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Pre and post flooding malaria parasitemia in gravid women, South East, Nigeria

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Abstract

The effect of global change on the incidence of vector borne diseases including malaria is of great importance. Malaria has been regarded as one of the most sensitive disease that responds fast to climate change. Pregnant women tend to have reduced immunity are more vulnerable to vector borne diseases such as malaria especially with climate change like flooding where these vectors borne diseases are endemic. To measure malaria parasitaemia in gravid women pre and post flooding and also to determine the relationship between malaria and seasonal flooding in South east Nigeria. This was a hospital-based cross-sectional study involving pregnant women aged 15-45 years attending the antenatal clinics of two maternity centres in a rural community South east Nigeria. Malaria was determined using the thick and thick blood films. *Plasmodium falciparum species* was examined in this study. Chi-square was used to assess the relationship between malaria and seasonal flooding. One Hundred and fifty pregnant women were recruited for the study. The prevalence of malaria in the gravid women pre and post flooding were 60.00% and 65.30% respectively. Malaria parasite was highest in the gravid women aged 28-31 years and the primigravids. There was no statistical difference between malaria and parity. The mean parasite density in the gravid women was significantly higher post flooding than pre flooding with p-value of 0.001. There was no significant relationship between malaria parasite in gravid women and the periods of investigation. The prevalence of malaria parasite among gravid women in the study area is high regardless of the seasonal flooding. Hence, the need for adherence to malaria prophylaxis protocol by the health care professionals and increase on community health education on malaria preventive strategies.

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Introduction

Malaria in pregnancy is a major cause of both maternal and fetal morbidity and mortality [1]. Studies have shown that 15-70% of fetal mortality can be linked to malaria infection [2]. In tropical regions where malaria is endemic, 212 million clinical cases and 1-3 million deaths resulting from malaria are reported annually [3]. According to reviews from various studies, an estimate of 125 million pregnant women worldwide are exposed to the risks associated with Malaria In Pregnancy (MIP) annually resulting to 200,0000 infant death each year [4].

According to a work by Epstein, three components are essential for most infectious disease to occur; an agent (pathogen) a host (vector) and a transmission environment [8]. This balance between the vector, pathogen and environment is called the epidemiological triad.

Flooding is a leading natural disaster and it is one of the most challenging environmental disasters faced by different nations of the world in the 21st century [5]. Flooding has been known to contribute majorly to a wide range of adverse health outcomes such drowning, injury, outbreaks of gastroenteritis, respiratory infections, poisoning, communicable diseases, malaria, epidemic diseases such as cholera and dengue fever [6,7]. Flooding is known to cause alteration in the environmental balance and thus creating a conducive ground (breeding ground) for the development and maturation of disease carrying vectors [9]. The diseases that can be affected by flooding will include those that require vehicular medium of transfer from one host to another (water borne) and or a host/vector as a part of its life cycle (vector borne) [1]. Flooding alters the environmental equilibrium and therefore leads to increase in incidence of and geographical range of climate sensitive infectious disease [10]. Intense precipitation mobilises the pathogens in the environment and / or encourages vector breeding which act as mechanical means of transmission. This process thereby increases the disease pathogen as well as the carrier vectors [11]. The effect of global change on the incidence of vector borne disease including malaria is of great medical importance [12]. In areas where malaria is endemic, prolonged precipitation that follows flooding is attributed to high malaria endemicity [13]. Precipitation following flooding may decrease the vector population thereby reducing malaria transmission [14]. However as the rainfall continues to decline and floods recede, stagnant pools of water are formed which then serves as a breeding ground for mosquitoes thereby causing an upsurge in vector populations and ultimately malaria in the following weeks [15].

This study therefore aims to measure malaria parasitemia in pregnant women who were the high risk group in the population due to the rate they come down with malaria and anemia during pregnancy pre and post flooding and therefore obtain if any significant correlation exists between malaria and seasonal flooding.

