although knowledge about malaria prevention measures was high (90%), it was poorly reflected in their practices (16%). Another study by Adebayo et al. Assessed the knowledge of malaria prevention among mothers of children aged under 5 years and pregnant women in a rural community in Southwest Nigeria. This latter study also found poor knowledge and utilization of malaria prevention measures among majority of the caregivers in the rural study area. Considering the vulnerability of both children aged under 5 years and pregnant women to malaria, this study aimed to determine the knowledge of malaria prevention and management among pregnant women and non-pregnant mothers of children aged under 5 years seeking health care at one of the main secondary maternity hospitals in Ibadan, Nigeria. Only few studies have assessed knowledge on malaria prevention among mothers in hospital-based setting. This study sought to fill this gap and provide new insights on the depth of knowledge gaps. The findings will help to improve implementation of integrated malaria control strategies. It will also be essential in establishing epidemiological and behavioural baseline indicators to

evaluate and improve progress by malaria control programmes (Kelechi Elizabeth Oladimeji,2019).

The World Health Organization (WHO) recommends the use of insecticide-treated nets (ITNs) as a measure to reduce the mentioned adverse effects during pregnancy. Similarly, one of the goals of the National Malaria Strategy in Ethiopia is to ensure that vulnerable individuals such as pregnant women benefit from preventative measures, such as ITNs. Even though, the Abuja declaration targets agreed upon by African heads of state in 2000 aims to provide at least 80% of pregnant women with ITNs by the year 2005, only 63% of pregnant women presently make use of an ITN in Ethiopia which hampered the effectiveness of ITNs. This is mainly due to issues related to replacementof nets, seasonality of malaria, and poor knowledge with regard to the link between mosquitoes and malaria as well as proper utilization of ITNs. Therefore, assessment of knowledge, attitudes and practices about malaria and the effective use of ITNs in this vulnerable group contribute immensely to sustainable control of the disease [19].

Effects of Maternal Malaria on Infants Among Pregnant Women.

Preterm Birth

The risk of a poor birth outcome is increased for pregnant women living in malaria- endemic regions. An estimated 85 million women a year are at risk of Plasmodium falciparum malaria in pregnancy. Pregnant women are more likely to be infected with malaria and to experience more severe disease8,9. Women with malaria in pregnant women are at higher risk for adverse birth outcomes10. Recommended care for pregnant women living in malaria-endemic regions includes the use of insecticide-treated bed nets (ITNs), intermittent preventive treatment of malaria in pregnancy (IPTp, beginning in the second trimester), and clinical management of malaria in pregnant women and anemia. However, low rates of ITN coverage, increasing resistance to IPTp drugs, and limited access to antenatal care are important barriers to impact, andmalaria in pregnant women remains a global health priority [13]. For many sub-Saharan African women of reproductive age, co-infection with HIV and malaria in pregnant women further increases the risk of poor birth outcomes. WLHIV have an increased incidence and density of peripheral and placental malaria infection, and experience more complications including maternal anemia and maternal death. Co-infection with malaria and HIV is associated with an increased risk of PTB and low birth weight compared to the risk from either infection alone. An estimated 15 million children are born preterm every year, resulting in over one million deaths in children under the age of five. The majority of all PTBs - over 60% - occur in subSaharan Africa and South Asia.

Malaria in pregnancy is also associated with preterm birth, where these babies are usually born small and have increased risk of mortality due to complications such as brain haemorrhage, sepsis, acute

respiratory illnesses and perinatal asphyxia. Surviving infants may develop lifelong morbidities such as learning disabilities, which become obvious when the infant reaches school age. Plasmodium infection in both early and late pregnancies has been associated with preterm deliveries. A study from Malawi showed that earlier infection (before 24 weeks gestation) was associated with a higher risk of preterm delivery. In a Cameroon study, pregnant women who experienced malaria in pregnant women during the third trimester were four times more likely to have preterm deliveries. Similarly, in areas with low malaria transmission such as Southeast Asia, P. falciparum infection during late pregnancy was also associated with preterm delivery. Studies on populations in malaria's areas have identified several factors that significantly increase the risk of preterm birth, including PM, systemic inflammation (particularly CXCL9 and IL-1β), primigravity, long-term iron supplementation and severe anaemia [16].

