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Hamatological parameters and malaria parasite infection among pregnant women in Northwest Nigeria

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PEER REVIEW

Peer reviewer

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Comments

The work presented here can be improved further to make up a case report. Otherwise major revisions (design procedures including the appropriate choice of sample size and results analysis and presentation) will be required to qualify this article to a peer review article.
(Details on Page 50)

ABSTRACT

Objective: To evaluate some hematological and anthropometric parameters, malaria infection at different trimesters in pregnancy. **Methods:** Fifty pregnant women (6 in first trimester, 28 in second trimester and 16 in third trimester) between ages of 15-40 years with ten age-matched non-pregnant women used as control were enrolled in the study. Consent were obtained from the subjects after which semi-structured questionnaires were administered to obtain data on demographic and socio-economic variables, reproductive and medical history. Anthropometric variables, and hematology were carried out using standard procedures. **Results:** Anthropometric characteristics showed no significant difference in weight, height and BMI when compared with non-pregnant control. Hematological values indicated higher values for non-pregnant women but not statistically significant. Prevalence of malaria infection in pregnant women showed that 40% of pregnant women examined were infected compared to 30% non-pregnant with those with first pregnancy (primagravid) recording the highest infection (47.62%) with pregnant women within age 15-18 years least infected (16.7%). Pregnant women in the third trimester had the highest (50%) malaria infection and there was increase in prevalence with increase education status and those with first pregnancy (primagravid) recorded the highest infection (47.62%). Treatment used when infected showed 36.8% and 42.9% used malaria drug and both drug/herbs respectively. **Conclusions:** Higher prevalence rate of malaria infection in pregnant women with the highest prevalence recorded in those with first conception (primigravidae). There is a need for continuous monitoring of hematological parameters and malaria parasite infection for better outcome of pregnancy.

KEYWORDS
Pregnant women, Venous blood, Trimesters, Hematological parameters, Anthropometry, Malaria parasites

1. Introduction.

Maternal mortality is the death of pregnant women due to complications of pregnancy or during child birth. Out of the global maternal deaths, 99% occur in the developing countries, and Nigeria accounts for 10%, which is the second highest in the world[1]. About 50% of pregnancies are unplanned[2], therefore, most women are unprepared for pregnancy in that the physical, nutritional, physiological demands are not met. During pregnancy, extra calories are needed due to a woman's increased basal metabolic rate and higher energy demands[3]. Prenatal infection is a major cause of maternal, fetal and neonatal morbidity and mortality[4,5]. Nutritional deficits may increase the risk of perinatal infection by diminishing or abolishing protective mechanisms[6].

Infection has a major effect on adverse pregnancy outcomes

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which appears the strongest among populations that suffer from malnutrition[7]. The most likely mediating factor linking this association is the effect of nutritional status on various host defense mechanisms and relationship existing between micronutrient deficiency and infection-mediated adverse pregnancy outcomes[7]. Malaria infection during pregnancy is a major public health problem in tropical and subtropical regions throughout the world[8]. Malaria is the most highly prevalent tropical disease, with high morbidity and mortality and high economic and social impact[9]. This study was centered on pregnant women attending antenatal clinic, their stages of pregnancy, nutritional status and malaria infection.

2. Materials and methods

2.1. Subjects

Fifty pregnant women (6 in first trimester, 28 in second trimesters and 16 in third trimesters) between the ages of 15-40 years were enrolled in the Antenatal Clinic of Family Health Care Centre in Samaru-Zaria, Kaduna State Nigeria for the study. Ten non-pregnant age-matched women were used as control subjects. Ethical approval was obtained from the Departmental Board of Research and verbal consents were obtained from the subjects.

2.2. Methodology

Semi-structured questionnaires were administered to obtain data on demographic and socio-economic variables, reproductive and medical history. Anthropometric variables were measured while women were wearing light clothing and bare footed with UNICEF electronic scale by SECA for weight and heightiometer. Trained medical officers in the health centre assisted in bleeding the women in the morning, following a standard procedure for blood collection[10]. Venous blood (5 mL) samples were drawn from the median cubital vein with minimum stasis while subjects were sitting. Part of the blood was slowly ejected into a K2EDTA containing tubes while the rest was left for about 30 min to coagulate. The uncoagulated blood was used to test for malaria parasite[11], white blood cells count, packed cell volume and hemoglobin[12]. Random blood sugar was measured by spectrophotometric method[10]. Serum albumin was measured by the method described by Silverman *et al*[13].