Materials and methods

Study area

This study was conducted in Atani, Ogbaru LGA, Anambra South-East Nigeria. Atani is a town on the eastern bank of the River Niger been populated by fishermen and farmers. They are known to produce most of the rice, fish, yam and cassava sold in Anambra and Delta markets. The population has grown to an estimated 230,000 [16].

The location of Atani within the tropical rainforest gives it the ecological basis for the production of a wide range of tropical agricultural products with widespread potential for industrial convention [16]. The climate of the study area is rainy and dry season, the dry season lasts from November to March while the rainy season lasts from April to October every year.

Study population

Blood samples were collected twice from one hundred and fifty pregnant women between the ages of 15 and 45 years, who came for ante-natal clinic at two Maternity Centres in Atani and were recruited for this study pre and post flooding. The same set of pregnant women were recruited before and after flooding. They were selected randomly without previous knowledge of their medical background. Structured questionnaires were given to the consenting pregnant women who came to the Maternity visit.

Sampling method and sample size calculation

The sample size was calculated using malaria prevalence from a previous study by Oluwagbemiga et al, 2018 [17].

Yamen formula was used to obtain the total sample size since the population was finite.

$$n = \frac{N}{K + N [e]^2}$$

Where; n= sample size

N= Population of study

e= Degree of error expected= 10%

$$\text{Therefore, } n = \frac{548}{1 + 548 [0.1]^2}$$

n = 84.567901235

Anticipating non-response of 10% (f)

$$\text{Adjusted Sample Size; } n_s = \frac{n}{1-f}$$

$$Ns = \frac{86}{0.9} = 95.5 \sim 100$$

However, 150 samples were collected.

Inclusion criteria

Pregnant women residing within Ogbaru Local Government Area and within the age bracket of 16-45 years and who will still be pregnant before and after the flooding.

Exclusion criteria

Pregnant women not residing within Ogbaru Local Government Area and those below 16 years or above 45 years who resides within Ogbaru Local Government and who will deliver before the flooding stops.

Informed consent/ ethical approval

Voluntary informed-consent was gotten verbally from each pregnant woman after adequate information concerning the aim of the study and guarantee of confidentiality were given.

The recruitment script explained the purpose, significance, benefits and potential risks of the study. The informed consent script stated that participation in the study will be anonymous, voluntary, non-participation will have no consequences whatsoever and they were free to withdraw from the study at any time they were no longer comfortable.

This study was approved by the Scientific and Ethics Review Boards of Nnamdi Azikiwe University Teaching Hospital (NAUTH) Nnewi, Anambra State, South-East Nigeria approved our study protocol with an ethical approval number NAUTH/CS/66/VOL.13/VER III/98/2020/027. The clearance was on the understanding that participant's anonymity must be maintained; optimal laboratory practices and information got must be handled with confidentiality and for research purpose only.

Data collection and examination of blood samples

Thick and thin blood films were made on different slides and labelled properly for the recognition of malaria parasite and identification of the Plasmodium species respectively [18]. This was done twice for each respondent before and after the seasonal flooding in the study area. The 10% Giemsa stain was used to stain the blood films after they have both been fixed using methanol for 2 minutes. The films were allowed to stand for 30 minutes and then cleaned off. The thick and thin blood films were observed using a light microscope at x100 oil immersion objective lens. The thick blood film was observed first to check for the presence of malaria parasite. Examination of the thin blood film was done next for the detection of intra-erythrocytic parasites using routine methods [19]. For this study, the blood films were only examined for the detection of *Plasmodium falciparum species*.

Blood samples were collected from the pregnant women by venepuncture through strict adherence to safety procedures. A tourniquet was tied around the upper arm to increase blood pressure in the veins. The cubital area for venepuncture was thoroughly cleaned with cotton wool soaked in methylated spirit and allowed to dry. The venous blood sample were collected and transferred into an Ethylene Diamine Tetra-acetic Acid (EDTA) sample tube and labelled accordingly. Thick and thin film studies were prepared and stained to detect the presence of Plasmodium falciparum.

Statistical analysis

Data collected were pooled and analysed using Chi-square test to assess the relationship between malaria and seasonal flooding and statistical significance was set at P< 0.05. Statistical Package for Social Sciences (SPSS) version 23.0 was used for all analysis.