Low Birth Weight

There are several adverse outcomes associated with malaria, which affect both the mother and the new born, including stillbirth, preterm birth, maternal and neonatal mortality, congenital malaria, maternal anaemia [14] and low birth weight (LBW, i.e., birth weight < 2.5 kg). Importantly, LBW ranks among the most commonly documented adverse birth outcomes. In 2019, there were an estimated 33 million pregnancies in 33 moderate-to-high malaria transmission countries in the World Health Organization (WHO) African Region. Thirty-five percent of these pregnancies were exposed to malaria infection, and it is estimated that malaria infection during the pregnancy resulted in 822.000 infants with LBW. In line with this, Eisele et al. estimated that 11% of neonatal deaths in sub-Saharan Africa are due to LBW associated with malaria infections duringpregnancy [19].

Environmental Factors of Malaria Among Pregnant Women

Climate Change

Climate change is projected to alter the distribution of vector borne diseases and malaria is no exception. Children under five years of age and pregnant women continue to be at risk. One of the key millennium development goals is to halve, halt, and reverse the scourge of malaria by 2015. The disease has not yet been halved, although a significant reduction in malaria incidences has been recorded. These little gains achieved to date are under threat from climate change. Malaria is sensitive to climate change in the sense that the vector that spreads malaria and the parasite that causes the disease are sensitive to climate variables especially rainfall and temperature. Research on the impact of climate change on the dynamics of malaria is still ongoing. However, most studies tend to consider the effect of temperature alone on the dynamics of malaria, neglecting the impact of incorporating rainfall in the mathematical models of malaria transmission. Understanding the role of temperature and rainfall in malaria

transmission is of particular importance in light of climate change as changes can alter vector development rates, shift vector geographical distribution, and alter transmission dynamics. Climate change is widely expected to significantly affect the global spread, intensity, and distribution of malaria [20].

Changes in temperature, rainfall, and relative humidity due to climate change are expected to influence malaria directly by modifying the behaviour and geographical distribution of malaria vectors and by changing the length of the life cycle of the parasite. Climate change is also expected to affect malaria indirectly by changing ecological relationships that are important to the organisms involved in malaria transmission (the vector, parasite, and host). Recent evidence shows that changes in temperature and precipitation have already changed the distribution and behaviour of the vector [21]

CONCULUSION

Age group, low educational level, unemployment and History of previous malaria affects the prevalence of malaria in pregnant women. climate change, breeding site mosquitoes in water stagnant and irregularly sleep under bed net are the major environmental factors that affects malaria infection in pregnant women.

References

1. Obeagu EI, Ogbonna US, Nwachukwu AC, Ochiabuto O, Enweani IB, Ezeoru VC. Prevalence of Malaria with Anaemia and HIV status in women of reproductive age in Onitsha, Nigeria. Journal of Pharmaceutical Research International. 2021 Feb 23;33(4):10-9.
2. Okorie HM, Obeagu EI, Obarezi HC, Anyiam AF. Assessment of some inflammatory cytokines in malaria infected pregnant women in Imo State Nigeria. International Journal of Medical Science and Dental Research. 2019;2(1):25-36.
3. Obeagu EI, Agreen FC. Anaemia among pregnant women: A review of African pregnant teenagers. J Pub Health Nutri. 2023; 6 (1). 2023;138.
4. Obeagu EI, Obeagu GU, Chukwueze CM, Ikpenwa JN, Ramos GF. Evaluation of Protein C, Protein S and Fibrinogen of Pregnant Women with Malaria in Owerri Metropolis. Madonna University journal of Medicine and Health Sciences ISSN: 2814-3035. 2022 Apr 19;2(2):1-9.
5. CDC. Life cycle of malaria, Centers for disease control and prevention. 2020. https://www.cdc.gov/malaria/about/biology/index.html.
6. Okorie HM, Obeagu EI, Eze EN, Jeremiah ZA. Assessment of some haematological parameters in malaria infected pregnant women in Imo state Nigeria. Int. J. Curr. Res. Biol. Med. 2018;3(9):1-4.
7. Okorie HM, Obeagu EI, Eze EN, Jeremiah ZA. Assessment of coagulation parameters in malaria infected pregnant women in Imo state Nigeria. International Journal of Current Research in Medical Sciences. 2018;4(9):41-9.
8. Ifeanyi O, Uzoma O, Amaeze A, Ijego A, Felix C, Ngozi A, Nchekwubedi C, Chinenye K. Maternal expressions (serum levels) of alpha tumour necrosis factor,