2.3. Statistical analysis

All calculations were done using the SPSS 13 statistical software package. Data were presented as mean±SD, and statistical analysis was carried out using the student's paired *t*-test and ANOVA. Differences were considered to be statistically significant at an error probability of less than 0.05 (P<0.05).

3. Results

Table 1 shows characteristics of respondents with majority within age of 20-29 years and, most had secondary education (38%) followed by Quaranic/Adult education (30%) compared to non-pregnant respondents which majority had post-secondary education (70%). Occupations of pregnant women are mostly as full-time housewives (54%).

Table 1

Demographic and socio-economic characteristics of respondents.

Variable		Pregnant women		Non-pregnant women	
		Frequency	%	Frequency	%
Tribe	Hausa	37	74	4	40
	Igbo	2	4	2	20
	Yoruba	-	-	1	10
	Others	11	22	3	30
Age (year)	15-19	11	22	-	-
	20-29	24	48	8	80
	30-40	15	30	2	20
Education	No Formal Education	2	4	-	-
	Quaranic/Adult Literacy	15	30	2	20
	Primary	12	24	1	10
	Secondary	19	38	-	-
	Post Secondary	2	4	7	70
Occupation	Full-Time Housewife	27	54	-	-
	Civil Servant	2	4	-	-
	Petty Trader	15	30	3	30
	Student	1	2	7	70
	Casual labour	5	10	-	-

Table 2 presents the anthropometric characteristics of respondents which showed no significant difference in weight, height and BMI when compared across the trimesters with non-pregnant control.

Table 2

Anthropometric characteristics of respondents.

Respondent	Frequency	Weight (kg)	Height (m)	BMI (kg/m^2)
Non-pregnant women	10	62.48±10.38	1.56±0.06	25.59±3.96
Pregnant women	50	59.04±13.09	1.56±0.05	24.19±5.01
Trimester 1	6	51.00±12.28	1.59±0.04	20.38±5.10
Trimester 2	28	57.21±9.65	1.57±0.05	23.39±4.02
Trimester 3	16	65.25±16.40	1.55±0.06	27.03±5.36

Values were mean±SD.

Table 3 shows mean haematological values (WBC, RBS, PCV, Hb, and Albumin) between non-pregnant women, pregnant women and three trimesters, which indicated higher values for all the parameters for non-pregnant women but not statistically significant. The prevalence of malaria infection in pregnant women is shown in Table 4 which showed 40% of pregnant women examined were infected compared to 30% non-pregnant with those with

Table 3
Hematological parameters of pregnant women across trimesters.

Parameters	Non-pregnant women (*n*=10)	Pregnant women (*n*=50)	Trimester 1 (*n*=6)	Trimester 2 (*n*=28)	Trimester 3 (*n*=16)
WBC($\times 10^3/mm^2$)	4.20±0.37	3.85±0.82	3.75±0.69	4.00±0.76	3.61±0.95
RBS (mmol/L)	4.81±1.35	3.64±0.73	3.80±0.83	3.64±0.69	3.58±0.79
PCV (%)	33.40±3.06	28.96±4.84	25.83±5.98	28.96±4.40	30.13±4.91
Hb (g/dL)	11.14±1.03	9.67±1.61	8.62±1.99	9.68±1.47	10.04±1.63
Albumin (g/dL)	3.84±0.56	2.98±0.57	3.21±0.68	2.93±0.48	2.98±0.67

Values were mean±SD. WBC: White Blood Cells Count, RBS: Random Blood Sugar, PCV: Packed Cell Volume, Hb: Haemoglobin.

first pregnancy (primagravid) recording the highest infection (47.62%).

Table 4
Malaria parasites infection level of pregnant women.

Respondent	No. Examined	No. Infected	Percentage of infection (%)
Non-pregnant women	10	3	30.0
Pregnant women	50	20	40.0
Primagravid	21	10	47.6
Multigravid	29	10	34.5

When data were also disaggregated according to age of pregnant women (Figure 1), those within age 23-26 years were least infected (16.7%). Pregnant women in the third trimester had the highest (50%) malaria infection followed by those in second trimester (35.7%) and third trimester (33.3%). Figure 2 shows the distribution of malaria infection according to educational status of the pregnant women which indicated increase in prevalence with increase education status. Data obtained on prevalence of malaria infection in pregnant women based on treatment used when infected indicates majority uses local herbs (66.7%), while 36.4% and 42.9% used malaria drug and both drug/herbs respectively.