Results

One hundred and fifty respondents met the inclusion criteria and their questionnaires were correctly filled. The mean age of the respondents was 29.1 ± 3.1 years (range=16-39 years). Of the 150 respondents, 124 (82.7%) were married and majority, 59 (39.3%) were in their first or second pregnancy. The socio-demographic characteristic of the respondents' is shown in Table 1.

Table 1: Sociodemographic status of the participants.

Variable	Frequency	Percentage (%)
Age		
16-19	5	3.33
20-23	16	10.67
24-27	46	30.67
28-31	49	32.67
32-35	23	15.33
36-39 Total= 150	11	7.33 P=59%
Marital status		
Single	26	17.30
Married	124	82.70
Index pregnancy		
1	59	39.3
2	59	39.3
3	20	13.3
4	9	6.0
5	3	2.0

The prevalence of malaria in relation to gravidity among gravid women attending ante-natal clinic is shown in Table 2. Out of the 150 pregnant women examined, the overall prevalence in relation to age gravidity was 59.4% respectively. The prevalence according to age groups indicated that the age group 28 – 31years had the highest prevalence of malaria (33.0%), followed by 24 – 27 years which had 31.7%, while the age group 16 – 19 years recorded the least prevalence of malaria 3.3%. The differences between the prevalence of malaria in different age groups were statistically insignificant (P>0.05).

Table 2: Prevalence of malaria in relation to gravidity among gravid women attending ante-natal clinic at two Maternity Centres in Atani, Anambra State, South-eastern Nigeria.

Gravidity	Number Examined (N=150)	(%) Number of gravidity	Number of Infected (%) (N=89)	Chi-Square (ᵡ)	df	P-value
Primigravida	91	55 (60.40)	55 (61.40)	0.736	2	0.692
Multigravida	59	34 (57.63)	34 (38.60)			

Table 3: Cross Tabulation of Women Infected with Malaria Parasite Before and After Flooding

			Infected	Free	Total
Period of collection	Before Flooding	Count	90	60	150
		% within Period of collection	60.0%	40.00%	100.0%
		% within Malaria Parasite Status	47.9%	53.2%	50.0%
		% of Total	30.0%	19.7%	50.0%
	After Flooding	Count	98	52	150
		% within Period of collection	65.3%	34.7%	100.0%
		% within Malaria Parasite Status	52.1%	46.8%	50.0%
		% of Total	32.7%	17.3%	50.0%
Total		Count	188	111	300
		% within Period of collection	62.7%	37.0%	100.0%
		% within Malaria Parasite Status	100.0%	100.0%	100.0%
		% of Total	62.7%	37.0%	100.0%

	Value	Df	P – value
Pearson Chi-Square	1.782[a]	2	0.410
Likelihood Ratio	2.169	2	
Linear-by-Linear Association	.501	1	

Table 4: Mean parasite density in the pregnant women before and after flooding.

	N	Mean malaria parasite density (±SD)	P-value
Before Flooding	90	1.18 ± 0.384	0.001
After Flooding	98	1.44 ± 0.610	
Total	188	1.31 ± 0.530	

The mean malaria parasite density in the pregnant women after flooding (1.44 ± 0.610) was significantly higher (p=0.01) than the mean density before flooding (1.18 ± 0.384).

Discussion

The prevalence rate of malaria among pregnant women pre and post flooding in this study was 60.00% and 65.30% respectively. Also, the mean malaria parasite density after flooding was significantly higher than the mean malaria parasite density before flooding. The increase in prevalence rate post flooding is not surprising because the change in the ecological system could increase the risk of malaria. Flooding provides good breeding sites for malaria vectors. As the vector population increases, transmission of the infection rises hence the increase in malaria density [20]. The prevalence rates noted in this study corroborated by other studies done out by Aribodor et al [21] and Akinboro et al [22] who observed rates of 64.4% and 63.6% respectively. These high rates were attributed to poor compliance to malaria control strategies and not only to holo endemicity of malaria in the study areas [22]. However, lower rate of 30.34% were observed in this study [23]. This disparity may be attributed to the location the study was conducted and the seasonal variations.