interleukin 10, interleukin 6 and interleukin 4 in malaria infected pregnant women based on parity in a Tertiary Hospital in Southeast, Nigeria. Journal of Pharmaceutical Research International. 2020 Sep 25;32(23):35-41.

9. Obeagu EI, Obeagu GU, Musiimenta E. Post partum haemorrhage among pregnant women: Update on risks factors. Int. J. Curr. Res. Med. Sci. 2023;9(2):14-7.
10. Okamgba OC, Nwosu DC, Nwobodo EI, Agu GC, Ozims SJ, Obeagu EI, Ibanga IE, Obioma-Elemba IE, Ihekaire DE, Obasi CC, Amah HC. Iron Status of Pregnant and Post-Partum Women with Malaria Parasitaemia in Aba Abia State, Nigeria. Annals of Clinical and Laboratory Research. 2017;5(4):206.
11. Hassan AO, Oso OV, Obeagu EI, Adeyemo AT. Malaria Vaccine: Prospects and Challenges. Madonna University Journal of Medicine and Health Sciences ISSN: 2814-3035. 2022 Jul 12;2(2):22-40.
12. Fana SA, Danladi M, A Bunza A, Nataala SU. Prevalence and risk factors associated with malaria infection among pregnant women in a semiurban community of north-western Nigeria. BMC. 2015. https://idpjournal.biomedcentral.com/articles/10.1186/s40249-015-0054-0#Tab2.
13. Ogomaka IA, Obeagu EI. Malaria in Pregnancy Amidst Possession of Insecticide Treated Bed Nets (ITNs) in Orlu LGA of Imo State, Nigeria. Journal of Pharmaceutical Research International. 2021 Aug 25;33(41B):380-6.
14. Obeagu EI, Opoku D, Obeagu GU. Burden of nutritional anaemia in Africa: A Review. Int. J. Adv. Res. Biol. Sci. 2023;10(2):160-3.
15. Obeagu EI, Ikpenwa JN, Chukwueze CM, Obeagu GU. Evaluation of protein C, protein S and fibrinogen of pregnant women in Owerri Metropolis. Madonna University journal of Medicine and Health Sciences ISSN: 2814-3035. 2022 Apr 18;2(1):292-8.
16. Obeagu EI, Ezimah AC, Obeagu GU. Erythropoietin in the anaemias of pregnancy: a review. Int J Curr Res Chem Pharm Sci. 2016;3(3):10-8.
17. Dosoo DK, Chandramohan D, Owusu-Agyei S. Epidemiology of malaria among pregnant women during their first antenatalclinic visit in the middle belt of Ghana: Ma
18. Goshu YA, Yitayew AE. Malaria knowledge and its associated factors among pregnant women attending antenatal clinic of Adis Zemen Hospital, North-western Ethiopia, 2018. PLoS ONE, 2019; 14(1): e0210221.
19. WHO. Malaria transmission andantimalarial medicines. 2015. www.who.int/about/licensing/copyright_form/en/index.html.
20. Ermert V, Fink AH, Morse AP, Paeth H. The impact of regional climate change on malaria risk due to greenhouse forcing and land-use changes in tropical Africa. Environmental health perspectives. 2012;120(1):77-84.
21. Srimath-Tirumula-Peddinti RC, Neelapu NR, Sidagam N. Association of climatic

variability, vector population and malarial disease in district of Visakhapatnam, India: a modeling and prediction analysis. PLoS One. 2015;10(6):e0128377.