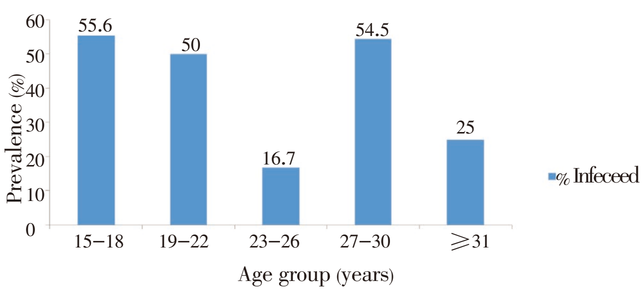

Figure 1. Prevalence of malaria parasite in pregnant women by age.

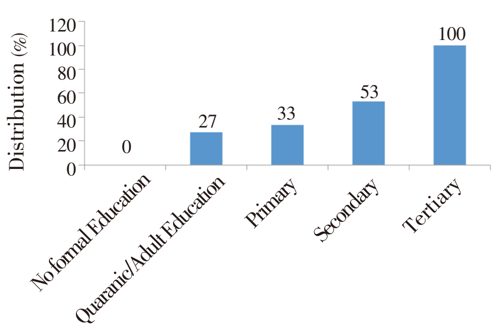

Figure 2. Distribution of malaria parasite by educational status of pregnanatients

4. Discussion

The aim of this study was to evaluate some anthropometric indices, hematological profile and malaria infection of pregnant women at different trimesters and compare with non pregnant women. There is no significant difference in the value of all the anthropometric and hematological parameters analyzed even when compared at different stages of pregnancy, although there was variation in actual numeric values. This study agrees with the report of Osonoga *et al.* but disagrees with the report of James *et al.* that there is significant difference across the trimesters in the value of WBC and PCV[14,15]. Osonoga *et al.* reported that reasons for the lack of significant difference may be due to quality healthcare available to the pregnant woman, and adequate management of their blood profiles with dietary supplementation[14] . However, mean numeric values for most of the hematological profiles were below the normal range values for pregnant women reported[16]. In highly endemic malarious area, the prevalence of clinical malaria is higher and its severity greater in pregnant women than that of in non-pregnant women[17]. This is also true in this study in which higher prevalence rate (40%) of malaria infection in pregnant women was recorded compared to non-pregnant women (30%). This was higher when correlated with other report which recorded low prevalence rate (6.8%)[17]. High prevalence rate was in primigravidae than multigravidae in accordance with report of Marielle *et al.* in pregnant women in Gabon and woman within age group of 15-18 years[18]. This may be attributed to the low level of immunity at the early periods of conception by women with first conception as reported[19]. High prevalence rate in the study area could result in maternal anaemia as reported by Osonoga *et al.* which correlated with the haemoglobin concentration of the pregnant women obtained in this study[14]. Inadequacies during pregnancy can trigger a cascade of metabolism disorders and result in severe health disorder which can adversely affects mother's and child's health by increasing the rate of pregnancy and delivery complications in women and contributes to deteriorating fetus development and fetus conditions which leads to increasing newborn morbidity[20]. The result of this study showed higher prevalence rate of malaria infection in pregnant women and those with first conception (primigravidae) with the highest prevalence. Continuous monitoring of hematological profile and malaria parasites infection is very essential for better outcome of pregnancy.

Conflict of interest statement

We declare that we have no conflict of interest.

Comments

Background

The authors tried to provide the background on an important work to address the question on the etiology of variable hematologic parameters and malaria infection during pregnancy. However, the authors unsuccessfully provided only limited references to support his hypothesis that widely exist today. The author has also failed to present a strong argument/rationale to justify the question wanted to research for.

Research frontiers

The question at hand is a crucial research question to be investigated on the existing varying literatures that reported this topic. However, the design of the research that was intended for this question has not been well formulated hence implemented to bring up vivid answers.

Related reports

The design of this work was based on a case-control study. This design is a perfect design for similar etiology studies. Contrary to what was expected, however, the authors reported the findings in a way that differed from the usual reporting frame for the case-control studies. It would be more precise if the authors did report odds of hematologic indices or malaria cases for cases and controls and their ratios. The current results in this report are difficult to associate with the question at hand.

Innovations & breakthroughs

Difficulty to discern.

Applications

Possible after major revisions.

Peer review

The work presented here can be improved further to make up a case report. Otherwise major revisions (design procedures including the appropriate choice of sample size and results analysis and presentation) will be required to qualify this article to a peer review article.

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