The malaria prevalence in relation to gravidity recorded that the primigravida has the highest prevalence of malaria 61.4%, while multigravida had the least prevalence of 38.6%. The prevalence of malaria was dependent on gravidity but with no significant difference (P>0.05). Out 150 pregnant women sampled, 90(60.00%) of them where infected with malaria parasite before flooding while 98(65.30%) of them where infected after flooding. There is no significant relationship between malaria parasite infection in the pregnant women and the period of test (X=1.782, p=0.410).

The malaria prevalence rate was highest among pregnant women aged 28-31 years. This finding was not statistically significant. Adefioye et al in their study also found that malaria prevalence was highest among age group 28-31 years [24]. This observation may be explained by poor covering of themselves by the younger pregnant women compared to the older ones. Also the younger gravid women have low immunity than the older women who may have had multiple births and exposure to malaria which may have increased their immunity.

The prevalence of malaria in relation to gravidity was highest among the primigravidas. This finding was not statistically significant. This observation was corroborated by various studies [22,23] conducted previously. This observation could be attributed to the fact that it has been found that factors responsible for susceptibility of primigravidas to malaria is inhibition of type 1 cytokine responses (Interferon, Interleukin 2, 12 and Tissue Necrosis Factors) [25]. These cell mediated responses are markedly suppressed in the first pregnancy than in subsequent pregnancies thus making the primigravidas more prone to malaria than the multigravidas [23]. However, other study [26] noted that multigravidas were more affected by malaria parasite than the primigravids. The differences in these findings could probably be due to individual responses to environmental factors which may in turn affect the development of immunity of infected persons.

Strengths and limitations of the study

The study is relevant because it was conducted among pregnant women, which helped them be aware of their environment being a good breeding site for the vector of malaria therefore helping to reduce the incidence of malaria and anaemia in pregnancy. It is a cross-sectional study involving only pregnant women. Therefore its generalizability to the whole community may not be fair.

Conclusion

The prevalence of malaria parasite among pregnant women in the study area is high regardless of the seasonal flooding. Hence, there is need for adherence to malaria prophylaxis protocol by the health care professionals and increase on community health education on malaria preventive strategies.

Declarations

Conflict of interest: The authors declared that there is no conflict of interest.

Author contributions

Onyeka Chukwudalu Ekwebene- conceptualized the work, designed the study, participated in the procedures, data collection and analysis and manuscript development

Valentine Chidi Obidile - participated in the data collection, procedures, literature review, manuscript development and review

Chioma Phyllis Nnamani -- participated in the data collection, procedures, literature review, manuscript development and review

George Uchenna Eleje - participated in the data collection, procedures, literature review, manuscript development and review

Chioma Favour Ekwebene- participated in the data collection, procedures, literature review, manuscript development and review

Franklin Chineye Akubukor - Participated in the study design, procedures, data collection and analysis, manuscript development and review.

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References

1. Joseph O, Oluwaseun OO, Toluwalase JI, et al. Malaria in Pregnancy: A Demographic and Clinical Surveillance at Mother and Child Hospital Ondo, South Western, Nigeria. J Prev Infect Control. 2017, 3:1.
2. Ribera JM, Hausmann-Muela S, D'Alessandro U, Grietens KP. Malaria in pregnancy. What can the Social Sciences contribute. PLOS Med. 2007; 4: 109-137.
3. RW Snow, CA Guerra, AM Noor, HY Myint, SI Hay. The global distribution of clinical episodes of Plasmodium falciparum malaria. Nature. 2005; 434: 214–217.
4. RW Steketee, BL Nahlen, ME Parise, C Menendez. The burden of malaria in pregnancy in malaria-endemic areas," American Journal of Tropical Medicine and Hygiene. 2001; 64: 28–35.
5. Desai M, terKuile FO, Nosten F, et al. Epidemiology and burden of malaria in pregnancy. Lancet Infect Dis. 2007; 7: 93-104
6. A Mumuni. Flooding and diarrhoeal disease incidence in urban poor communities in Accra, Ghana: investigating the effects of risk perception measures," Doctoral, thesis, University of Ghana, Accra, Ghana. 2013.
7. PR Epstein. Climate change and emerging infectious diseases," Microbes and Infection. 2001; 3: 747–754, 2001.
8. Fredrick Okoth Okaka, Beneah D. O. Odhiambo. Relationship between Flooding and Out Break of Infectious Diseases in Kenya: A Review of the Literature. Journal of Environmental and Public Health. 2018: 5452938.
9. Brown L, Murray V. Examining the relationship between infectious diseases and flooding in Europe: A systemic literature review and summary of possible health interventions', Disaster Health. 2003; 1: 1–11.
10. Peate I, Wild K. Nar M. Nursing practice: Knowledge and care, John Wiley & Sons, New Jersey. 2013.
11. Patz JA, Epstein PR, Burke TA, Balbus JM. Global climate change and emerging infectious diseases. JAMA. 1996; 275: 217–23.
12. World Health Organization (WHO). Flooding and communicable diseases fact sheet: risk assessment and preventive measures. 2018.
13. Patz JA, Githeko AK, McCarty JP, Hussein S, Confalonieri U, et al. Climate change and infectious diseases. Climate change and human health: risks and responses 2003; 6: 103¬37.
14. Dacie JV, Lewis SM. Investigation of haematological disorders: Practical haematology. Churchill Livingstone Edinburgh United Kingdom. 2006; 177-180.
15. World health organization: world malaria report Switzerland. 2005.
16. Onwutalobi, Anthony-Claret. Nnewi industrialization overview- 'The official Nnewi city portal' www.nnewi.info. Retrieved 2021-08-18
17. Oluwagbemiga A, Bamidele A, Babatunde A, Chimere A, Medinat S, et al. Prevalence of Malaria in Pregnant Women Attending Antenatal Clinic in Primary Health Centres in Lagos, South West, Nigeria. J AdvancesMed Medical Res. 2018; 25: 1-9.
18. Jombo GTA, Mbaawuaga EM, Ayegba AS, Araoye MA. Anaemia, malaria burden and its control methods among pregnant women in a semi-urban community of northern Nigeria. J Public Health Epidemiol. 2011; 3: 317-323.
19. World Health Organisation. Malaria Fact Sheet No.94. 2020.
20. Odongo-Aginya E, Ssegwanyi G, Kategere P, Vuzi P. Relationship between malaria infection intensity and rainfall pattern in Entebbe peninsula, Uganda. Afr Health Sci. 2005; 5: 238–45.
21. Aribodor DN, Nwaorgu OC, Eneanya CI, Okoli I, Pukkila-Worley R, et al. Association of low birth weight and placental malarial infection in Nigeria. J Infect Dev Ctries. 2009; 3: 620–3.
22. Akinboro R, Ojurongbe O, Akindele A, Adefioye O, Bolaji O, Olaniran O, et al. Plasmodium falciparum parasitemia in pregnancy in relation to maternal anaemia. African J Clin Exp Microbiol. 2010; 11: 164–9.

23. Okorafor UP, Ogbu UM. Malaria Parasitaemia Among Pregnant Women Attending Antenatals In A Nigerian Specialist Hospital. Int J Innov Healthc Res. 2020; 8: 1–4.

24. Adefioye O, Adeyeba O, Hassan W, Oyeniran O. Prevalence of malaria parasite infection among pregnant women in Oshogbo, Southwest, Nigeria. Am J Sci Res. 2007; 2: 43–5.

25. McGregor IA. Epidemiology, malaria and pregnancy. American Journal of Tropical Medicine and Hygiene. 1984; 33: 517–25.

26. Odikamnoro O, Iganga A, Ozowara N, Okoh N. Prevalence of malaria among pregnant mothers and possible relationship to parity in Abakaliki Southeast Nigeria. Eur J Exp Biol. 2014; 4: 15–9.